No. 4

BASIC DESIGN STUDY REPORT
ON
THE SMALL-SCALE FISHERIES DEVELOPMENT
AND
FISHING HARBOUR PREPARATION PROJECTS
IN
THE FEDERATED STATES OF MICRONESIA
(Vol.1 KOSRAE SMALL-SCALE FISHERIES DEVELOPMENT PROJECT)

JANUARY 1986

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PREFACE

In response to the request of the Government of the Federated States of Micronesia, the Government of Japan decided to conduct a Basic Design Study on the Small-Scale Fisheries Development Project and Fishing Harbour Preparation Project, and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Micronesia a study team headed by Mr. Noboru Oshima from 30th September to 23rd October, 1985.

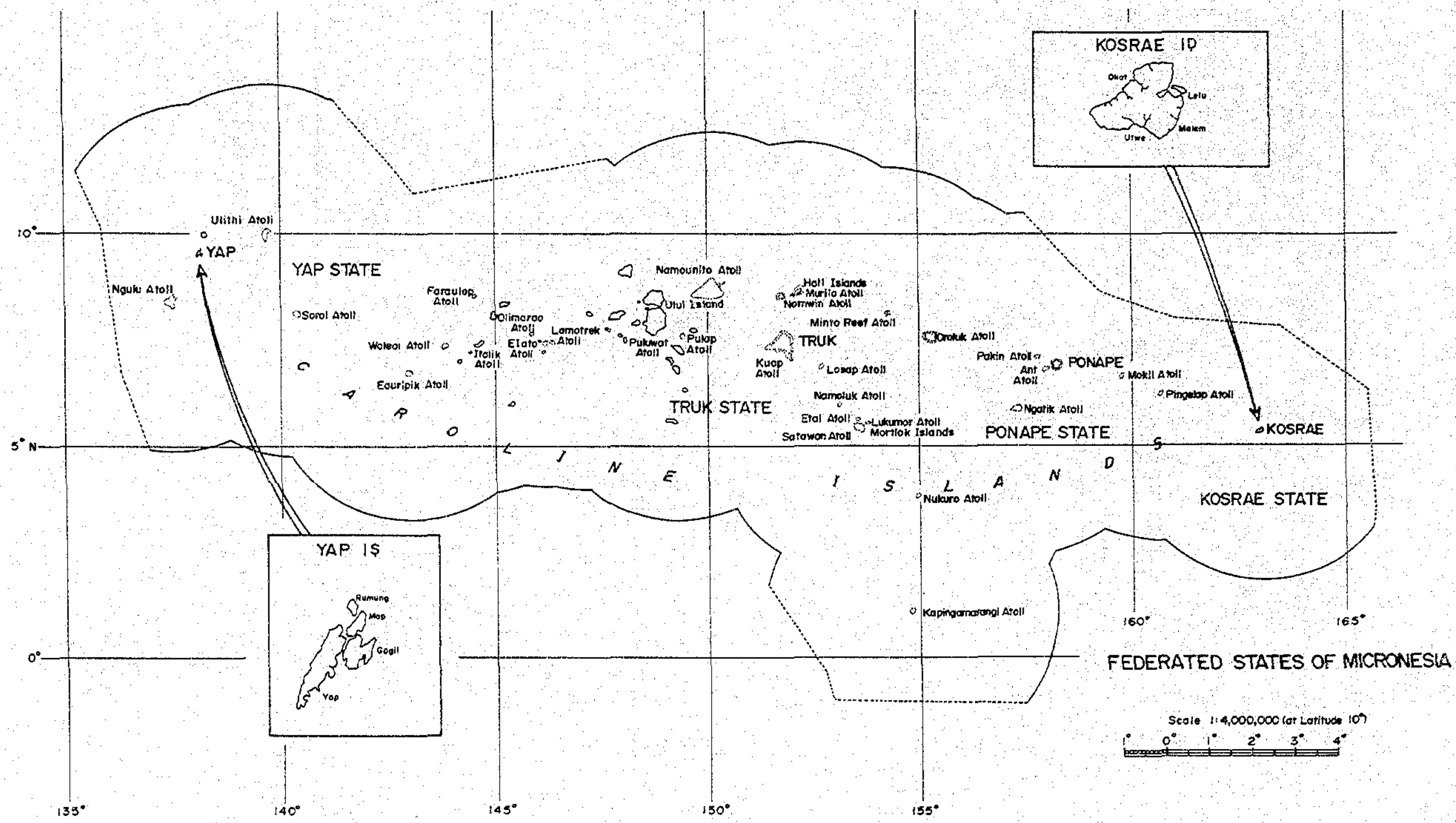
The team had discussions on the Project with the officials concerned of the Government of Micronesia and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

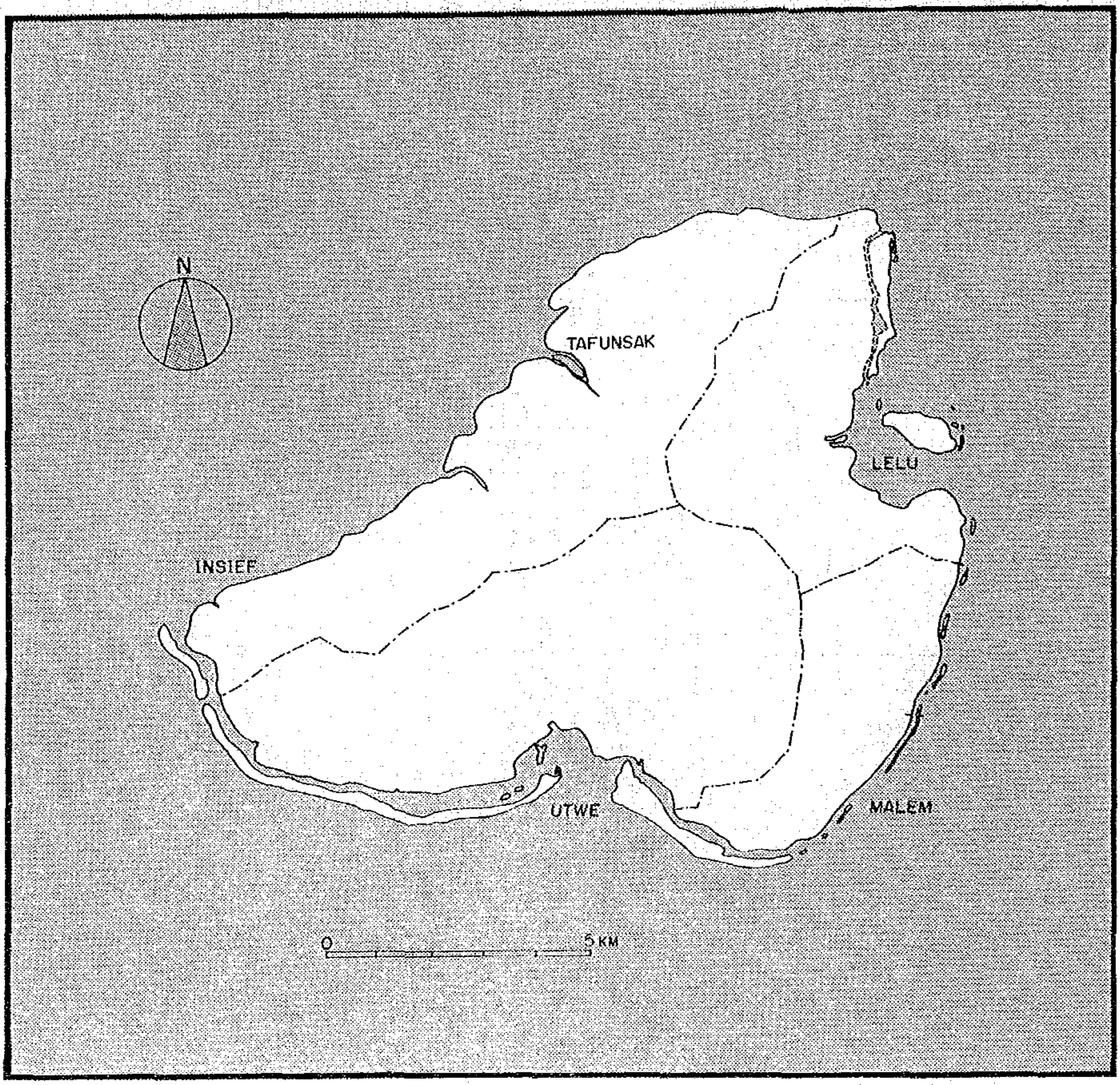
I wish to express my deep appreciation to the officials concerned of the Government of the Federated States of Micronesia for their close cooperation extended to the team.

January, 1986

Keisuke Arita
President
Japan International Cooperation Agency



FEDERATED STATES OF MICRONESIA



KOSRAE STATE

SUMMARY

The economy of the Federated States of Micronesia [FSM] comprises both a subsistence and a money economy, with the former type dominant outside the nation's major towns and main islands. More than 40% of GNP is derived from agriculture and fisheries but the bulk of this represents subsistence production. There is very little else that could qualify as industrial activity in the country. The Government of the FSM relies on the U.S. for the bulk of its revenues. However, with the termination of Trust Territory status, this aid will henceforth be based on a Compact of Free Association with the U.S., and it is anticipated that per-capita aid will be reduced by about half over the next decade. There is, accordingly a compelling need to develop self-supporting industries and establish a viable industrial base that can withstand the future reduction in aid revenues.

Micronesian food imports constitute about 1/3 of the country's total imports. Despite the rich fish resource in Micronesian waters, there is a large volume of canned fish imports. The Government looks to industrial development to provide employment opportunities for the rapidly increasing population in the younger age brackets.

While the rich marine resources in Micronesian waters are being utilized by foreign vessels, few Micronesians themselves are benefiting from these activities. At a time when the establishment of a viable economic structure has become a matter of the most urgent priority with the termination of Trusteeship status, and in the absence of any other significant resources or industries, high hopes are held for fisheries development.

Accordingly, the Government of the FSM, in its "First National Development Plan (1985-1989)", has positioned fisheries development as a top-priority target for development investment, with 32% ($45 million) of the Nation's development budget allocated to this area.

The Kosrae fishery is strictly subsistence in nature and so has not yet emerged from the status of a traditional, small scale fishery. However,

as a result of the strong demand for fish among the people of this State, in recent years, certain fishermen have initiated operations beyond the reef using outboard-powered vessels.

However, the population of Kosrae is increasing at the very rapid rate of 3.2% per annum and, despite the resulting growth in the demand for fish products as a source of animal protein, local production is unable to keep up with the mounting demand, forcing a tremendous reliance on imports.

The reef around the Kosrae is relatively confined, while the waters outside the reef often tend to be quite rough as a result of the trade-winds. As a consequence, production by the traditional fishery, based primarily on non-powered canoes, is quite low and so cannot hope to meet the growing demand for fishery products. For this reason, the Government of Kosrae State has prepared a program for developing a commercial fishery, whose principal fishing grounds would lie beyond the reef, based on motorization of the fishing fleet. It has also made plans for the development of a pilot skipjack pole-and-line operation which, via a research and training program, would remote the utilization of the rich pelagic resources in these waters and thereby nurture a true industrial fishery.

The Government of the FSM has made a request for cooperation from the Government of Japan, via a grant-in-aid, for purposes of implementing these programs, with the responsible organ to be the Marine Resources Division of the Government of Kosrae State.

Based on this request, the GOJ decided to conduct a Basic Design Study and asked the Japan International Cooperation Agency (JICA) to dispatch a Basic Design Study Team to Micronesia. This team made a field survey of the activities of the Marine Resources Division as well as the present status of the Kosrae fishery and exchanged views with officials of both the National and Kosrae State Governments.

As a result of this survey and the discussions with officials concerned of the National and State Governments, the Survey Team has concluded that there is a need, for purposes of developing the fisheries of Kosrae State, to encourage fishing activity beyond the reef and to establish a pilot skipjack pole-and-line operation. The Team felt that it would be most appropriate to provide, for these purposes, small FRP boats, a pilot skipjack pole-and-line vessel, a workshop, and various fishing equipments and accessories.

Following is a summary of the equipment and facilities to be donated by the Government of Japan under this plan:

1.	Small FRP boats with a total length of 25 feet; catamalan	70 boats
2.	Outboard motors (25 PS)	74 units
3.	Reserve outboard motors for emergency use (8 PS)	70 units
4.	Skipjack pole-and-line vessel for pilot operations (total length 16 m; about 180 PS, equipped with stick-held dip nets)	1 vessel
5.	Fish aggregating devices	10 sets
6.	Fishing gear	1 lot
7.	Floating jetty (1.5 m x 20 m)	1 installation
8.	Workshop single-story steel-frame building, with a floor area of 130 m^2	1 structure
9.	Equipment for the Workshop for repairs on outboard motors and the FRP boats	1 lot

The period of construction is estimated at 11.5 months in all -- 4 months for the preparation of the Detail Design, estimating, bidding and contracting; and 7.5 months for the procurement and shipment of materials and equipment and for actual construction in Kosrae.

The Marine Resources Division of the State of Kosrae will be responsible for the distribution of the small FRP boats and fishing supplies to the local fishermen as well as for the operation of the pilot skipjack pole-and-line vessel and the workshop.

The total annual budgets required to operate the skipjack pole-and-line vessel and the workshop, as provided under this program, are estimated to be $51,560 and $20,070 respectively, and the Marine Resources Division of Kosrae State is expected to be able to secure the necessary funding.

Benefits to be derived from this project include the development of a commercial fishery, based on the diffusion of fishing boats and fishing gear suitable to Kosrae fishing grounds, and a consequent increase in fish production, leading to a reduction in food imports. An increase in employment may also be anticipated from the project. And, as confidence develops in the future of a commercial fishery in Kosrae, more sophisticated fishery development plans can be formulated.

Based on cost-benefits analysis shows that the Internal Rate of Return (IRR) is expected to be 40.53%. In our judgment, therefore, the implementation of the subject project would bring major benefits to the Kosrae economy, so that there would be ample justification for the Government of Japan to extend cooperation in the form of a grant-in-aid.

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APPENDIX

CHAPTER 1 GENERAL INTRODUCTION

Section 1 Introduction

With a view to establishing an independent economic structure following the termination of trusteeship status, the Government of the Federated States of Micronesia has drawn up its First National Development Plan (1985-1989). In this Plan, emphasis is placed on fisheries development, using the rich resources within the country's Exclusive Economic Zone, and this sector is given the highest priority in the program of developmental investments.

The governments of Kosrae and Yap States, in developing their respective fisheries, are attaching urgent priority to the improvement of the artisanal fisheries and to the equipping of fishing ports. In order to carry out these plans, the FSM Government has asked the Government of Japan for cooperation in the form of a grant-in-aid.

The Government of Japan, in turn, decided to conduct a Basic Design Study and, under the auspices of the Japan International Cooperation Agency (JICA), dispatched a Basic Design Study Team to Micronesia headed by Mr. Noboru Oshima, Deputy Director, Fishing Port Planning Div., Fishing Port Dept., Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries. This team visited Micronesia from September 30 to October 23, 1985.

The survey involved studying the program for Improving Traditional Fisheries in Kosrae State and the request by the FSM Government regarding the development of a fishing port in Yap State with a view to establishing the appropriateness of both projects. The Team also gathered information on fishing conditions in order to establish the proper scale of the Kosrae program for improving the traditional fisheries and the functional scale of the fishery facilities in Yap. It also gathered data on current activities of the Marine Resources Division of Kosrae State and the Yap Fishing Authority as well as on the terrain and geology of the planned construction sites along with the program of the

FSM and States Governments for maintenance and operation of the target projects.

During the Team visit, various discussions were held between the Team and the FSM and States Governments; the results were compiled into a Minutes of Discussions, copies of which were signed and exchanged.

The Survey Team, after returning to Japan, was to analyze and evaluate the survey findings and prepare a Basic Design for the subject projects. This Basic Design Study Report has been prepared in order to present data required by the Government of Japan for grant-in-aid cooperation.

The names of the Team members, survey itinerary, and a list of discussants, along with a copy of the Minutes of Discussions are included as appendices to this report.

Section 2 A Socio-Economic Profile of the FSM

2.1 The Two-Tiered Structure of Micronesia's Economy

The economy of the FSM is composed of two different economic systems: the "product, or money, economy", where goods and services are bought and sold with money as the trading medium, and a subsistence economy based on "barter".

The former type of economy is centered in the principal islands and cities and incorporates merchants, government workers, and urban workers. The latter type functions in outlying villages on the main island and on the outer islands.

Examples may be seen in various parts of the world of economies in which barter plays a major role, but this characteristic is particularly strong in the FSM. It would be proper to say that over 50% of the population are under the influences of the barter, or subsistence economy. Excluding school age population, the subsistence population accounts for some 50% of the FSM total, with the share exceeding 55% in Kosrae State.

Of course, even in these so-called subsistence economies, a market-based economy is beginning to penetrate through the medium of imported products, but the unique features of the subsistence economy — based on status, village chiefs, village, land, and family — are closely interwoven with the subsistence economy. We believe, therefore, that a long period of transition, covering many stages, will be required to change the subsistence economy of Micronesia over to a money economy.

The breakdown of GDP for Micronesia shows that agriculture and fisheries account for 42.2% of total ($44.9 million), government services for 29.6% ($31.5 million); and wholesale and retail activities for 11.9% ($12.7 million). However, within the agriculture and fisheries section, subsistence operations contribute $40.6 million of the sector total. Subtracting these activities, the agriculture and fishery sector would comprise a mere 6.5% of GDP, well behind government services (47.8%) and wholesale/retail activity (19.2%) .

Apart from government expenditures and wholesale/retail business, supported by government payrolls, there are no industries as such in the FSM.

2.2 Need for Self-Supporting Industries

The greater part of the FSM's money economy is supported by government payrolls. Over 80% of total fiscal revenues are derived from U.S. aid, with domestic tax revenues contributing only 15-18%.

American policies toward Micronesia changed sharply during the early 1960's in a direction outlined in the "Solomon Report". In addition, U.S. assistance to this area, starting in 1963, began to register a sharp growth, and the subsequent inflow of aid funds greatly exceeded the sums given to neighboring nations. This aid, in 1977, represented 80% of total Micronesian GNP.

However, since the great bulk of this aid has been used primarily for educational and welfare services, it has been spent on government operations, particularly government salaries; thus, little, if any, has been used for infrastructure or industrial development.

In 1978, anticipating the end of the trusteeship era, the U.S. established a "Capital Improvement Program" with a view toward building infrastructure and providing employment opportunities to the Micronesian people. Based on this special aid program, Micronesia was, it is true, able to start building airports, roads, harbors, water supply and sewage, and other infrastructure facilities but the obligations resulting from the many years of negligence remain large and so, despite this rapid expansion of aid, the infrastructure gap has not yet been closed.

Micronesia, as a typical island state, is subject to many constraints and problems. Vast distances and time separate the main island from outlying islands, a fact which not only inhibits the flow of people and goods but also acts as a constraint on the speed and frequency of information transfer. In addition, total land area is small and, as a result of volcanic rocks and coral reefs, top soil is almost non-existent.

Thus, the soil is barren, capable of supporting only the production of such products as coconuts and taros. Since the islands are surrounded by the sea, however, they are well endowed with marine resources, but the nation lacks the means to effectively utilize them.

In order to solve these problems, capital, technology, and labor are required. The U.S. administration put its primary efforts into education and social welfare, but the development of a basic infrastructure, which could have formed the base for production activity, has been sadly neglected over a long period of time.

In the primary sector (agriculture and fisheries), there has been no significant introduction of capital or technology. For this reason, the islands have been unable to sustain even the levels of agriculture and fishery production attained during the 1930's.

In a comparison of 1930 and 1970 production levels in Micronesia, in terms of present value,* livestock and forestry output in the 1970's had declined to only 41% of the level of the 1930's and fisheries to only 9.3%, while agriculture had become virtually extinct at only 1.2%.

Micronesia, during the 1930's, was under the direct administration of Japan and production was mainly in the hands of the Japanese. Thus, in drawing comparisons with current levels of output achieved by Micronesians on their own, there were obviously major differences in terms of capital and technology, making a meaningful comparison impossible. However, with respect to acreage under cultivation (including palm tree forest area), for example, there was a decline of almost 50% from 54,446 hectares in 1936 to 31,008 hectares in 1979. Thus, it would be correct to say that the productivity of the 1930's had virtually disintegrated.

In connection with the termination of the trusteeship, the U.S. promised financial assistance to the various nations of Micronesia, based on

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* "Can Micronesia Become Economically Self-sufficient?" Micronesia #55, by Yasuhiro Takahashi

Compacts of Free Association with each country.

However, according to one estimate of trends in this assistance taking into account rates of population growth and inflation, postulating an annual inflation rate of 6% and a population growth of 3% per annum, within 10 years, per capita aid receipts would fall, in real terms, to only half of their original levels.

For this reason, it has become an urgent priority for the people of Micronesia to develop self-sustaining industries and thereby establish an industrial base which can withstand the decline in economic aid.

2.3 Dependence on Food Imports and the Employment Problem

A distinguishing characteristic of the FSM balance of payments is that exports cover no more than 6.6% of imports, resulting in a serious trade imbalance and a persistent deficit in the balance of payments, which is more than covered by U.S. aid. The country, thus, has an enormous dependence on this aid.

54% of FSM exports are derived from tourism, followed by copra (38%). The two categories combined hold a commanding 92% share of total exports. However, revenues from exports do not offset even 1/3 of the amounts expended for food imports. These food imports account for 22.8% of total imports, second to fuels and oils. And, if tobacco and beverages are added, food and related products account for 37% of total imports.

In the First National Development Plan (1985-1990), one major problem area was felt to be the inadequacy of statistics on foreign trade. The Basic Survey Team requested a breakdown of food imports during its field study but, unfortunately, properly organized figures were not available.

The only figures obtainable were fairly old, relating to 1975/76, when the country was still a part of Trust Territory. In that year, rice accounted for 42% of total food imports, canned meats 20%, and canned fish 14%. The salient features were the large imports of the staple food, rice, and of canned fish, despite the abundant fish resources in

Micronesian waters. It may be presumed that these patterns have not changed since independence.

Looking next at the breakdown of national expenditures (1983), 73.5% are accounted for by foods and beverages, of which only $25.1 million (28.17%) pass through the money economy, with the barter economy dominant at $40.6 million (or 45.4%).

Micronesia's total population has been increasing rapidly since the 1960's, registering an average annual growth of 3% from 1970 to 1980. Kosrae State has shown the highest rate of growth, at 3.16%.

Reflecting this rapid population growth in recent years, the share of the younger age groups in the total population has been increasing conspicuously. In 1980, 44.5% of the total population was below 16 years of age; the male working population was 75.9% of total (16,140 persons) and the female 42.3% (8,940), with the number of unemployed at 2,980 and 2,540 respectively.

An unemployed person is defined as one who "has been looking for work to earn money during the past four weeks". Since the above figures exclude "under-employed" persons who, while having no steady employment, support themselves from the subsistence economy, they tend to understate the true magnitude of the unemployment problem in the FSM.

Only about 50% of the working population are active in the money economy, where government employees account for 56% (and over 60% in the States of Kosrae and Yap). Thus, the role of the government in the labor market can be said to be enormous from this standpoint. However, as a result of the decline in U.S. aid, government employment can no longer be counted on to expand; to the contrary, with the anticipated rationalization in this area hopes must now be placed on solving the unemployment problem by expanding opportunities in the private industrial sector so as to absorb the increasing number of young jobseekers. From this standpoint as well, there is an urgent need to develop self-supporting industries.

2.4 Expectations in the Area of Fisheries Development

The Congress of Micronesia, in 1976, adopted a "5-Year Development Plan" (1976-1981) in order to establish a viable economic structure following the end of trusteeship. The primary goal of this Plan was to raise production in agriculture and fisheries while curbing government-level expenditures so as to correct the serious fiscal imbalance. A secondary objective was to increase productivity with a view to raising per capita incomes.

The FSM then developed a "First National Development Plan (1985-1989)", which looks upon these years as a period of transition and reconstruction following the actual end of U.S. administration.

Though this Development Plan is an integration of the development programs of the individual States, particular emphasis has been placed on the development of fisheries so as to utilize the abundant fishery resources in the FSM Exclusive Economic Zone. As a result, the fisheries sector has been accorded the highest priority in development expenditures, accounting for $45 million, or a full 32%, of total investment.

In the FSM's off-shore waters, there are excellent prospects for the development of a commercial fishery for highly migratory species, centering on skipjack and tuna. The total catch of skipjack in the Pacific Ocean comes to around 400,000 tons annnually, standing well above production in the Indian and Atlantic Oceans. The great bulk of the Pacific catch is taken from the Western Pacific, including Micronesian waters.

Before World War II, there was a Micronesian tuna fishing fleet, based in Truk, which was composed of 66 Japanese skipjack pole-and-line vessels of between 10 - 15 tons, whole combined annual catches averaged about 5,000 tons. Despite this catch history, at the present time, the Truk fishery is comprised of only three 21-ton vessels belonging to the Truk State Government and 4 privately owned vessels of 15 - 19 tons. This fleet catches no more than 450 - 700 tons of skipjack annually.

The States of Pohnpei, Yap, and Kosrae have vessels that confine their activities to surveys and resource development, making only limited catches that are only a minute fraction of the pelagic catches by foreign countries (such as Japan and the U.S.) within the FSM Exclusive Economic Zone.

FSM's fishery resources inside the reef are considered to be the richest in the entire South Pacific. According to a 1980 study by the South Pacific Commission, the catch per hour, using bottom vertical long line, came to 9.6 kg in Kosrae and 6.9 kg in Yap, suggesting the abundance of the resources to be found inside the reef.

However, since inshore fisheries are subject to the restricted productivity of coral reef waters, there are inherent limits to these resources. If uncreasonable fishing pressure were to be placed on these reef areas, the inshore resources might conceivably be completely depleted.

At present, in American Samoa, where motorization of fishing vessels has been underway since 1972, there has been an increase in fishing pressure on coastal waters. As a result, there has been a decided trend toward smaller-sized fish, as evidenced by a decline in the resource base and catch efficiency for demersal fish in particular (e.g., Lethrinidae, Epinephelus septemfasciatus, Scomberomorus sinensis). Thus, in only a few years aftervessel motorization, controls had to be imposed on reef fish fishing to give the resource a change to recover.

The same sort of development has taken place in Western Samoa, where powered vessels have lost interest in operations within the reef and a movement has developed to restrict catch effort — i.e., to limit the number of fishing vessels (FAO, 1978).

Even from the standpoint of developing the present subsistence fishery in the FSM into a strong commercial fishery with a view toward generating stable supplies of fish proteins for its populations care must be taken not to exceed Maximum Sustainable Yields (MSY) and to avoid a concentration of fishing effort in particular locations.

The rich fishery resources in FSM waters are at present being exploited to only a negligible extent by the Micronesian people. Not only are the bulk of these resources being taken by foreign fishing vessels, but there has been an inundation of imported fish products onto the tables of the Micronesian people, who have traditionally been a fish-eating people.

At a time when there is an urgent need to develop a viable economic structure, owing to the end of trusteeship, and considering the almost total void of other resources or industries, we can only say that there is an increasingly pressing need for fishery development in the FSM.

CHAPTER 2 KOSRAE SMALL-SCALE FISHERIES DEVELOPMENT PROJECT

Section 1 Background of the Plan

1.1 Fishery Resources

Although the FSM, as a nation, lays claim to a 200 mile exclusive economic zone, the waters up to the 12-mile mark come under the jurisdiction of the various states. Thus, the development and protection of fishing privileges within the 12-mile zone are the responsibility of the individual state.

Since no detailed resource study has been conducted to date on the waters surrounding Kosrae State, we do not have a clear idea of the size of these resources. However, based on an operations report made in 1979 by a Japanese tuna longline vessel, angling rate in Kosrate waters (the catch rate per 100 hooks) were 1.7 for yellowfin tuna, 0.6 for bigeyed tuna, 0.07 for striped marlin, and 0.01 for billfishes.

In addition, we may note that catches by foreign fishing vessels within the Kosrae 200-mile zone have been increasing year by year.

(in tons)

Year	Skipjack Pole-and-Line Vessels	Tuna Longline Vessel	Total
1974	1,427	512	1,939
1975	2,137	812	2,949
1976	7,121	970	8,091
1977	10,024	879	10,903
1978	10,620	907	11,527

Source: Kosrae Statistical Bureau (T.T.P.I. 1980 Report)

The Kosrae Government estimates, based on SPC surveys and catch data from foreign vessels, that the size of the pelagic resources within the Kosrae 200-mile zone is in the order of 10,000 - 50,000 tons.

Kosrae is a single volcanic island which has neither an archipelago nor atolls. Its ocean floor sharply declines, as is characteristic of volcanic islands, so that the area within the reef is by no means large. The land area of Kosrae is 109.5 km^2. The area of shallow waters 15 m or less deep is 21.7 km^2 and of reef shelf below 15 m deep is 19.3 km^2.

Based on the demersal fish resource study by SPC, the feasible production volume in good fishing grounds of less than 15 m depth is estimated at 100 tons and that in reef waters of below 15 m depth at 44 - 200 tons.

A fishing industry has already developed within reef waters of less than 15 m depth. While it is true that fishing effort has not yet reached the point of threatening resource depletion, it can be presumed, looking to the future, that some sort of control will eventually have to be placed on fishing effort in these waters.

Fishing outside the reef has, to this point, been totally undeveloped. But with respect to the pelagic resources in offshore waters, in particular, even taking into account the catches by foreign vessels, there appears to be ample resource margin. In the light of the above factors, it is clear that the development effort should be directed mainly at the pelagic resource.

1.2 Present State of Kosrae Fisheries

The fishing industry in Kosrae State cannot be termed an industry as such. Fishing is, rather, looked upon as a part of the traditional way of life; in other words, fish are caught, when necessary, using non-powered canoes, traps, and spears, for the family's own consumption. In the past, palm leaves have been used to fabricate a sort of net, while primitive tuck-net fishing activity, involving about 10 persons, is also seen. The people engaged in this sort of fishing effort as a subsistence activity.

The target species for this fishing activity are those within the reef and mangrove areas. 445 species have been reported, of which some 250 are edible. The following species are representative:

Inside the reef
- Labridae family (at least 20 varieties)
- Scaridae family (at least 5 varieties)
- Gobiidae family (at least 5 varieties)
- Lutjanidae family
- Serranidae family

Mangrove areas
- Mugilidae
- Siganidae

Fishing in Kosrae is a subsistence activity, and technology is at a low level. However, the local inhabitants have a strong affinity for fish and, in recent years, a group of commercial fishermen have emerged who fish outside the reef with outboard engines mounted on wood canoes or FRP boats.

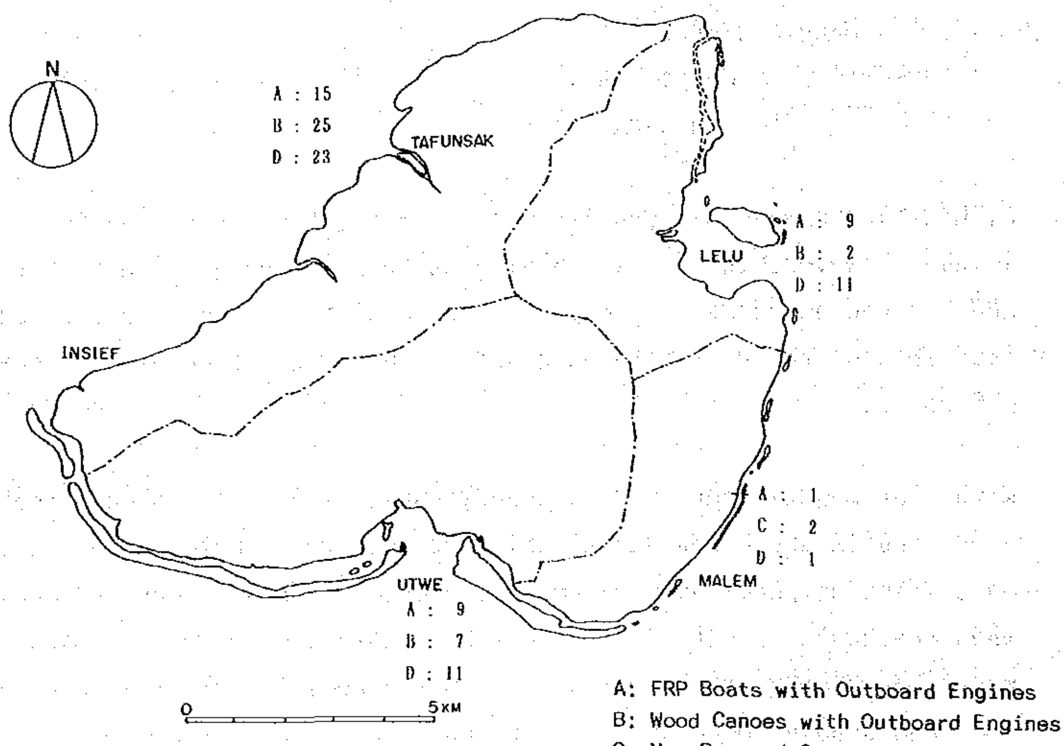
With the exception of July - October, there is a continual northeast tradewind in the Kosrae area, which causes swell on the open sea and makes fishing perilous for unpowered canoes. Thus, there are many days when the boats cannot fish. There have also been cases of casualties resulting from boats being carried away a considerable distance by the tide and unable to return to base under their own power.

In August and September, the tradewinds abate, and the sea becomes smooth, making this the best fishing season of the year. During this period, canoes troll for such pelagic species as yellowfin and skip-jack.

To fish outside the reef, it is absolutely necessary that powered fishing boats be used and that these vessels be easy to handle and capable of being fitted with outboard engines.

For this reason, there is a considerable latent demand for boats among the local population. When the Marine Resources Division had a sale to dispose of its FRP boats, there was a flood of would-be buyers, and the boats were sold out on the spot.

Kosrae State is made up of 4 municipalities, centering on the capital, Lelu, and the fishing population is scattered throughout the island. The following table shows the distribution of fishermen, outboard engines, and FRP boats by district:



Distribution of Fishermen

	Fishermen	Outboard Engines	FRP Boats
Tafunsak	40	23	15
Lelu	11	11	9
Màlem	3	1	1
Utwa	16	11	9
	70	46	34

Source: Kosrae Statistical Bureau

There are no data on fish production. However, there are estimates, albeit somewhat dated, on catch volume for 1979 for subsistence purposes: within the reef (including mangrove areas) — 100 tons; outside the reef — 34 tons, for a total of 134 tons in all. The average fish price at that time was 70 - 75 cents per lb., based on which the value of production insiue the reef was $155,000, that outside the reef — $56,000, for a total of $211,000, a considerable sum indeed.

On the other hand, in an effort to utilize the rich pelagic resources and create an industrial fishery, the Kosrae State Government plans to introduce an experimental skipjack pole-and-line fishery, with the Marine Resource Division slated to be the implementing organ.

Although foreign fishing operations have been on the increase in the waters around Kosrae, almost no fishing activity has been undertaken by the citizens of this State. The Kosrae Government, convinced of the urgent need to develop a local fishery, has established a skipjack pole-and-line fishing base, manned by Japanese, which has been handling an estimated 15,000 tons per year, and looks upon this resource with high hopes. The State is, therefore, seeking to develop the skipjack and yellowfin tuna resources around Kosrae. For this purpose, the Marine Resources Division owns and operates a 35 foot FRP vessel. This vessel makes bait and fishing ground surveys oriented to a skipjack pole-and-line fishery, which does not require large gear and can be operated using relatively simple fishing vessels.

However, owing to the small size of the above vessel, it has not been possible to fit it with a forced circulation of line bait-hold or stick-held nets. As a result, adequate surveys have not yet been possible.

The Kosrae fisheries may be divided into the following 3 classifications:

	Fishing Methods	Fishing Grounds	Directed Species
Subsistence fishery	Tuck-net Traps Non-powered canoes	Inside the reef and in mangrove areas	Reef species Crustaceans
Commercial fishery	Canoes with outboard engines	Inside the reef On the reef Shelf offshore	Mullet Flyingfish Skipjack Yellowfin
Industrial fishery	Small pole-and-line FRP vessels	Offshore	Skipjack Yellowfin

Kosrae is no exception to the rapid population growth that is characteristic of the developing countries; growth has been at the very high rate of 3.16% per annum. Along with this growth, there has been an increase in the demand for fish products as a source of animal protein, but domestic production has been unable to keep up with this increased demand.

While there are no figures on imports of frozen or canned fish, judging from the fact that food products accounted for 60% of total imports in 1983, we may presume that a substantial sum is expended on fish imports each year to fill the supply-demand gap.

1.3 The Mairne Resources & Fisheries Division

The agency in Kosrae that is responsible for all matters relating to fishery administration is the Marine Resources & Fisheries Division (MRF), which falls under the jurisdiction of the Department of Conservation and Development. The DCD is directed by the Deputy Governor in charge of development.

The MRF is based in the capital city, Lelu. Including foreign advisors, it has a staff of 12, and its operations cover the following areas:

... to provide guidance to and disseminate new fishing techniques to the local fishermen;

... to procure adequate and effective gear for both public and private fisheries;

... to help develop production in the private sector through the effective development of marine resources;

... to conserve and develop the resources in Kosrae's 12-mile zone.

The MRF is engaged in a large number of administrative functions, such as the preparation of Development Plans and the drafting of fishery legislation. However, in order to expand its technical activities in the operations area, the Division was reorganized in October, 1985.

1.4 The Fishery Development Plan

1.4.1 The Five-Year Development Plan

The Kosrae State Government, in an effort to establish economic self-sufficiency following the end of the trusteeship era, has initiated a Five-Year Development Plan (1985-1989), which places top priority on investments in fishery development. The objectives of this Fisheries Development Plan may be summarized as follows:

1. In order to attain self-sufficiency in fish production, fish catches are to be increased in both the subsistence and small-scale commercial sectors.

2. In order to augment foreign exchange revenues, a plan will be implemented to achieve effective use of pelagic resources.

3. Efforts will be initiated to conduct feasibility studies on aquaculture potential.

4. A plan is to be drafted for the conservation and administration of marine resources so as to protect the marine environment and determine maximum sustainable yields.

On the matter of natural resources, the Fisheries Development Plan notes the various advantages of the State for fisheries development, pointing out that pelagic resources are abundant within the Kosrae 200-mile zone, while rich resources also exist inside the reef. Proper conditions are also satisfied for the cultivation of mullet, milkfish and similar species.

From the standpoint of human resources, the State is most advantageously situated, in that a large labor force exists of the young people necessary for fisheries development, and most of these people are familiar and comfortable with fishing activity.

Kosrae is also fairly well situated with respect to infrastructure, though this is by no means complete. There is a jetty, a blast freezer, an ice-plant, refrigerator, water supply and power facilities.

With respect to a market for the fish catches given the existing dependence on imported fish supplies, if this market infrastructure could be shifted over to domestic products, there would be ample purchasing power in the State to support such a market mechanism.

Turning now to the negative elements which tend to hinder fishery development in Kosrae, we should note that fishing activity is often restricted by the island's topography and weather. And, since there is a large concentration of population in the capital city, Lelu, there is an ever-present danger of resource depletion in the reef and mangrove areas. In addition, commercial fisheries have not yet developed, while fishermen incomes are felt to be low relative to those of the wage-earning population.

Fishery development is also impeded by the inexperience of government officials and by inadequate resource and bait surveys. Furthermore, with respect to distribution facilities, there is no agency presently charged with domestic fish distribution, while imported canned fish is well accepted in the market from the standpoint of both taste and price.

Kosrae State is probably the least developed part of the FSM, and, historically, this has always been closed, single-island society. Even today, over 90% of the inhabitants were born and raised in Kosrae, and few foreigners or Micronesians from other islands are found here. However, in recent years, expenditures have been made on developmental infrastructure which have sparked some rapid changes. A road network has been completed linking the island's four municipalities, along with power and water distribution facilities, while an airport and port are almost finished. The diffusion of autos is staggering; the number of cars on the road is said to have increased 10-fold over the past decade. Even now, a number of public works projects are under construction and so, measured against the monumental changes taking place in this society, it is clear that fishery development lags far behind other sectors.

At a time when ordinary aid revenue from the U.S. is declining, and 60% of total imports are accounted for by foodstuffs, fishery development becomes an urgent priority in terms of raising the State's level of self-sufficiency in food. Thus, for Kosrae State to establish a viable economy in the wake of the termination of trusteeship, fisheries must occupy a central position in the planned industrial structure from the standpoint of both marine and human resources.

1.4.2 The Request Plan

In the 5-Year Development Plan, as a means of fulfilling the target for fishery development, various projects have been designated, such as a Pole-and-Line Fishery Program and a Pelagic Fish Aggregating Devices Program. But, owing to budgetary constraints at both the State and Federal levels, none of the above projects have as yet been finalized. The only accomplishment to date has been a trochus shell project, which was started last year and has been continued into the current year. 8 tons of catch from this project have been exported.

With regard to the other projects, the State must rely on assistance from other countries. In any event, considering the staff limitations at MRF, it will obviously be difficult to implement all of these projects simultaneously.

As explained previously, Kosrae's fisheries can be broadly classified into subsistence fisheries, commercial fishery, and industrial fishery. However, since 1979, no positive measures have been taken to increase the subsistence catch. As a result, we do not believe that there has been any material change in the catch volume by subsistence fishing operations since that time.

However, if conservation measures are taken in the reef fishing grounds, it is likely that, at best, only the status will be maintained in current subsistence catch levels. Thus, in order to raise the present inadequate catch level, it will be necessary to utilize resources beyond the reef, which in turn creates a requirement for powered vessels capable of fishing in the open sea and for gear that would be suitable to the fishing grounds beyond the reef.

The Kosrae State Government, through the encouragement of the commercial fishery, which is somewhat more advanced than the subsistence fishery, seeks to expand the supply of fish products, maintain employment, and prevent a population drain to other countries that would result in the disintegration of the State's economy. However, owing to the serious shortage of funds, no concrete measures have yet been taken to this end.

At present, fishermen who take up fishing as a fulltime occupation, mainly on an individual basis, have not yet standardized their boats, engines, or fishing gear.

For this reason, there is clearly a pressing need to establish a base from which to develop a commercial fishery.

At the same time, in order to properly explore the feasibility of a industrial fishery in the future, there is also a need to establish experimental skipjack pole-and-line operations.

In order to implement, as soon as possible, policies for Kosrae's Fishery Development Program, the State Government has drawn up plans to distribute boats equipped with outboard engines and to procure a vessel for pilot skipjack fishing operations. However, since it is difficult to fund these programs out of the Federal or State budget, the FSM Government has requested a grant-in-aid from the Government of Japan.

The program to distribute outboard-powered boats calls for the distribution of 100 FRP boats and engines to fishermen in the island's 4 municipalities, with MRF as the implementing agency, as a means of expanding fishing operations beyond the reef. In this connection, in order to avert mishaps at sea, the plan also anticipates the installation of signal flares and equipment for the automatic transmission of distress signals.

The plan to obtain a skipjack fishing training vessel envisions a vessel of approximately 52 feet, equipped with stick-held nets for catching the bait fish required for the MRF skipjack operations, fish gathering lamps, a forced circulation bait-hold, and water sprinkling equipment.

Section 2 Details of the Plan

2.1 Purpose

Since Kosrae State is favored with a high rainfall, it has long been possible, using primitive burn agriculture, to produce such crops as taros, yams, bananas, and breadfruit. Fishing developed as a beach-front industry of the village, forming one part of its subsistence economy. In other words, agriculture and fisheries were carried on together, and this enabled the State to continue a subsistence economy to this day.

In view of the almost complete lack of livestock, fishing represents the only hope of achieving self-sufficiency in animal proteins.

The Kosrae fishery remains, to this day, a subsistence operation, but external conditions at the distribution level are now combining to permit the development of commercial fishermen. These conditions include the penetration of a money economy, the growing demand for proteins, and the donation of refrigeration equipment by Japan.

As the improvement in fish production proceeds, we can also contemplate a growth in both catch and distribution volume. Thus, based on the donation of powered vessels suited to Kosrae waters, the State can now promote the development of a commercial fishery. And, through the Skipjack Fishing Training Vessel, it can look toward an improvement in fishing techniques which will in time bring great improvements in nutrition, based on the expanded production, as well as the displacement of food imports, thereby fulfilling the principal objectives of the Kosrae Development Plan. This project can, in time, also produce such subsidiary benefits as an expansion of employment opportunities and a growth of fishermen's cash income.

The objective of this project, then, is to donate a skipjack fishing training vessel, small FRP boats, outboard engines, gear, a workshop, and servicing and repair equipment for the purpose of motorizing the fishing fleet, with a view to developing a commercial fishery, and assessing the future potential for an industrial fishing in Kosrae.

2.2 Plan Execution

2.2.1 Motorized Boat Plan

(1) <u>Boat With Outboard Engine:</u>

The Kosrae fishery at present is just starting to move toward powered vessels operated by commercial fishermen, and so care is needed in carrying out the plan to improve the artisanal fishery.

At the present time, vessel motorization is being done on an individual level, with outboard engines bought through bank loans to expand fishing operations. However, this method of procurement is, of course, limited to persons with the requisite financial strength: it is difficult to obtain financial assistance or technical training from public agencies. With respect to fishing methods as well, despite vessel motorization, there has been very little progress thus far in absorbing new techniques, and so the target species and fishing technology for the motorized boats remain pretty much the same as for the non-powered canoes.

For this reason, it is necessary, at this time, to lay the foundation for a specialized fishery by delivering to the fishermen, through the MRF, vessels and gear that are appropriate to small scale fisheries.

If a smooth start is not made at this time, much time and effort would be required to redo this operation at a later date. And the program must also avoid competition with the traditional subsistence fisheries by targeting different grounds and species. For this reason, in the initial plan to motorize vessels with outboard engines, it is not enough to simply donate the equipment; it will be necessary for fishermen to become familiar with the various problems and new fishing methods that stem from the use of this equipment and learn to handle it properly. And we must not overlook the functions of gear fabrication, engine maintenance facilities, and training in fishing methods.

The physical characteristics of Kosrae — the fact that it is just one island and that all of its residents are linked by land — can certainly be considered favorable conditions for fishery development. For this facilitates close contact with the management authorities in terms of dissemination activities, improves the efficiency of fish distribution, and means that the organization responsible for repairs and technical guidance can cover the island from one central location.

Outboard engines are not durable and tend to break down more frequently than inboard, and there is also the problem of high fuel cost. However, in Kosrae, the fishermen are not familiar with engines and, in the absence of mooring facilities, have no alternative but to beach their boats in front of their respective villages. Under existing conditions, therefore, until such time as infrastructure is improved and fishing technology develops to the point that larger vessels equipped with inboard engines become necessary, we feel that motorization via outboard engines is the optimum course.

Furthermore, with regard to the boats on which outboard engines are installed, it should be noted that Kosrae has a narrow reef and that there is a relatively short season of calm waters outside the reef. For this reason, there is a need for extremely seaworthy vessels with a high degree of operational stability.

(2) <u>The Plan to Distribute Small FRP Boats:</u>

Based on FAO recommendations, the average daily caloric intake for the South Pacific region has been set at 2,185 calories, with 58 g of animal protein.

The pure protein content of chicken, meat, and fish meat generally runs 10 - 20 g of the edible portion. Thus, at a minimum, 290 g of fish meat must be consumed per capita per day. (58 g ÷ 20% = 290 g)

290 g x 365 days = 105 kg/person/year

Accordingly, for Kosrae State as a whole, the required consumption to secure a minimum of 58 g/person/day becomes:

105 kg x 6,530 persons = 691 tons

If, for 1982, we add subsistence fish catches to canned and frozen imports of meat, poultry, fish products, we obtain a total supply of 281 tons in that year.

Share of Food Products in Total Imports (by value)		Total Imports
1982	($ 978,924)	$ 2,333,273
1983	($ 1,181,272)	$ 2,926,088

Source: Kosrae Statistical Office

At a time of increased dependence on imports of frozen and canned fish, which are presently preferred for reasons of both taste and convenience, it will be difficult to reduce these imports. But, if we set as a goal reducing these imports to the 1982 level, we would have a 410 ton shortfall of meat and fish products:

691 tons - 281 tons = 410 tons

If we assume that the entire 410 ton shorfall is to be obtained from fish products, and assuming an edible ratio of 70%, we would require 585 tons a year of fish products from local sources.

410 ÷ 70% = 585 tons

Species	Edible Ratios
Skipjack	65%
Common dolphin	50%
Spanish mackerel	55%
Sea Bream	40%
Flying fish	55%
Yellowfin	65%
Mullet	60%

Source: Japan Food Standards, 4th Edt., Resource Survey Committee, Science and Technology Agency

Based on an estimate given us by MRF, based on receipts at the refrigerated warehouse in Lelu, the present daily catch per capita by Kosrae fishermen now using outboard powered boats may estimated at about 30 kg.

Type of Fish / Month		June		July		August		September	
		1~15	16~30	1~15	16~31	1~15	16~31	1~15	16~30
Reef fish	(kg)	N.A	6	-	-	-	-	21	U.A
Tuna	(kg)	N.A	217	233	295	215	230	353	N.A
Subsistence catch	(kg)	-	50	50	50	50	50	50	-
Number of fishing days	(day)	-	10	10	10	10	10	10	-
Total			273	283	345	265	280	403	

Average: 30.8 kg/day

Assuming that the boats to be donated under this program will be 2-man vessels and operated 140 days per year, and assuming a catch effort at present levels, a minimum annual catch per boat of 8.4 tons (30 kg x 140 days x 2 persons) can be anticipated.

From the preceding:

585 tons of required fish ÷ 8.4 = 69.6 vessels

Accordingly, a donation of about 70 FRP boats would be appropriate.

Even if this number were provided and added to the 46 boats already under power, the motorization ratio in Kosrae would still be only 17% of the 600 canoes presently in use — which is not a particularly high ratio for the first stage of a motorization program.

The introduction of a new fishing structure must, to some extent, be accomplished in an integrated manner. As benefits from the diffusion of vessels, engines, and gear, we may expect healthy competition, since a number of fishermen will then own and use the same type of vessel; an improvement in knowledge of fishing techniques suitable to the area; and the facilitation of statistical controls, since the supervision and sale of fishing gear will be vested in the MRF, which in turn will aid in survey resource projects.

With respect to the hull materials, we considered the use of water-resistant plywood and aluminum. In the case of an aluminum boat, the materials would be more costly than FRP or wood and this type of boat would be costlier to build, while the repair tools are quite specialized. We have decided, therefore, that aluminum boats would not be appropriate for this area.

With water-resistant plywood, there is a problem with its short life; the maximum life of this kind of boat is only about 3 years, at which time a replacement vessel must be built. While construction cost is low, this type does not offer any degree of permanence so that total cost becomes quite high.

In the case of the FRP boat, there is considerable durability, while maintenance is almost unnecessary and repairs do not call for a high level of skills. Reflecting these various advantages, in recent years, almost all small boats have been made of FRP and, for this plan as well, we feel that FRP boats would be optimum.

(3) Reserve Outboard Engines for Emergency Use:

While outboard engines have the advantages of lightness and ease of handling, they are much more prone to breakdown than inboard engines. If serious accidents resulting in loss of life were to occur in Kosrae at this early stage of fishery development, the people of the island would come to feel that fishing is a dangerous occupation, with negative consequences for effective development of this activity.

For this reason, we feel it is necessary to mount small emergency outboard engines on the boats with sufficient power to enable them to return to port from the fishing grounds in the event of failure of the main engine.

It is customary, in FAO projects, to provide such supplementary engines. For example, supplementary engines have been provided in the following two FAO projects.

One of these is the Village Fishermen Project (FAO/DANIDA) in Western Samoa, which bears a strong resemblance to the subject program. This project seeks to develop a commercial fishery in the area and increase catches by building catamaran boats and motorizing the fishery. The other project is the Artisanal Fisheries Development Project (FAO) in Comoros, which involves local building of boats, using a prototypes of the existing catamaran vessels in that area, distributing these boats among fishermen, and vessel motorization.

(4) Workshop:

Outboard engines break down frequently, a situation which we must live with. Thus, without repair capability, smooth progress in vessel motorization cannot be achieved, and this would hinder the development of a commercial fishery.

At present, outboards purchased by individual fishermen are being repaired at private or public auto repair shops, but these facilities are inadequate. If a large number of engines were to be introduced via this program, there would be no adequate facilities for their inspection or repair.

There is, in addition, a need for a site that can perform repair and servicing work on the FRP hulls. A workshop that is capable of servicing both outboard engines and FRP hulls is an indispensable element in the vessel motorization plan.

This workshop would have the following functions:

1. To make hull repairs on the small-size fishing boats

owned by the MRF and on the FRP boats equipped with outboard engines owned by local fishermen.

2. Maintenance, regular inspections, and repairs on outboard engines as well as other engines in the small-size fishing vessels.

3. Stocking spare parts and materials, as required to support the above operations.

The bulk of the repair operations connected with hulls and rigging are, as a rule, carried out on the spot. There will be a requirement for repair technicians and tools and space to store the necessary supply of materials and parts for the repair and servicing operations.

The main operation at this facility is to be the inspection and servicing of the outboard engines to be installed on the small fishing boats which, as already noted, are the target of this grant-in-aid. However, repair work will also be done on engines of the small fishing vessels owned by the MRF and on refrigerators, ice-making units, and other equipment related to fishery operations.

We have provided the following layout and staff for the subject workshop:

Layout:

1. Repair area for outboard engines
2. Administrative office
3. Warehouse

Staff:

	No. of Persons
Supervisory technician	1
Hulls and rigging	2
Technicians to work on outboard and other engines	2
Total	5

(5) Fishing Gear, Fish Aggregating Devices:

It is vital that motorization be carried out concomitantly with the improvement of fishing technology. For vessel motorization in the absence of such technological improvement will only mean that operating areas can be broadened and new fishing grounds reached; it will not mean that production can be significantly expanded. Only with the introduction of efficient gear and effective fishing methods can the benefits from motorization be given full play. It is essential, therefore, that, at the time of vessel motorization, new gear should be provided and efforts be made to improve fishing techniques.

The gear to be fitted to the small FRP boats should be easy to master and, thus, not too far removed from existing levels of fishing techniques. They should also be efficient and more productive than present gear. One of the demerits of the outboard engine is its very high energy consumption, and so the choice of gear should be made with priority given to fuel economy.

The directed species for the small FRP boats will include such pelagic species as skipjack and yellowfin tuna and demersal fish like grouper and parrotfish. Based on the use of bottom hand lines and vertical long line fishing, the boats can be stopped when taking the demersal fish but, in the case of pelagic species, for which trolling will be used, it will be necessary to keep the boat moving. In this case, in order to economize on time and fuel while searching for schools, it would be effective to design fish aggregating devices, as already provided in the Kosrae Fisheries Development Plan.

(6) Floating Jetty:

After the motorized vessels have been distributed throughout Kosrae, the MRF facilities will be used to transport fishing catches to the refrigerator, for the exchange of information among fishermen, for technical training programs, and for the repair of outboard engines. It will be necessary, therefore, to provide mooring facilities for the fishermen's boats near the MRF offices.

The MRF is located on the inner shore of Lelu Bay, and the beach in front of these facilities is almost perfectly shielded from the open sea. We have, thus, concluded that a floating jetty of reinforced plastic, of a type that can be readily assembled, would be appropriate.

We estimate that the maximum number of boats that will be moored at any one time for regular inspections, gear fabrication, delivery of catch, or taking on ice will be about 10.

2.2.2 Skipjack Fishing Training Vessel

For Kosrae State to achieve economic viability, fishery development — particularly the establishment of a industrial fishery through efficient utilization of pelagic resources — is of vital importance. Pelagic resources offering commercial possibilities include skipjack, yellowfin, other tunas, and billfishes, all of which are presently being taken in the Kosrae area by foreign fishing vessels — skipjack and small yellowfin by pole-and-line and purse seiners and tuna and billfishes by longliners.

The Kosrae State Government, as a result of its own studies, as implemented by the MRF, has confirmed the availability of bait resources and has established that a large-scale fishery will not be required, gear will be relatively easy to make, the required fishing techniques will be easy to master, and a pool of experienced personnel is available. The State has on this basis, planned to develop the skipjack pole-and-line fishery as an industrial activity.

However, before this fishery can be industrialized, it will be necessary to secure bait supplies and conduct feasibility studies on fishing grounds and other aspects. The present training vessel operated by the MRF is too small in size to be fitted with the fishing equipment required to conduct these feasibility studies. For this reason, there is a need for a training vessel equipped with the required fishing gear for skipjack pole-and-line operations.

Skipjack schools usually migrate at a speed of 6 - 7 knots. For the Skipjack Fishing Training Vessel to be able to chase these schools, a cruising speed of about 10 knots will be required. Since the fishing grounds are close to the island, 2 day trips will be sufficient. A 9-man crew will be required, including a fishing master, captain, and 7 ordinary crew members.

Section 3 The Basic Plan

3.1 Basic Policy

We have following three basic policies in our Basic Design Plan:

1) That the Plan accelerate the development of commercial fishermen, who are just beginning to appear on the scene in Kosrae, help to motorize fishing vessels, and serve as the first stage in overall fishing development. All equipment and facilities have been selected on the basis of the skill levels of existing fishermen and so should be easy to master.

2) In designing the new small FRP boats and the Skipjack Training Vessel, we have taken into consideration the oceanographic and meteorological conditions in the Kosrae area, such as the rough seas caused by the narrow reef and tradewinds.

3) With respect to the engine repair facilities and the workshop, we have given careful consideration to the level of building technology in Kosrae and selected designs that are easy to construct and lend themselves to economical maintenance. In addition, for the workshop equipment, we have chosen items that are compatible with existing levels of technology in Kosrae and oriented to the repair of outboard motors and FRP boats.

3.2 Small FRP Boats

3.2.1 Small FRP Boats

After giving consideration to seaworthiness, performance, and stability at sea, we came to the conclusion that the optimum vessel type would be the catamaran, as popularly used in Western Samoa and Sri Lanka. With this type of boat, there is a wide work deck area and a wide hull; yet, considering its size, speed can be generated with relatively low horsepower. Also, the catamaran type is extremely stable and seaworthy.

There have been many cases in Kosrae where outboard motors have been fitted to outrigger canoes, but we feel the fishermen will have a greater sense of security with the catamaran type than with a singlehull boat. This type of boat, moreover, is very easy to get used to.

The longer the boat relative to the length of the waves, the more seaworthy the vessel. And, with respect to speed too, the longer the better. The outrigger canoes in the area run between 20 - 23 feet but, to enhance maneuverability with a 2-man crew, we have set the length of the small FRP boats at about 25 feet. Cruising speed has been set at 13 knots, the speed required for trolling operations.

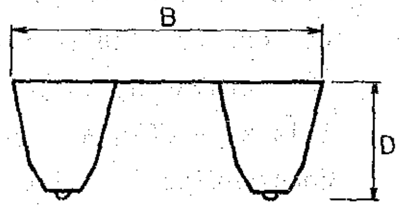
In rigging, we shall follow Japanese standards for safety equipment for "Small Sports Fishing and Charter Boats in Smooth Waters of 12 Meters or Less". There are no standards covering signal flares or paddles, but we have provided paddles, so that the vessel can be moved in an emergency, and signal flares to permit notification of vessel position at such times.

Fittings

Anchor	(1)
Anchor rope	(1)
Life jackets	(2)
Signal flares	(1 set)
Lifesaving buoy rings	(1 set)
Night lamps	(1 set)
Mooring ropes	(2)
Paddles	(2 sets)

Main Specifications

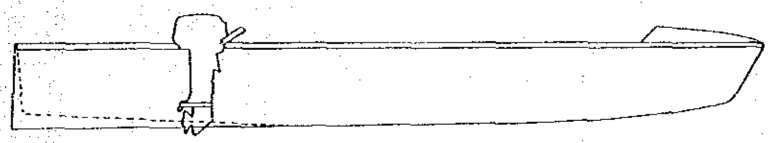
Total length .... about 25'
Breadth
  Mold (B) .... about 2.7 m
  Depth Mold (D) ... about 0.9 m
  Speed .... 13 knots
  Crew .... 2 persons

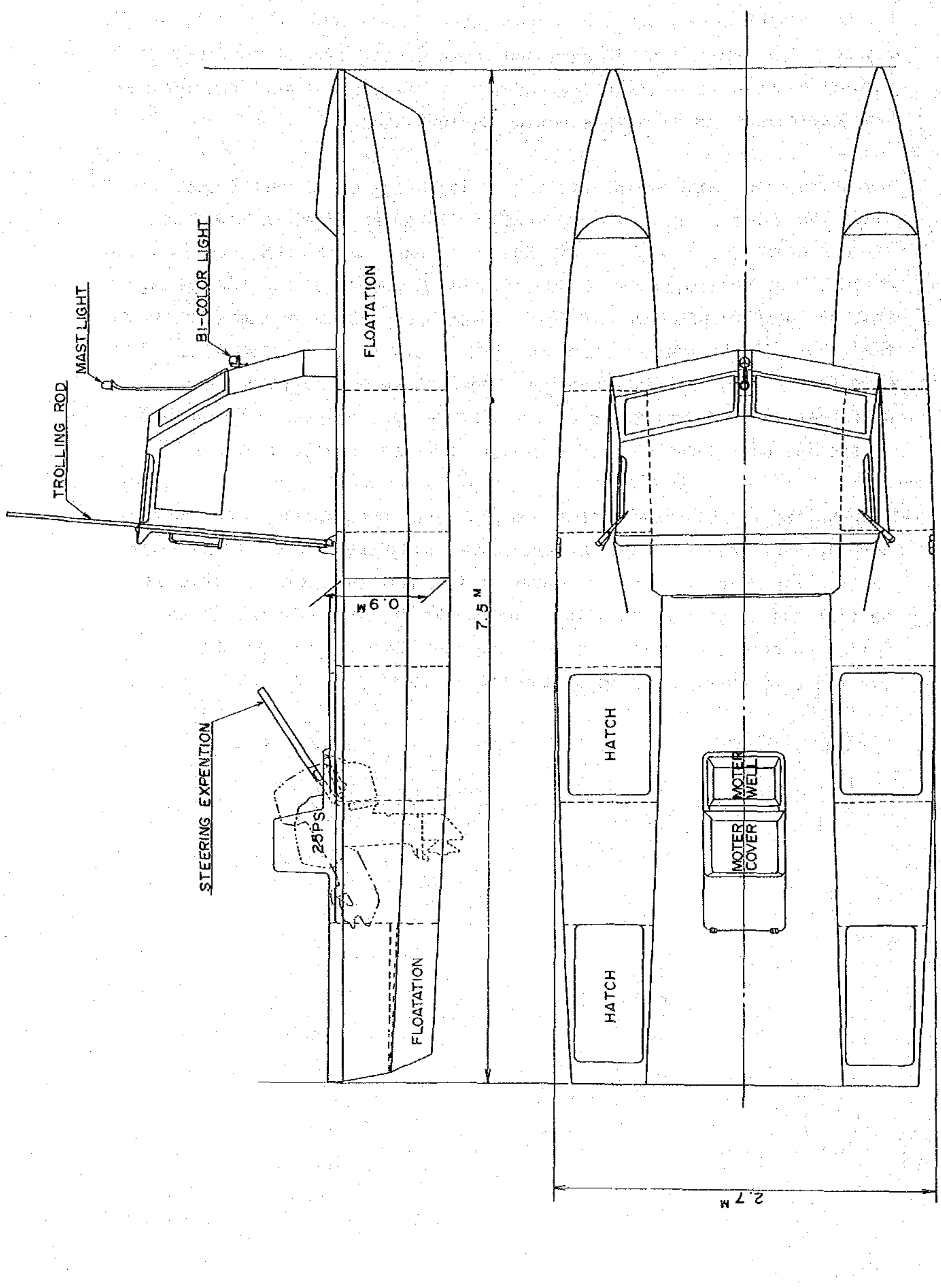


In the case of catamaran type vessels, the phenomenon of "wave lash" may develop, owing to hull shape and the distance between the hulls. It will be necessary, therefore, to verify these specifications through tank experiments at the implementing design stage.

The beaches in front of the fishing villages are coral reef beaches. Since the waters near shore are shallow and sharp coral is found in various places, the draft of the boat will have to be shallow. The draft of the outrigger canoes in the area is about 30 cm. Similarly, that of the FRP boats used in the area is about 20 cm. From this, we feel that, if the draft of the small FRP boats to be donated were no more than 25 cm, the fishermen would find these new boats not too different in feel from the ones they are already using, in which case no special consideration need be given to vessel handling.

Twin-hulled vessels have rather poor turning performance. However, turning performance can be improved by raising the bottom of the stern section and using the bow or center of the boat as a sort of fulcrum, so that the stern portion glides during the turning action. In the following chart, we do this by raising the lower portion of the hull (in the configuration shown by the dotted line).





SMALL F.R.P BOAT

3.2.2 Outboard Engines

Using the performance standards for traditional Japanese wooden boats, and after appropriate horsepower conversion, we were able to determine the horsepower of the outboard motors.

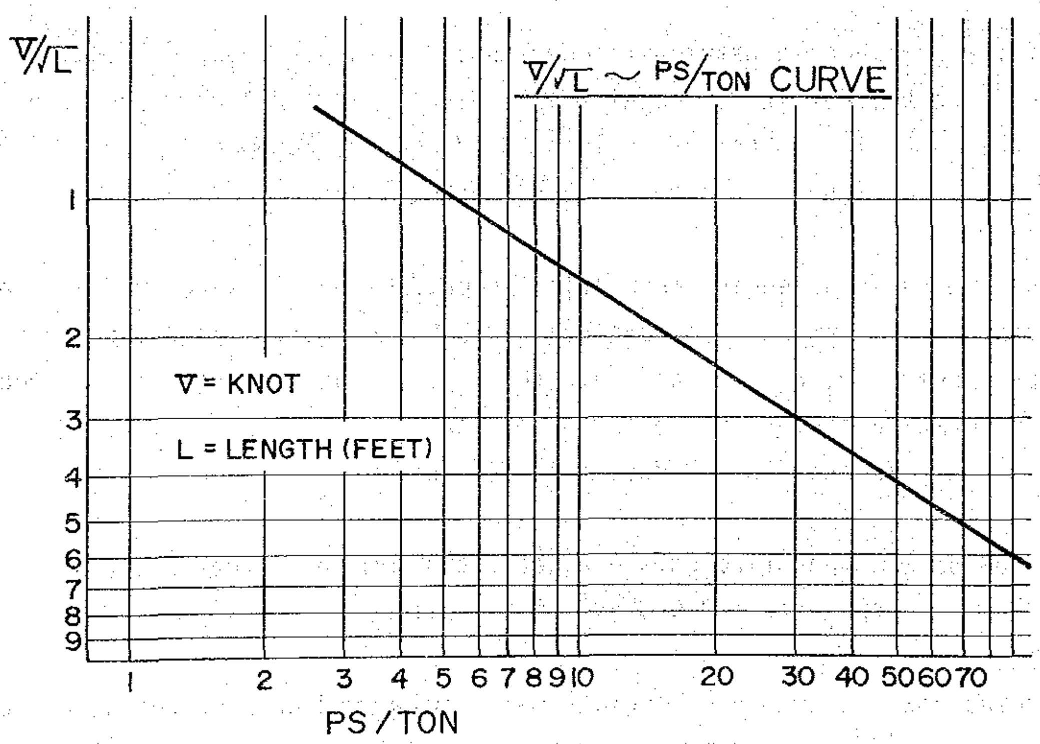
The following three conditions were postulated:

Total length .... 25 ft. catamaran
Speed .... 13 knots
Hull weight of the small FRP boats .... about 1 ton

Based on the equation: V/L - PS/ton, the horsepower is converted as follows:

V/L = 13/25 = 2.6
based on V/L - PS/ton
PS/ton = 24

and the required horsepower for the outboard engines becomes 25 PS.



Figuring one engine per FRB boat, we have a requirement for 70 units. In addition, there will be a need to provide spare engines so that full-time fishing operations will not be interrupted while an engine is being serviced.

Based on the required volume of spare parts, and estimating the probable frequency of breakdowns, we can determine the number of engines that will be in the shop on any given day and from this derive the requisite number of spare engines.

The required volume of spare parts for a 2-year period is about 1500 items per 100 outboard engines. The minimum number of parts per repair is about 3, based on past experience of engine manufacturers.

Accordingly, the annual number of engines to be repaired, based on a total of 70 engines, works out to:

1500 pieces (2 years) ÷ 3 items = 175 (unit)
(spare parts required by year) (No. of parts needed per repair)

If the workshop is assumed to operate 250 days per year, 0.7 engines would be brought in for repairs each day. Allowing 4 days for each repair job, the number of engines idled per day becomes;

0.7 units x 4 days = 2.8 (engines)

The frequency of engine inspections should be once a year in order to maintain performance and lengthen their useful life. Figuring 2 days per inspection, we can calculate the total number of engines required for normal use over the course of a year:

70 engines x 2 days = 140 engines

Based on 250 operating days per year, the number per day will be:

140 units ÷ 250 days = 0.55 units

Adding now the number of engines being inspected or repaired on a given day, we have:

2.8 + 0.55 = 3.35 units

Accordingly, there is a requirement for 4 spare engines.

Regular supply of outboard engines	70
Spare engines	4
Total	74

Thus, a total of 74 engines of 25 HP have been specified.

3.2.3 Reserve Outboard Engine for Emergency Use

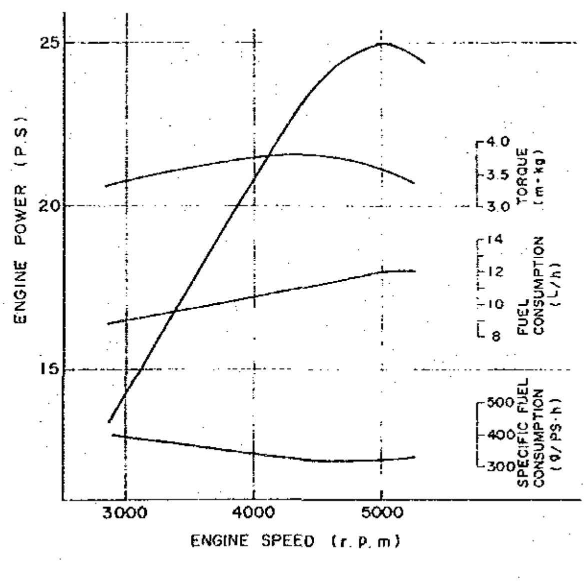
In determining the horsepower of these emergency engines, which are to be used when the main 25 HP engine breaks down, we feel that, giving consideration to conditions in open waters, the 25 foot vessel should be able to maintain a minimum speed of 6 knots when operating under the power of these emergency engines.

Based, then, on the curve in the previous chart V/L - PS/ton, the required horsepower for the reserve engines becomes 8 HP.

3.2.4 Fish Aggregating Devices

When fishing under the power of the outboard engines to be furnished under this program, given the very high fuel consumption of these engines, the prime consideration must be efficiency of fishing operations.

OUTBOARD ENGINE PERFORMANCE
25PS TYPE

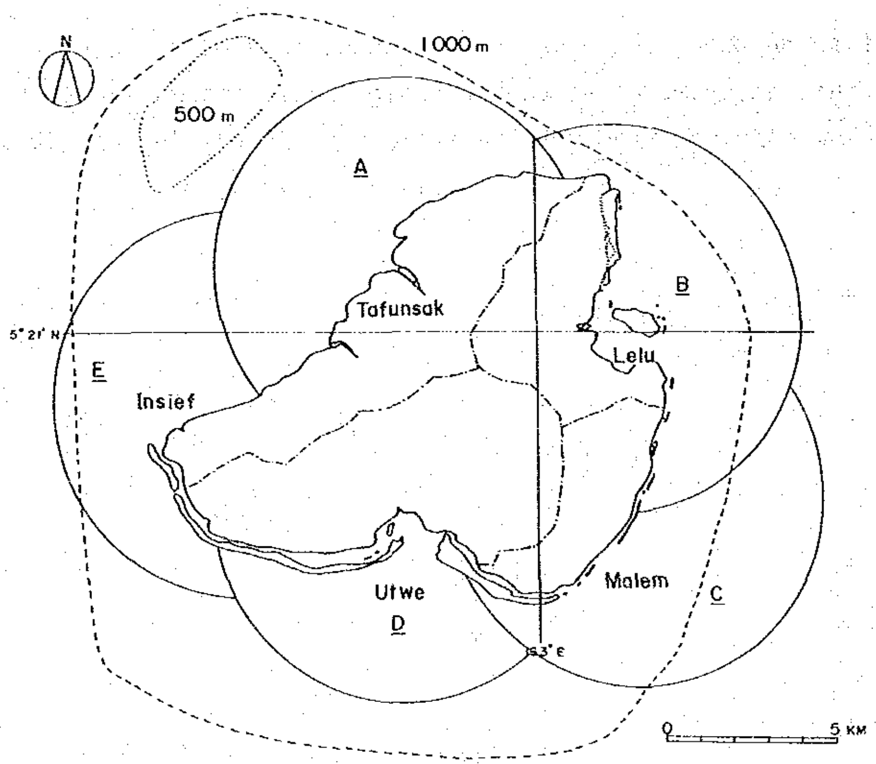


When using the trolling method, the vessel cruises in pursuit of fish schools. After detecting a bird flock, the vessel moves to a position under the birds and lets out the bait hooks. Since a great deal of fuel and time are used for detection, any reduction in this effort would have the effect of lowering operating expenses to a significant degree.

Since Kosrae is made up of only one island, with no tributary islands in the vicinity, there are few fish schools aggregating around an island. For this reason, we feel, it would be useful to set fish aggregating devices at depths of 1,000 - 2,000 m within 3 miles of the Kosrae coast.

By placing the aggregating devices on rafts, nets, or other floating objects in the open sea, plankton and small fish will aggregate, followed by migratory species that feed on these plankton and small fish. This principle has been used effectively in the Philippines, Western Samoa, Truck and elsewhere in the South Pacific, including Micronesia.

Considering that the primary purpose of this device is to economize on the cost of locating fish schools, there would be no point in placing these devices too far from shore; they should be placed within 3 miles of the fishing base. On this basis, we have made aggregate placements at a total of 10 locations in Kosrae, as shown in the following chart.



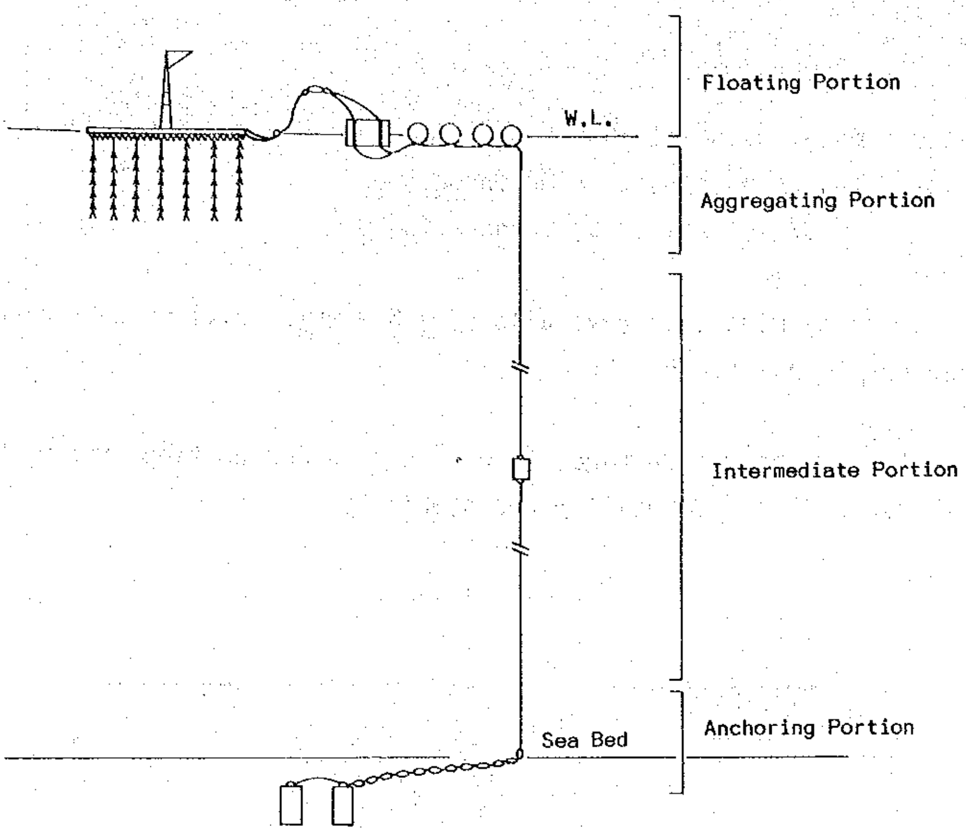


Fig. Fish Aggregating Devices

The most appropriate locations for these fish aggregating devices would be within 3 miles of each fishing base at a depth of approximately 1,000 m. Actual placements would be done by the MRF, which plans to set 2 locations per area on the basis of surveys.

3.2.5 Floating Jetty

This jetty will have to permit simultaneous mooring of up to 10 boats. The total width of each boat is 2.7 m; thus, the required total mooring length will be:

Width (2.7m) x 10 boats = 27 m

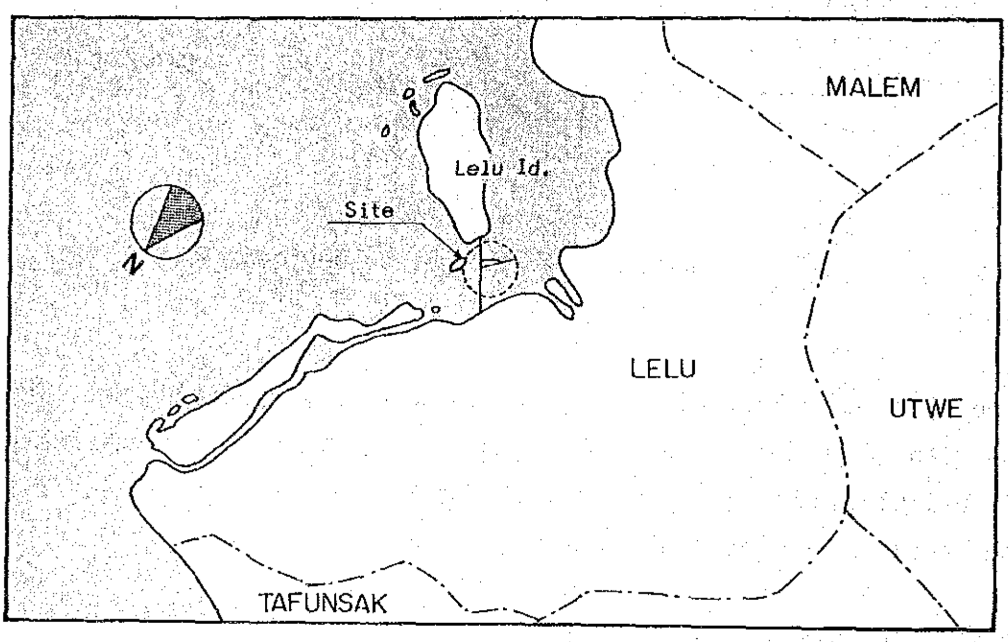
However, if spacing is not provided between the boats, there is a danger of collision or damage from wave action. We will, thus, provide a pace of 1 m between the vessels, resulting in a total length requirement of 37 m.

Accordingly, assuming that boats will be moored on both sides of the jetty, the required jetty length becomes:

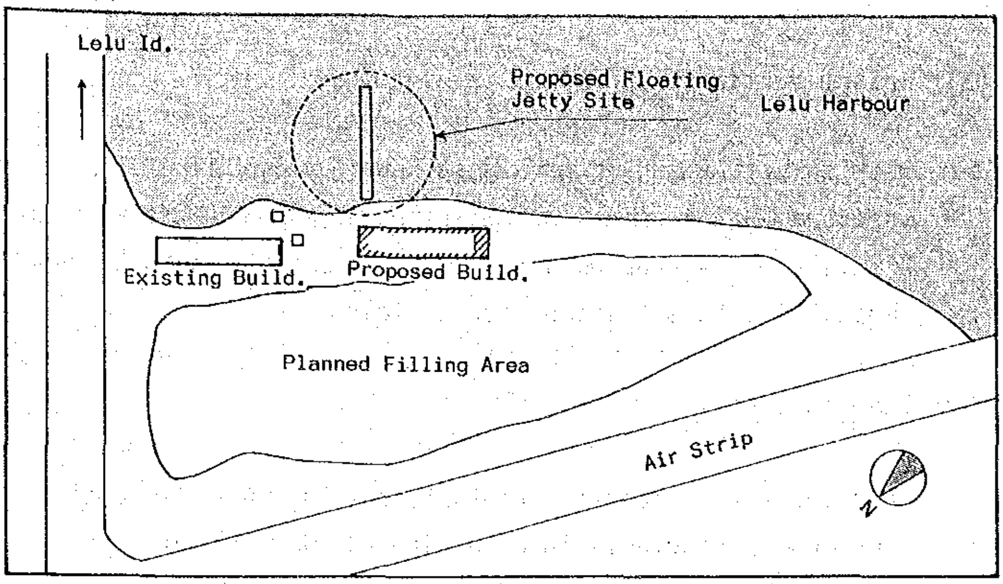
37 m ÷ 2 = 18.5, rounded to 20 m.

As to jetty width, we have allowed 1.5 m which will be sufficient for two persons to pass each other.

For the buoyancy structure, we will use an FRP heating system which offers excellent durability and stability.



Location Map 1



Location Map 2

3.2.6 Fishing Gear

(1) Trolling Gear:

Using artificial bait hooks, the boat targets, as it cruises, the Pelagic migratory species: e.g., skipjack and yellowfin tuna. We have thus provided 4 sets of gear to be attached to each boat as an expendable item. We plan to donate sets for 3 cycles to give the fishermen an opportunity to become familiar with the use of this gear. It is presumed that, after the first 3 cycles, they will be in a position to purchase materials and fabricate their own gear.

(2) Bottom Hand Line:

This technique will be used to catch demersal fish, at 100 - 200 m depths, from the edge of the reef. Engines are stopped for the fishing operation, and it is most effective for the operation to be conducted at night.

We have provided 2 sets of gear with each boat, which, as in the case of the trolling gear, will be sufficient for 3 cycles.

(3) Bottom Vertical Long Line:

With this technique, while doing bottom hand line fishing, the vertical long line are set with supplementary bait attached. 2 sets of this gear will be distributed to each boat, and this supply will be sufficient for 3 cycles.

(4) Ice Containers:

In order to maintain freshness, one container will be issued to each boat. However, since the ice plant is located only in Lelu, we shall provide another 30 containers for transport by truck.

3.3 Skipjack Fishing Training Vessel

3.3.1 Hull and Type

Possible hull materials include wood, steel, and FRP. However, since FRP is light, sturdy, and durable, is easy to work with, and is relatively cheap, it is frequently used in vessels of 20 GT or less.

If a wooden vessel is used for a long period of time, it will absorb sea water and become heavy, with the result that, to maintain its original performance, it becomes necessary at some point to substitute a higher horsepower engine. In the case of steel vessels, it is necessary, in order to prevent corrosion, to put the vessel in drydock once a year for repainting. For the above reasons, FRP has been selected as the vessel material.

The vessel type will be single-deck, with a fish hold in the bow and the engines in the stern. On skipjack pole-and-line vessels, characteristically, the fishing is done on the sides of the vessel and so a fishing stand, with water sprinkling facilities, is mounted on the outside of the bulwark(s), with the bowsprit extending out from the bow.

3.3.2 Determination of Capacity

(1) Live-bait Hold:

On skipjack pole-and-line vessels, such species as banded blue sprat, spotted herring, and ox-eye scad are caught within the reef, using sticknets, and raised in the live-fish hold as a source of fresh bait.

Generally speaking, some 50 - 70% of this bait fish is said to die each day, though this mortality ratio may vary by species, time of catch, and fish size. In order to avoid the loss of bait fish in the live-fish hold, the generally accepted storage density is 10 - 20 kg/m^3 of hold area.*

One standard sets the maximum loading density at 13 kg/cm^3.

In Kosrae, in view of the low levels of technical training and experience, in order to hold down mortality rates to some extent, we plan to install a forced circulation unit in the live fish tank, but we shall nevertheless use 13 kg/m^3 as the load density factor.

At present, judging by the experience with the 35 ft. FRP vessel presently owned by the MRF, on the average, 14.5 buckets, each containing 3 kg of bait fish, are used daily.

Bait Fish 14.5 baskets x 3 kg = 43.5 kg

Accordingly, the capacity of the live bait hold would be:

43.5 kg - 13 kg/m^3 = 3.34 m^3

For insulation purposes, the vessel bottom and sides will be lined with 100 m/m urethane foam, which will constitute the FRP covering. Thus, the total required capacity for the live bait hold, including insulation, will be about 4 m^3.

* From "Research on Bait Fish for Skipjack Fishing", by Nakano.

(2) Ice Hold:

Based on the average performance of skipjack pole-and-line vessels (GT 19 ton) operating in Japanese waters, some 1.5 tons of ice are loaded per 2-day trip.

In the case of the subject vessel, we are estimating a maximum catch of about 1 ton over 2 operating days, on the basis of which we have calculated the required capacity of the ice hold as follows.

The required ice capacity is set at 1.4 x catch volume. Figuring the specific gravity of ice at 0.92 ton/m^3 and the storage ratio of ice at 0.6, we have:

$$\text{Capacity of ice hold} = \frac{1 \text{ ton} \times 1.4}{0.92 \times 0.6} \times 2 = 5.07 \text{ m}^3$$

Again, as the FRP covering, we shall insulate the bottoms and sides of the vessel with 100 m/m urethane foam. Accordingly, the required total capacity of the ice hold, including insulation, will be about 6 m^3.

(3) Fuel Tank:

With the main engine being set at 180 PS, fuel consumption is 185 g/hr/PS. Figuring 2-day trips of 8 hours per day, the consumption per trip will be:

$$\frac{180 \text{ PS} \times 185 \text{ g} \times 8 \text{ hours} \times 2 \text{ days}}{0.85 \text{ kg}/\ell} = 627\ \ell$$

At 2 trips per week and with once-a-week refueling, the required minimum capacity would be 1254 liters. However, including a safety margin, we have set this capacity at 1600 liters.

(4) Fresh-water Tank:

In Japan, with fishing vessels of 20 GT or over, the minimum required size of fresh-water tank, as prescribed by the Seamen's Code, is set at 20 liters per day per man. Applying this standard to the subject vessel, the required volume of fresh water becomes:

$20\ \ell \times 9$ persons $\times\ 2$ days $= 360\ \ell$

Therefore, the capacity of the freshwater tank has been set at 360 liters.

(5) Engine Room:

Skipjack schools migrate at about 6 - 7 knots. For the subject vessel to pursue these schools, it must be capable of generating about 10 knots per hour when full load condition. In a vessel of about 10 GT, an engine of at least 180 PS is required for this purpose.

In addition, since bait fish are to be caught with stick-held net, power must be provided for such equipment via a generator coupled to the engine.

Allowing, in addition to the length of the engine and generator, space for maintenance of both units, we have set the total area of the engine room at about 9 m^3.

(6) Crew's Room Design:

Since the subject vessel will operate on 2-day trips, quarters will be required. The crew composition will be:

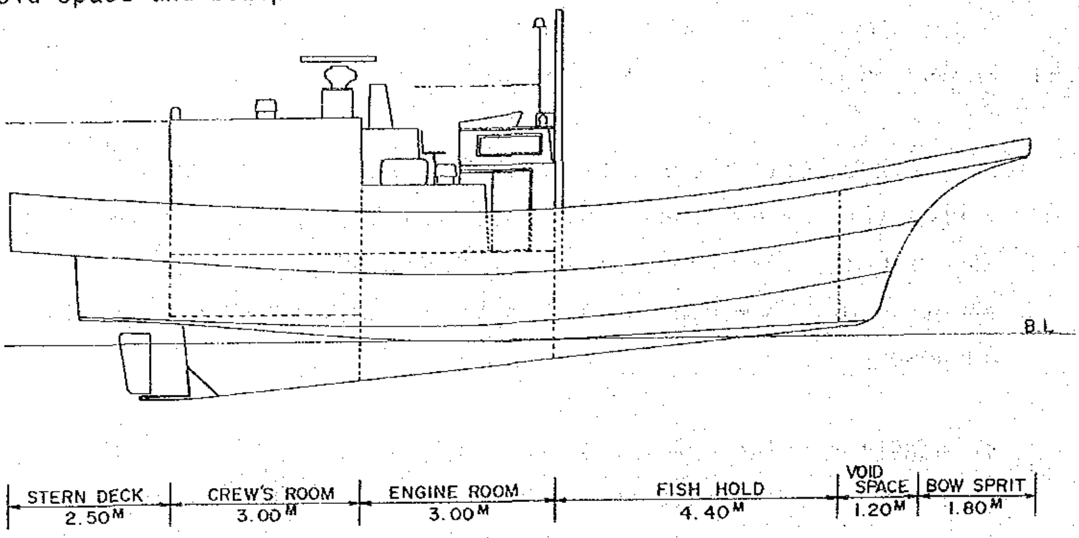
Captain	1
Master Fisherman	1
Fishermen	7
Total	9

One member of the crew will be on watch all night, while another will be piloting the vessel. Thus, at any one time, quarters with bunks for 7 persons must be provided, along with a simple galley.

We have allowed approximately 5.4 m² for these living quarters.

3.3.3 Determination of Overall Length

The subject vessel is to be an FRP skipjack pole-and-line vessel, with deck space, crew's room, engine room and hold space toward the stern and void space and bowsprit toward the bow.



(1) Stern Deck Length 2.5 m:

2.5 m is required for stern operating space when mooring emergency use during steering breakdowns and operating area.

(2) Length of Crew's Room Area 3.0 m:

Approximately 3.0 m of length are needed to accommodate bunks for 7 crew members and a small galley.

(3) Length of Engine Room 3.0 m:

While batteries and pumps will also be provided, length of the engine room is determined by dimensions of the main engine and generator.

Main engine (180 PS) ..... Approx. 1,600 m/m
Generator (3 KVA) .... Approx. 600 m/m
(including installation space)

Allowing, in addition, for installation of the engine mount and maintenance requirements, a total length of about 3 m will be needed.

(4) Length of the Holds 4.4 m:

The total capacity, including insulation, of the live fish and ice holds is about 10 m^3. With a plan width of 3 m and a plan depth of 1 m, 3.33 m of length are required for these hold areas. However, since the width at the bow is narrower than at mid-ship (in order to cut through the waves), extra length must be provided.

Based on comparable data, the average width of the bow area is usually 75% of that at mid-vessel. Accordingly, the length becomes:

$$\frac{10\ m^3}{3 \times 1 \times 0.75} = 4.4\ m$$

(5) Length of Bow Void 1.2 m:

In regulations on reinforced plastic of the Japan Maritime Association, it is stipulated that "a space be provided in the bow of between 0.05 - 0.13 L in the vessel length". Based on this regulation, and applying data on perpendicular length in comparable type vessels, we have set the bow void length at 1.2 m.

(6) Length of Bowsprit 1.8 m:

Applying data for comparable vessels, we have set the length of the bowsprit at 1.8 m.

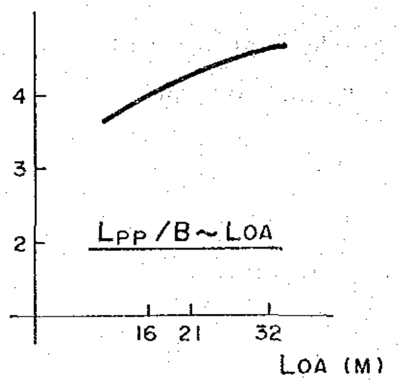
Aggregating the above lengths, we derive a total vessel length of 15.9 m, which has been rounded to about 16 m.

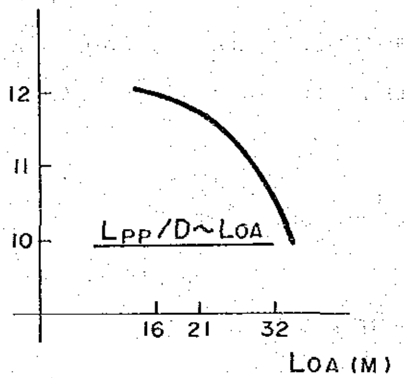
3.3.4 Main Specifications

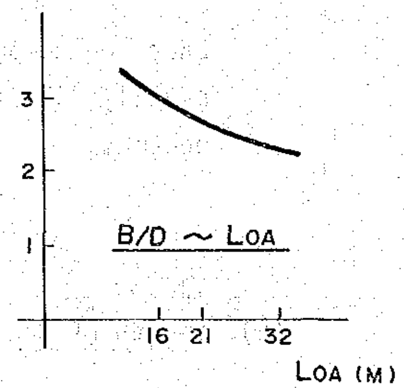
Based on data for comparable vessels on the coefficients of total length/length c., length/breadth c, length/depth c. and breadth/depth c, we can derive, from the above total length, the dimensions (L, B, D) of the subject vessel.

Related data for comparable vessels are as follows:

Loa/Lpp = 1.33
Lpp/B = 3.96
Lpp/D = 11.88
B/D = 2.98



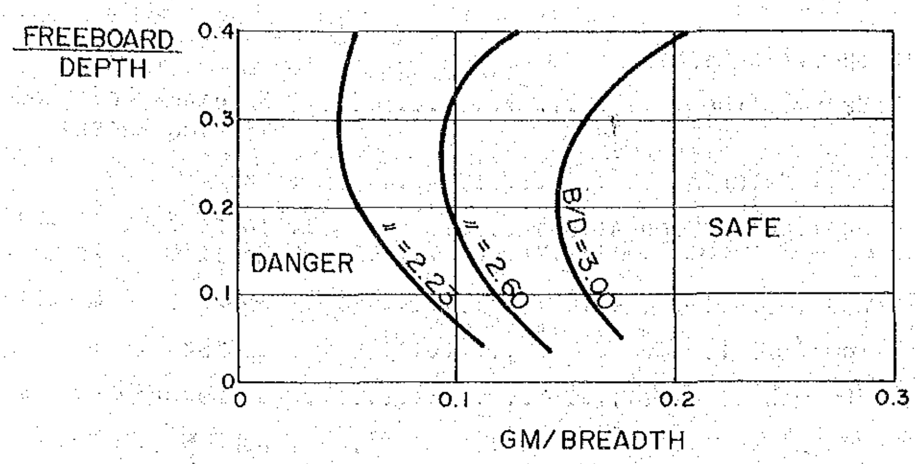




With Loa at 16 m,

Length : Lpp = Loa/1.33 = 12 m
Breadth : B = Lpp/3.96 = 3 m
Depth : D = Lpp/11.88 = 1 m

Let us next consider vessel stability against side waves and cross-winds:



SAFETY LIMIT CURVE BY B/D

It is clear from the above that, the larger the B/D value, the closer the safety limit curve approaches the right side of the chart. This demonstrates that, the larger the B/D ratio, the larger the GM must be to maintain a given level of safety.

The subject vessel has the following dimensions:

Plan freeboard .... 0.44 m
Plan depth .... 1.00 m
Plan vessel breadth .... 3.00 m

Thus, freeboard/depth = 0.44 m

If we now estimate GM (metacentric height) from this chart, based on GM/vessel breadth = 0.22, GM = 0.66 m is the minimum value from a safety standpoint.

Thus, based on data for comparable vessels, under the most adverse top-heavy conditions, if GM is estimated at 0.68 m or more, BD will, we feel, be at an acceptable level.

3.3.5 General Specifications for the Skipjack Training Vessel

Main Specifications

Vessel Type	Skipjack Pole-and-Line Fishing Vessel
Hull Material	FRP
Applicable Regulations	To conform to the Japan Maritime Safety Law
Loa	approx. 16 m
Lpp	approx. 12 m
Breadth	approx. 3 m
Depth	approx. 1 m
Gross Tonnage	approx. 10 tons
Live Bait Hold	3.34 m^3 or over
Ice Hold	5.0 m^3 or over
Fuel Tank	1,600 liters
Freshwater Tank	250 liters
Service Speed (full load condition)	approx. 10 knots
Crew	9 persons

Engine Room

Main Engine (180 PS or over)	1 unit
Generator (3 KVA)	1 unit

Fishing Equipment

Skipjack Fishing Poles	30 pcs.
Stick-held Net (including spares)	1 set
Forced Circulation Unit	1 set
Fish Gathering Lamp (2 KW)	1 set

Navigational Equipment

Radio Equipment (SSB)	1 set
Radar	1 set
Fish Finder	1 set
Radio Direction Finder	1 set
Life-saving Equipment	1 set
Lamp	1 set
Vessel Fixtures	1 set

3.4 Workshop

3.4.1 Size Determination

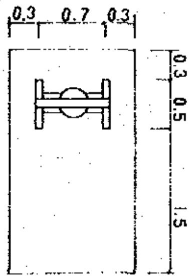
(1) Outboard Engine Repair Room:

The required area for the facility has been determined on the basis of the volume of work to be performed and the amount of equipment that must be incorporated. the repair operations on outboard engines, which is the primary purpose of this facility, have been broken down between those in response to breakdowns and those in connection with regular inspections.

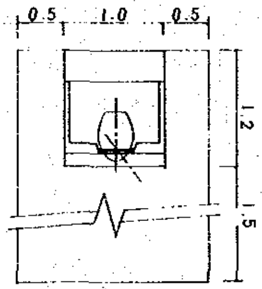
As previously indicated, the number of engines likely to be undergoing repair or inspection in this facility at any given time has been set at 4.

Determination of Required Area:

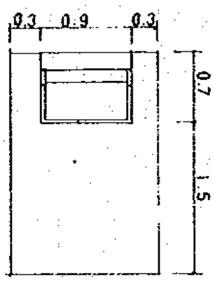
Among the repair equipment to be incorporated, separate space will be required for the hydraulic press, the test tank, the cleaning stand, parts shelf, compressor, workstand, and a stand. The respective areas for each of these items are shown below:



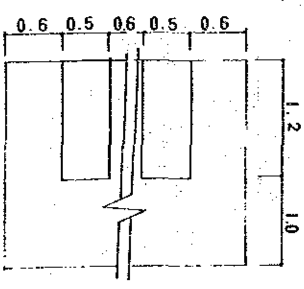
Hydraulic Press
1.3×2.3=2.99m²



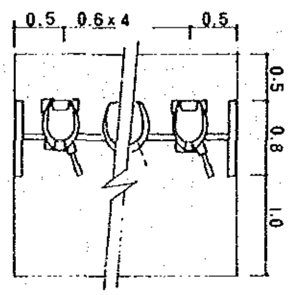
Test Tank
2×2.7=5.4m²



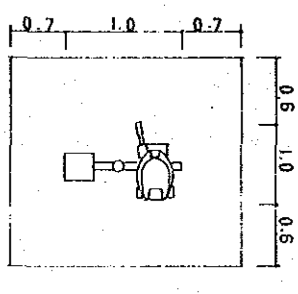
Parts Cleaning Stand
2.2×1.5=3.3m²



Parts Shelf
2.8×2.2=6.16m²



Stand
3.4×2.3=7.82m²



Work Stand
2.4×2.2=5.28m²

Assuming that the repair work on the outboard engines will be done by the workstand method, the repair area per engine will be:

$$2.4 \times 2.2 = 5.28 \times 4 \text{ engines} = 21.12 \text{ m}^2$$

Accordingly,

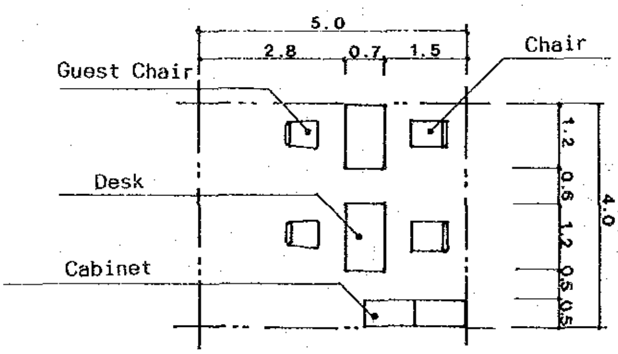
Total space for equipment	25.67 m^2
Total space for repairs	21.12 m^2
Total	46.79 m^2

Figuring the space for equipment and repairs at 46.79 m^2, and after a further allowance for space for receiving and dispatching operations and for access space to the various equipment, the required total area becomes about 60 m^2.

In view of the small number of inboard engines to be serviced, space for this purpose can be obtained on an ad-hoc basis, as needed; thus, no special provision for inboard repair space need be made in this plan.

(2) Administrative Office:

This will include space for the administrative personnel in the workshop. The required area has been calculated on the basis of a staff of 5 technicians and 2 office workers. The required furnishings will include desks and chairs, cabinets, and chairs for visitors. Allowing for appropriate spacing of this furniture, the required space, as shown in the following layout, works out to about 20 m^2.



Office space will be provided for a Supervisory Technician and a Works Supervisor. Based on a compilation of available building design data, the total required space becomes 19.5 m^2 - 26.5 m^2.

Supervisory Technician	....	13.0 - 18.0 m^2
Works Supervisor	....	6.5 - 8.5 m^2
	Total	19.5 - 26.5 m^2

The appropriate density per unit of area, based on the same compilation, has been set at 0.11 - 0.28 persons/m^2. The density that has been set for the plan office is 0.1 person/m^2, which is at the upper limit of the acceptable range. Based on the above assessment, and allowing also for receiving visitors, we arrive at about 20 m^2 for the required area.

(3) Storage Room; Other Areas:

In this plan, the items that must be stored include parts for outboard engines, spare equipment for the FRP boat, ice containers, for use on the other boats owned by MRF, and fishing gear. The items to be stored will be quite varied, and so the volume of these stored materials and the periods of storage will not be constant.

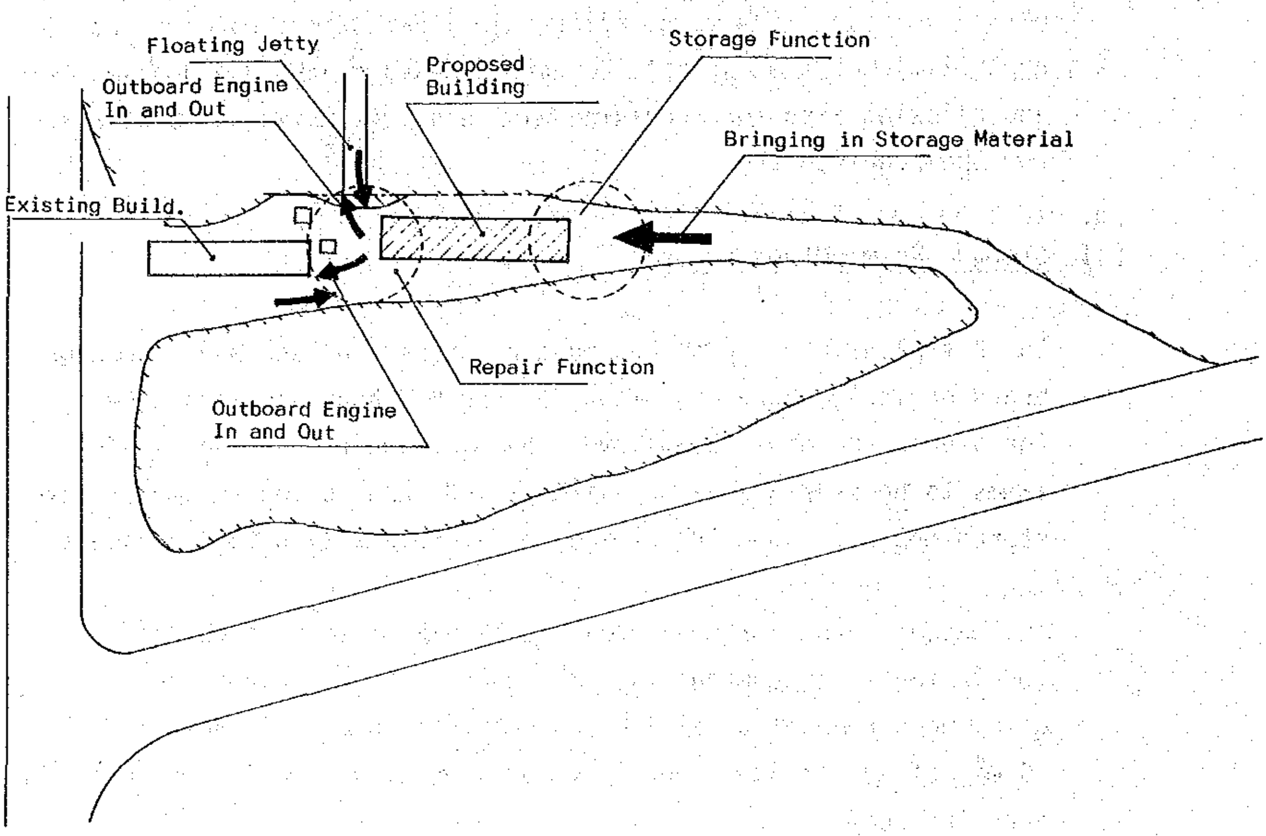
If, based on the workshop area, we set 10 m^2 each as the space requirements for components, FRP replacement materials, and fishing gear, we arrive at a total requirement of 30 m^2. An additional 10 m^2, at the maximum, should be provided for a men's lavatory and dressing room.

3.4.2 Construction Plan

(1) Location Plan:

The planned construction site is quite long in an east-west direction but extremely short from north to south. (cf. following Figure). On the eastern side are located the refrigerator and ice plant belonging to the MRF.

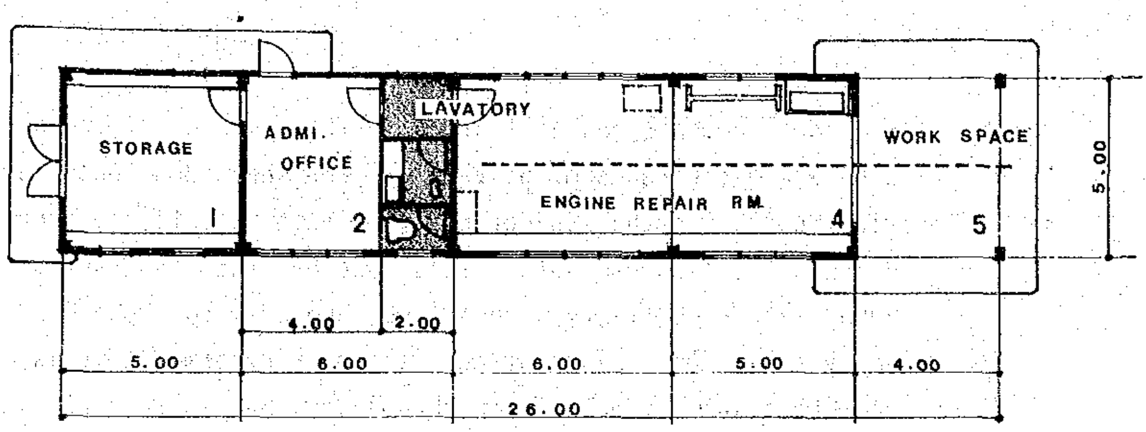
Access to the site is possible from both the east and west sides. However, after the planned facilities have been put in place, it will no longer be possible for vehicles to pass through the site from the side to the other. Thus, the repair operations, the storage function, and the placement of the various rooms will be effected in such manner that the entry of outboard engines destined for repair will be from the eastern side, while that of materials intended for storage will take place from the west.



(2) Plan:

The various rooms in the subject facility are intimately related to one another so that it would be desirable to draw up a movement plan linking the various locations. However, while there is relative leeway in a lengthwise direction, the depth of the site is quite limited, to 5 - 6 m at most.

In the placement of the various rooms, we have given careful consideration to the in-and-out flow of materials and to the movement of people and have also provided some 20 m^2 of covered work space as a supplementary work area for repairs on small fishing boats and fishing gear. As shown below, the layout plan is lateral; we have located the administrative office in the middle of the facility and the storage and repair areas at either end.



The total floor area for the planned facility is 130 m^2.

(3) Structural Plan:

The plan site is located on land which has been recently reclaimed. The soil is relatively soft, of coral sand penetrated, and so excessive load-bearing conditions cannot be expected. Accordingly, the structure must be made light enough to bear its own weight with a high ceiling to permit the use of a hoist crane for the movement of functionally heavy materials, ventilation, and a wide opening to allow the movement of repair equipment.

In consideration of the above conditions, it would, in fact, be inappropriate to use the H.C. block construction that is prevalent in this area. The use of reinforced rigid structure construction would, in our view, be optimum from the standpoint of shortening the construction period.

(4) Building Component Plan:

In planning the construction components, we have given careful consideration to the natural conditions, high heat and humidity and large rainfall and social conditions, the many constraints on local procurement of materials, skilled workers, and construction machinery.

(a) Roof:

The most common types of roofing in the vicinity of the plan area are gable roofs of galvanized iron sheet and concrete flat roofs. In the subject plan, we have essentially specified pitched steel-sheet roofs. This type has the advantage of being water-resistant, widely used, and easy to repair. However, we must point out certain major defects in terms of poor heat insulation and low durability, but these negatives can be countered by the use of ceiling space, insulation, and high-quality paint.

(b) Exterior Wall:

The most commonly used material in Kosrae is H.C. block, but it would be structurally difficult to use this, throughout the building, in view of the wide opening and high eaves. But this material will be used, to take advantage of its durability, in the lower part of the walls, where damage is liable to occur from collisions, owing to the building's characteristics. For the rest of the wall, we will use the same material as for the roof — viz, steel sheets.

(c) Interior Finish:

For the interior walls, we will use mortar finish in the block portions and paint in the steel plate portions. Only in the lavatory area will paint be used on both ceilings and walls. For the floor finish, we feel that, based on the nature of the facility, mortar would be ideal. For windows, we shall use jalousie windows, which are most common in the area.

3.4.3 Building Equipment

In this section, we shall consider the power, water supply, and drainage facilities.

(1) Electric Work:

Power lines already reach the neighboring facility, and so power will be brought into the plan facility over branch circuit panel via special circuits. The power facilities can be classified into those for lighting and those for power. Both requirements are small in scale, at most 10 KVA. And, considering that there will be no equipment requiring back-up power, the power distribution for the facility can be via direct power lines. There is no need for emergency generators.

The standard local voltage is:

Lighting and outlets .... Single phase 110 V, 60 Hz
Power .... 3 phase 220 V, 60 Hz

(a) Lighting and Outlet Facilities:

Lighting in the vicinity is generally fluorescent, and this will, in principle, be the type employed in the subject facility. Incandescent and other types of lighting will be used where necessary. Wall outlets will be standard 110 V, single phase.

The illuminance levels for the various rooms will 400 LUX for the office, 200 LUX for the repair areas, and 100 LUX for the storage and washroom areas.

(b) Power Facilities:

These include the compressor and welding unit in the repair area. The power source will be 3 phase 220 V, which will be distributed through a safety switch over an independent circuit.

(2) Plumbing Work:

(a) Water-Supply:

Water will be brought into the facility through branch pipes from the municipal water mains which serve the neighboring MRF facility. There will be 5 use terminals in the facility, toilets, washroom, and hydrants, all with extremely small requirements. The water supply will be directly connnected.

(b) Drainage Pipe:

The drainage system will be divided into four branches sewage, miscellaneous drainage, work area drainage, and rain water drainage. The system for sewage and miscellaneous drainage will involve processing in a septic tank, followed by evaporation and seepage.

For work area drainage, which contains oil, the oil will first be separated via oil trap and the remaining water then evaporated and seeped. The rainwater will be discharged directly into the sea in the rear of the site via an open gutter.

3.4.4 Workshop Equipment Plan

The following equipment will be required to ensure smooth operation of the subject facility:

(1) For Outboard Engine Repairs:

The required equipment has been classified into machinery for repair use, tools, facilities, and receiving fixtures. Japan has had long experience in the operation of this type of work area. We have selected the necessary equipment based on this experience, as adapted to local conditions. The complement of equipment is as follows:

Equipment for Repair use
- Hydraulic press
- Drill machine
- Vice
- Grinder
- Crank aligner
- Parts cleaning stand

Fixtures
- Outboard engine test facility (test tank)
- Air supply facility (compressor)
- Work bench (workstand)
- Workstand (workstand)
- Charging unit (battery charger)
- Materials handling facilities (chain block)

Storage Facilities
- Cabinet
- Parts shelf

Tools
- Repair tools

(2) For FRP Repairs:

The equipment required for FRP repairs may be classified into tools and materials.

In FRP repair work, the key factors are the repair environment, repair technology, and the selection of glass-fiber, and resin materials. Given adequate knowledge and equipment in these areas, FRP repairs are not all that difficult.

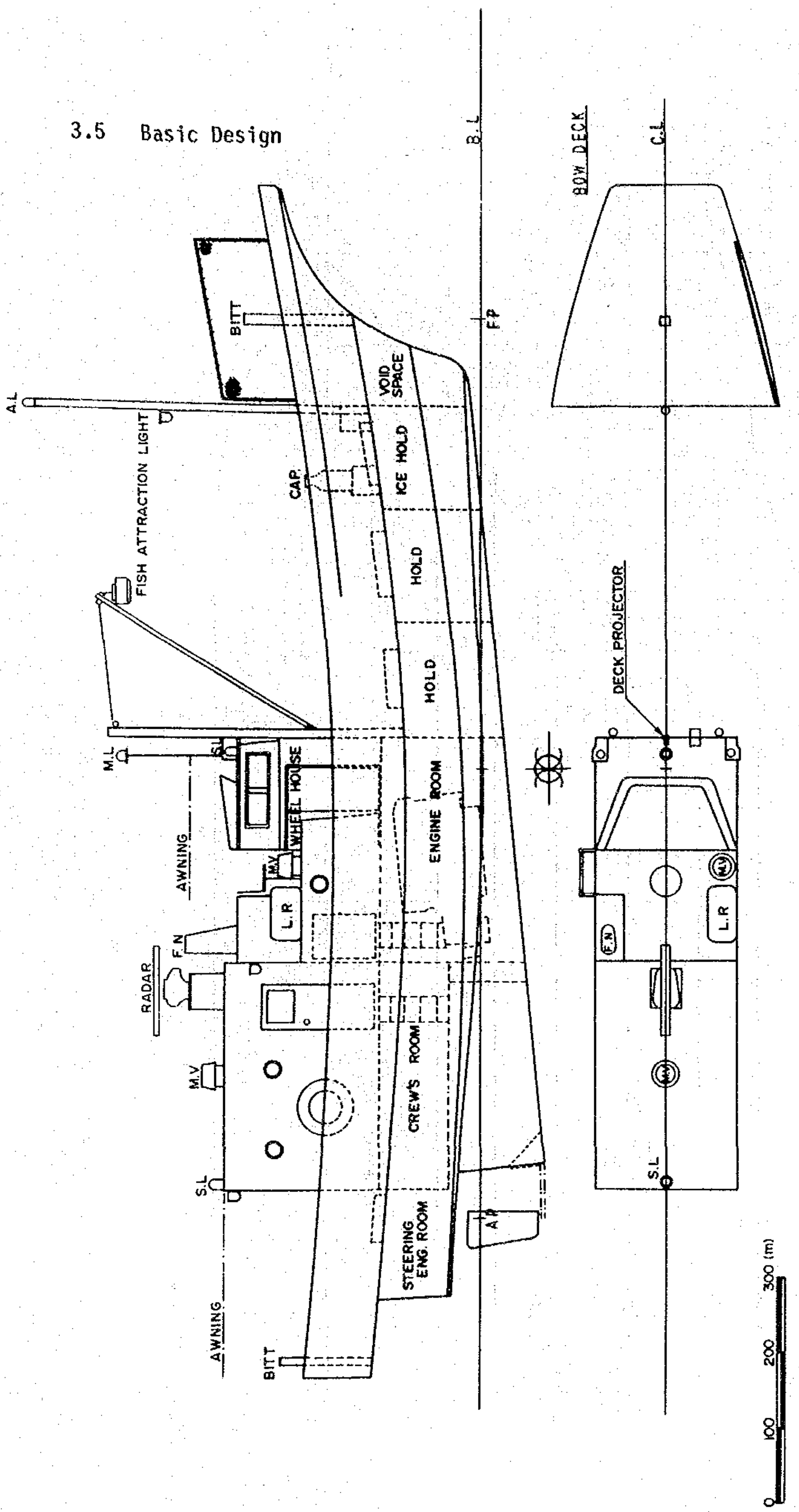
Among the plan personnel are people who have visited Japan as trainees from Kosrae State and have acquired skills in the operation and repair of regular engines, outboard engines, and FRP boats. We believe, therefore, that there will be no problems in relation to either technological levels or knowledge in carrying out this work.

Following is an outline of the equipment to be used in FRP repairs:

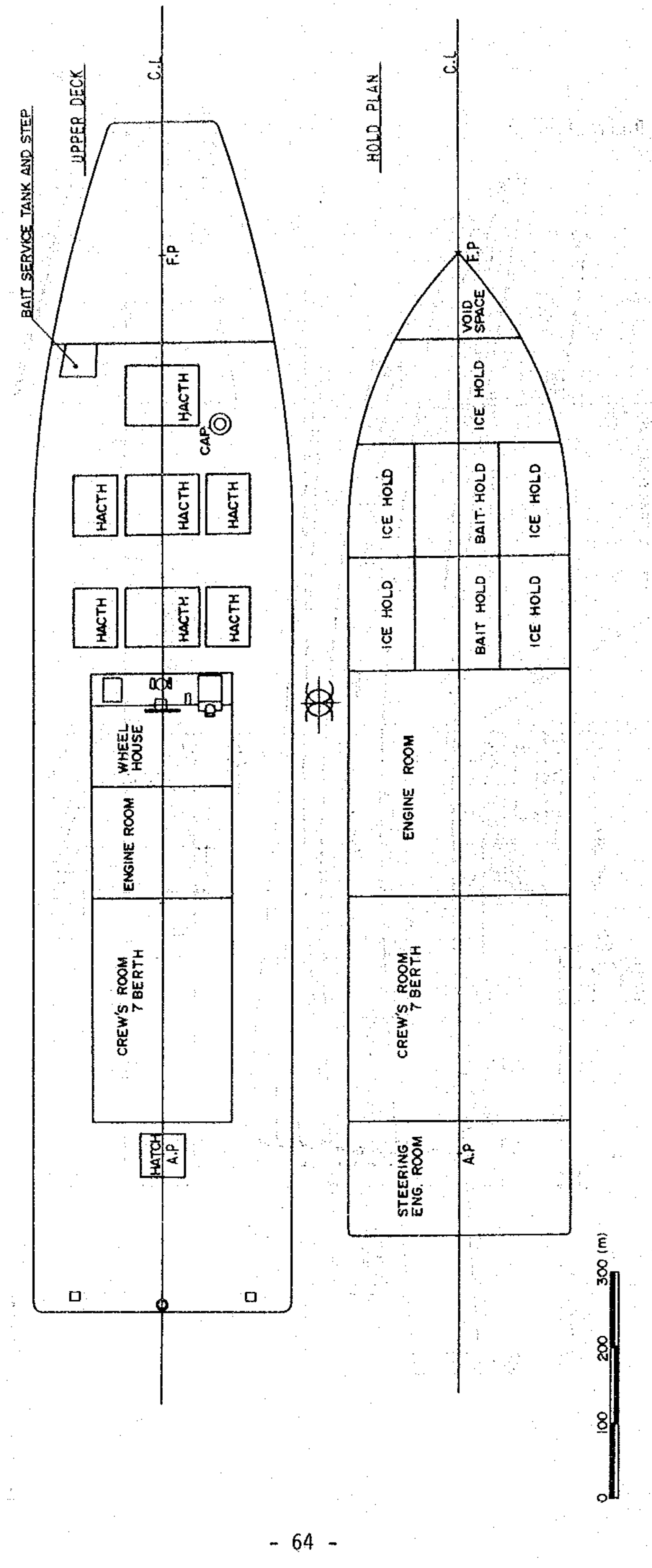
Tools for FRP Repairs
- Sandpaper
- Disc sander
- Hack-saw
- Drill
- Scale

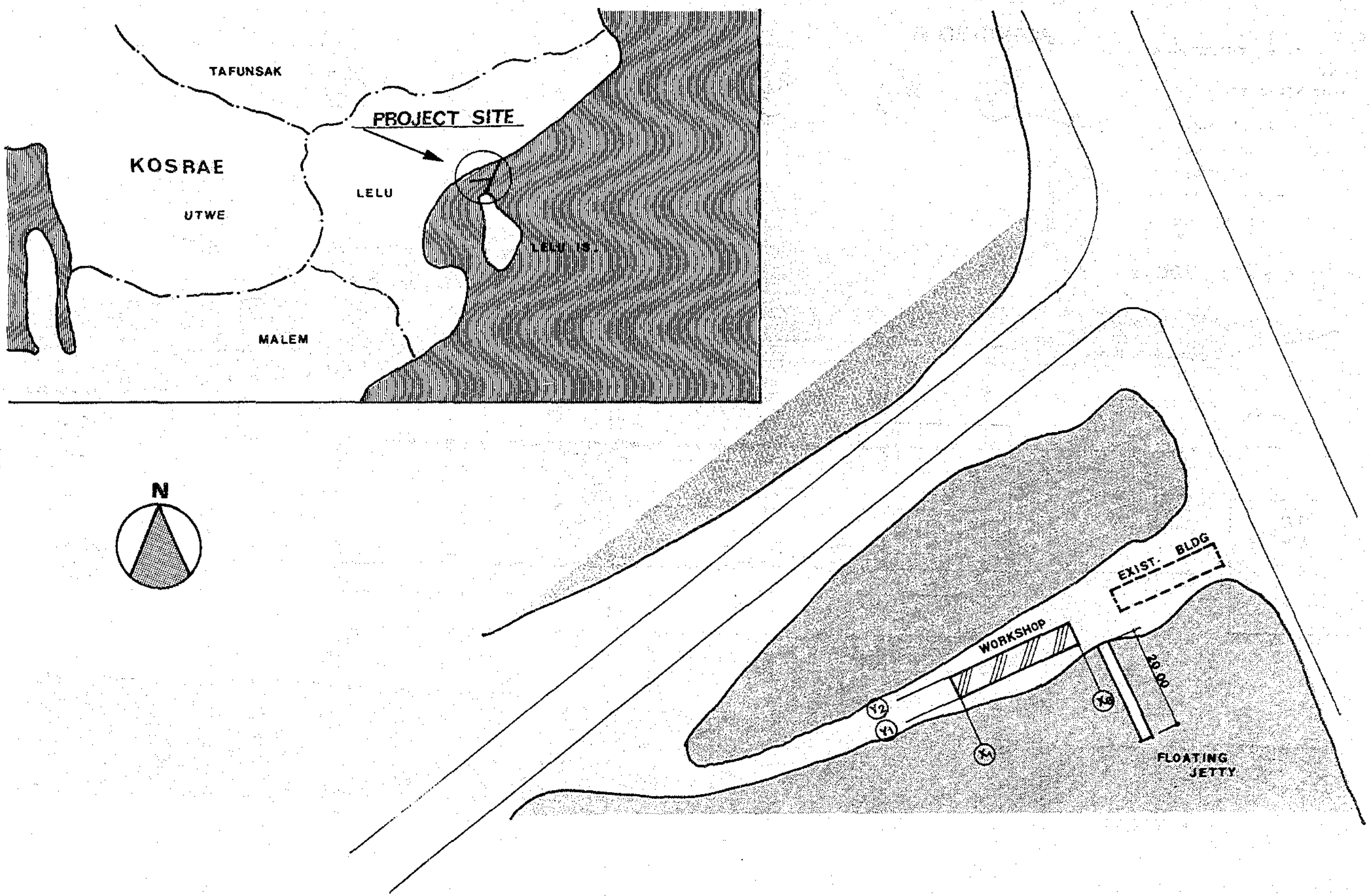
Materials for use in FRP Repairs
- Polyester resin
- Gel coat
- Acetone
- Glass cloth
- Glass rubbing cloth
- Glass mat

3.5 Basic Design

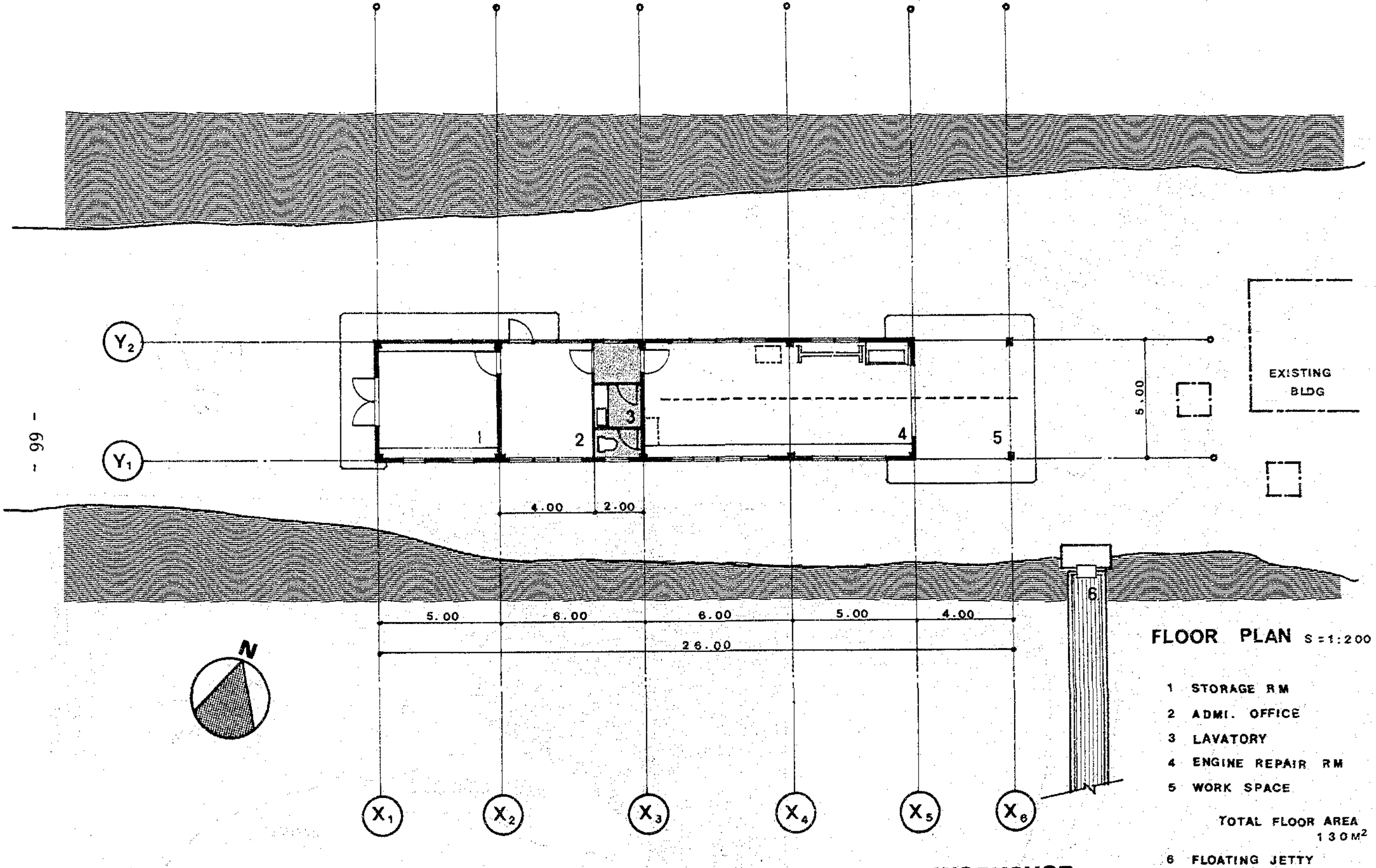


GENERAL ARRANGEMENT SKIPJACK FISHING TRAINING VESSEL

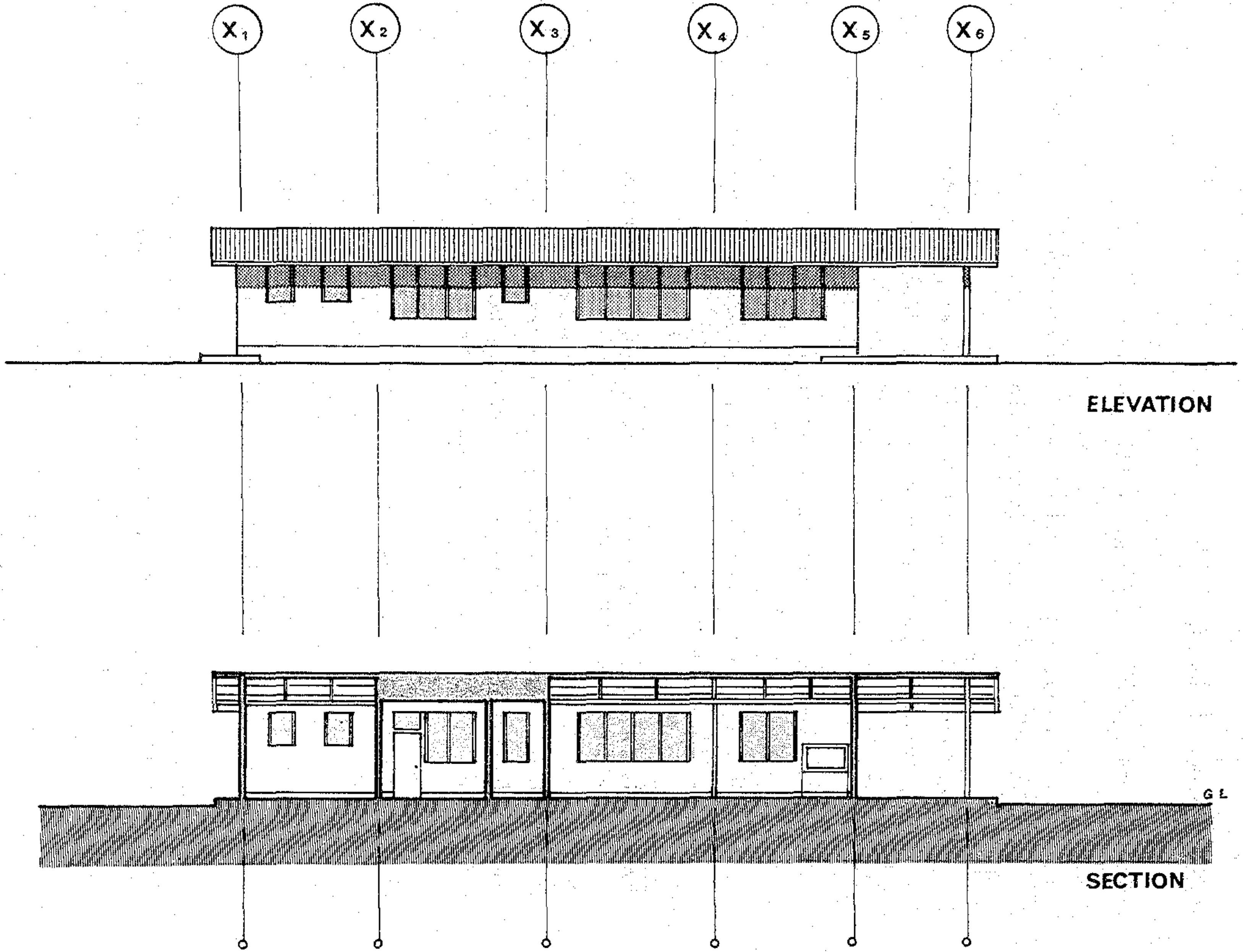

BAIT SERVICE TANK AND STEP
UPPER DECK
C.L
F.P
HACTH
CAP
HACTH
HACTH
HACTH
HACTH
HACTH
HACTH
WHEEL HOUSE
ENGINE ROOM
CREW'S ROOM 7 BERTH
HATCH
A.P
HOLD PLAN
C.L
F.P
VOID SPACE
ICE HOLD
ICE HOLD
BAIT HOLD
ICE HOLD
ICE HOLD
BAIT HOLD
ICE HOLD
ENGINE ROOM
CREW'S ROOM 7 BERTH
STEERING ENG. ROOM
A.P
0
100
200
300 (m)



LOCATION PLAN S = 1 : 1,000 M


EXISTING BLDG
5.00
1
2
3
4
5
6
4.00
2.00
5.00
6.00
6.00
5.00
4.00
26.00
N
Y_1
Y_2
X_1
X_2
X_3
X_4
X_5
X_6
FLOOR PLAN S=1:200
1 STORAGE RM
2 ADMI. OFFICE
3 LAVATORY
4 ENGINE REPAIR RM
5 WORK SPACE
TOTAL FLOOR AREA 130M²
6 FLOATING JETTY

WORKSHOP



WORKSHOP S = 1 : 200

3.6 Construction Scope

3.6.1 Scope of the Plan

The following items are included in this project:

1) The procurement of small FRP boats and equipment for commercial fishermen and guidance in their use.

2) Construction of a Skipjack Training Vessel for the MRF and provision of services relating to pilot operations of this vessel.

3) Construction of a workshop on MRF site.

4) Provision of services required for implementation and supervision of the above.

3.6.2 Division of Responsibilities between Government of FSM and the Government of Japan

If this plan is implemented on the basis of a grant-in-aid from Japan, the distribution of responsibilities between the two governments will be as follows:

(1) Items to be the responsibility of the FSM Government:

1) Smooth clearance through customs of all equipment, the training vessel, and spare parts; payment of all expenses, including any duties, commissions, or handling charges.

2) Provision of the construction site for the workshop at the MRF facility in Lelu; the removal of any obstructions and leveling, as required.

3) In connection with the provision of equipment, the training vessel, and the various services, FSM will obtain and/or grant

all necessary approvals, permits, and other privileges for the necessary Japanese personnel and will arrange to exempt such persons from all taxes and other assessments in FSM.

4) FSM will take measures to obtain the necessary budgets for effective operation, maintenance, and control of the equipment, furnishings, and training vessel to be provided under the grant-in-aid; and for preparation and operation of the necessary equipment and fixtures.

(2) Items to be the Responsibility of the Japanese Side:

1) Necessary expenditures for the procurement of the small FRP boats and materials, construction of the Skipjack Training Vessel for the MRF, and construction of the workshop.

2) Ocean freight, ocean shipment, insurance and inland freight for the small FRP boats, materials, the Skipjack Training Vessel, and materials brought into Kosrae for the construction program.

3) Construction services, including the Detail Design, assistance in bidding, and construction supervision.

3.7 Estimate of Cost to be borne by the FSM Side

Cost for cleaning and leveling the proposed site is estimated at 2,145 thousands Yen.

Section 4 Project Implementation Plan

4.1 Implementation Plan

(1) Implementing Organ:

If this project is implemented on the basis of an exchange of notes between the two countries, the MRF will be made fully responsible for all aspects of project implementation and operation, including the small FRP boats, the Skipjack Fishing Training Vessel, and the Workshop for outboard engine repairs.

(2) Implementation Method:

The construction contract for the project will be made between FSM National Government and a Japanese corporation.

The work in this project may be divided essentially between the project to construct small boats and a Skipjack Fishing Training Vessel and the project to build a workshop for the repair of outboard engines. After a consideration of various contracting methods, we decided, in the interest of smooth project implementation, to employ one prime contractor under a blanket agreement.

This is because of the close relationship between both project phases. The maintenance checks on the small boats and the Skipjack Fishing Training Vessel, which are to be donated under the project, will be performed at the new Workshop, for which the required equipment, expendables and spare parts must be provided. Also, the size of the project is too small to justify division of the contract.

The contractor will be selected on the basis of competitive bids obtained from prequalified Japanese companies.

4.2 Construction Plan

The Skipjack Fishing Training Vessel is to be specially built in Japan. The FRP boats and equipment will also be procured in Japan for shipment to Kosrae. Based on the scope of the construction and equipment and local building know-how, it is estimated that some 8 months will be required to construct the Workshop.

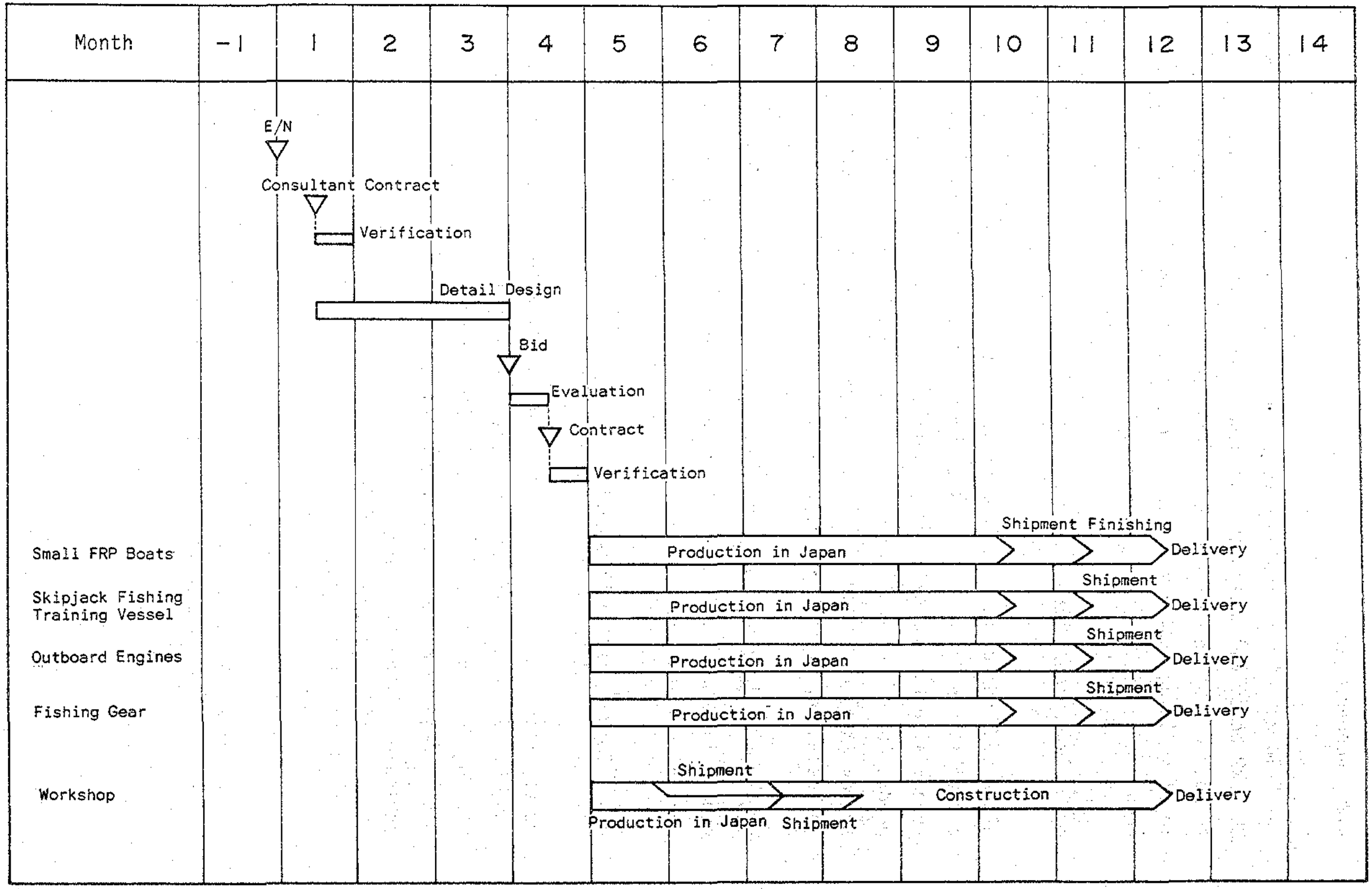
4.3 Supervisory Structure

After concluding the procurement and construction contracts, our activities in Japan will involve checking the construction diagrams, supervising the building of the Skipjack Fishing Training Vessel and production of the small FRP boats and equipment, and providing guidance to the local contractor. If required, we will also made special trips to Kosrae for on-the-spot supervision.

Toward the completion of the construction work, we will conduct a completion check in Kosrae, at which time we shall turn over the building and all equipment to the FSM.

4.4 Implementation Schedule

We estimate that, from the exchange of notes, some 12 months will be required for production and delivery of the small boats and the Skipjack Fishing Training Vessel. 12 months would similarly be required for construction and delivery of the Workshop. The anticipated project schedule will be as follows:



Month
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
E/N
Consultant Contract
Verification
Detail Design
Bid
Evaluation
Contract
Verification
Small FRP Boats
Skipjack Fishing Training Vessel
Outboard Engines
Fishing Gear
Workshop
Shipment Finishing
Production in Japan
Delivery
Shipment
Construction
Production in Japan

Section 5 Management Plan

5.1 Distribution of the Small FRP Boats

(1) Management System

In distributing the small FRP boats, we anticipate, the MRF will solicit applications and then review the technical qualifications of the applicants. Successful applicants will be enrolled in a 5-day training course which will cover the following areas.

Day	Subject	Contents	Location
1st Day	Engines	Refueling methods Starting and stopping Gear shifting Ignition check Cleaning of filters Inspection	MRF Workshop
2nd Day	Operations; safety	Boat operations Stopping/docking Operation of safety equipment (paddle, emergency engine, life jackets, etc.	At sea
3rd Day	Fishing gear	Fabrication of devices for trolling, bottom fishing, buoy lines	MRF Workshop
4th Day	Fishing methods	Trolling School finding methods Trolling speed Bottom-fishing; buoy lines Fishing Methods Anchoring	At sea
5th Day	Review and summary	Review of previous material and exams	MRF Workshop and at sea

After the training course, applicants will return to their villages and start fishing operations. Since gear and fittings are to be sold, the plan vessels will follow the following fishing methods:

Fishing Days:

140 days/year;
20 dyas per month during the good fishing season (August/September);
10 days a month the rest of the year.

Number of Fishing Hours:

The vessels will troll at 3 of the 10 locations at which payao (fish aggregating devices) have been set. Each of the payao will be positioned within 3 miles of shore so that round trip cruising time should be about 30 minutes (at 12 - 13 knots per hour).

Fishing operations will be conducted for about one hour. Depending on the size of the pelagic catch, the vessel, on its return to the island, may anchor itself in shelf waters inside the reef of 100 - 150 m depth for bottom fishing operations. Since engines will be stopped during bottom fishing operations, engine operating time has been set at 1.5 hours per trip.

Outboard engine replacement has been based on a life of 1,000 hours (operating hours). Thus, projected life has been set at:

1,000 hours ÷ (140 days x 1.5 hours) = 4.8 years.

Since the hulls will be FRP, their useful life is expected to be 15 years.

Gear sufficient for 3 cycles will be provided gratis along with each boat. However, since these are expendable items, subsequent requirements will have to be purchased. MRF will handle gear procurement and stock this gear for sale to fishermen.

From the above, it is possible to estimate operating costs per vessel. With regard to purchase funds, it will be necessary for