Ministry of Agriculture, Lands,
Fisheries and Barbuda Affairs
Antigua and Barbuda

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF FISHERY EQUIPMENT AND MACHINERY IN ANTIGUA AND BARBUDA

FEBRUARY 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OAFIC CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory study and entrust the survey to OAFIC, Co., Ltd.

The survey team had a series of discussions with the officials concerned of the Government of Antigua and Barbuda, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Antigua and Barbuda for their close cooperation extended to the survey team.

February, 2015

Makoto KITANAKA
Director General
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SUMMARY

1. Country Profile

Antigua and Barbuda is an island nation in the Eastern Caribbean. It has a population of approximately 89,000 (World Bank, 2013) and covers an area of 442km^2 (about the same size as Tanegashima Island). It is bounded on the west by the Caribbean Sea and on the east by the Atlantic Ocean. The gross national income (GNI) is US$1.161 billion (World Bank, 2013) and the GNI per capita is US$12,910 – the second highest among the six countries of the Eastern Caribbean. The tourism industry accounts for approximately 60% of the GNI, but the economy, which is easily swayed by fluctuations in tourist numbers, is unstable. The government is now trying to diversify its industries. One of its projects aims to develop the fishery industry through the effective use of resources within its expansive coral sea regions and exclusive economic zones, all while creating a stable supply of domestic fishery products to replace imports and earning foreign currency by exporting fishery products.

2. Project Background and Outline

Since 2000, Antigua and Barbuda's fish catch volumes have hovered between 2,000 and 3,000 tons per year. Among Eastern Caribbean nations, Antigua and Barbuda has a relatively expansive region of coral reefs and shallow seas, which make ideal fishing grounds for demersal fish, lobsters, conch and the like. For this reason, demersal fish account for over 80% of the fish catch volume. Aside from conch, however, demersal fish catches are on the decline. Meanwhile, pelagic fish catches have been limited due to the movement of fishing grounds and the increasing cost of fuel. Moreover, the country has been plagued by foreign fishing vessels fishing illegally to the south of Antigua and the west of Barbuda. Despite Coast Guard patrols, the area is vast and impossible to cover. Furthermore, fisheries complexes have been developed in five locations (Market Wharf, Point Wharf, Urlings, Parham and Codrington (Barbuda Island)) through past grant aid projects. Although these facilities have been used effectively to improve the distribution of fishery products in the country, the larger equipment, such as ice-making and refrigeration equipment, has aged and is suffering from reduced capacity due to the passage of time. As a result, insufficient ice and cold storage capacity have led to reduced fishing vessel operating rates and limitations on the storage and distribution of fresh fish in some regions

The Government of Antigua and Barbuda has been tackling on sustainable fishery development through formulation and execution of *Fisheries Development Strategy 2011 – 2015*, a five-year plan for fisheries development, which includes the development goals of (1) Preparation of comprehensive Fisheries Management Plan, (2) Utilization of under-exploited species, (3) Infrastructure development (fishery complexes and hurricane shelters), (4) Revision of fisheries legislation, and (5) Development of National Plan of Action to Address IUU. In concrete, to ensure the proper management of marine resources, it formulated new fisheries regulations in 2011 based on limited access, as opposed to the open access utilized before, and has been working to strengthen its fishery management capacity. At the same time, to rein in overfishing in its coastal waters, the country's government has begun using fish aggregating devices (FADs) to create offshore fishing grounds in an effort to promote a shift from reliance primarily on demersal fish to the catching of more oceanic pelagic fish. However, it faces many issues such as ensuring stable commercial fishing in offshore fishing grounds, developing underutilized resources and promoting their distribution, and monitoring illegal fishing.

Amid this backdrop, JICA conducted a data collection survey during November 2013 and February 2014 to confirm the situation surrounding the fishery industry in the nations of the Eastern Caribbean, assess the current state of the fishery facilities and equipment installed using Japanese grant aid, and examine the possibility of future cooperation in the fishery sector. As a result of these surveys, several needs, including upgrades to existing facilities and equipment and the installation of new facilities and equipment to respond to new issues related to change of fishing status and promotion of fishery management, have been confirmed.

The Government of Antigua and Barbuda requested Japanese grant aid for the following initiatives it has deemed as highly urgent: the upgrading of refrigeration equipment at four fisheries complexes, the installation of two submerged-type FADs, the installation of a surveillance radar system, and the introduction of a multipurpose boat.

3. Outline of Survey Result and Project Scope

In response to this request, JICA sent a preparatory survey team to the country as outlined below, in order to formulate the project for upgrading and new introduction of fishery related machinery and equipment which are urgently required, examine its appropriateness and necessity, and prepare outline design, considering the result of a data collection survey conducted previously.

1st field survey: July 21 - August 31, 2014

2nd field survey (in-country explanations): November 24 - December 10, 2014

JICA conducted these field surveys and analyzed the situation in the country to assess the following: the background and content of the project, natural conditions, management and maintenance frameworks, construction conditions, and the materials procurement situation. As a result, this project was found to link closely with the upper level plans of the Government of Antigua and Barbuda, and it was confirmed to be necessary for the promotion of the development of the fishery sector. As for the scope of cooperation for this project, it was determined that the upgrading of refrigeration equipment, the installation of two submerged-type FADs, the installation of a surveillance radar system, and the introduction of a multipurpose boat were appropriate undertakings, and the outline design of the project was drafted as follows.

Category	Site	Equipment	Quantity
Refrigeration facilities	Market Wharf	Ice plant (flake ice, 4.5 tons/day)	2
		Refrigeration equipment for cold storage ($40m^3$, ±0°C)	1 set
		Insulated truck (2 tons)	1
	Point Wharf	Air conditioners (indoor and outdoor units x 19)	1 set
	Parham	Ice plant (flake ice, 1 ton/day)	2
		Refrigeration equipment for cold storage ($30m^3$, ±0°C)	1 set
	Urlings	Ice plant (flake ice, 1 ton/day)	2
		Refrigeration equipment for cold storage ($30m^3$, ±0°C)	1 set
Water supply system	Market Wharf	Reservoir tank ($36m^3$, including pump)	1
	Point Wharf	Reservoir tank ($30m^3$, including pump)	1
	Urlings	Feed pump (pressure-sensitive)	2
Surveillance radar system	Freetown	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna)	1 set

	Mt. Obama	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna x 6)	1 set
	Codrington	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna x 2)	1 set
	Point Wharf	Monitoring station equipment (monitors x 3, computers x 3, switching hubs x 3, microwave antennae x 3 pairs, tower x 1)	1 set
VHF radio system	Parham	VHF radio x 1, VHF antenna x 1, power source x 1	1 set
Submerged-type fish aggregating device	Atlantic Ocean side	Submerged-type FAD (Depth: 1,300m)	1
	Caribbean Sea side	Submerged-type FAD (Depth: 850m)	1
Multipurpose boat	Point Wharf	Length overall: 11m, Width: 2.8m, Depth: 1.4m; 115 horsepower diesel engine)	1 vessel

4. Project Period and Appropriate Cost

The project will require five months for the implementation design and 12.5 months for procurement of equipment and machinery. Expenses borne by the Government of Antigua and Barbuda is estimated EC$97,000 (approx. ¥3.7 million).

5. Project Evaluation

(1) Appropriateness

The *Fisheries Development Strategy 2011 – 2015*, the country's 5-year development plan gave the objectives such as the utilization of unused fishery resources, the infrastructure development, and the improvement of data collection and fishery information system. Based on the Castries Declaration (2010) on eradication of IUU fishing, the country formulated a new fisheries regulation in 2013 and has been tackling on strengthening of fishery management capabilities. The Project will contribute to realization of efficient fish distribution through the improvement of functions of fish distribution facilities (infrastructure), which were introduced by Japan's past grant aid cooperation, as well as to promotion of fisheries management through introduction of a surveillance radar system, a multipurpose boat and submerged-type fish aggregating devices (FAD), in conformity with the objectives set forth in the above national plan.

Since the Japan's Rolling Plan for Antigua and Barbuda adopts "fishery" as an important sector, "support to sustainable development of fisheries" as a development issue, and "programme for support to development of fisheries and fishing community" as a cooperation programme, the Project, which will contribute to sustainable development of fisheries, is conformed to Japan's policy of 'Official Development Assistance' (ODA).

Furthermore, Antigua and Barbuda has an important cooperative relation with Japan in fishery sector, so that the implementation of the Project is deemed as appropriate.

(2) Effectiveness

By the implementation of the Project, the following quantitative and qualitative effects are expected in the points of the improvement of fish distribution and the promotion of fishery management.

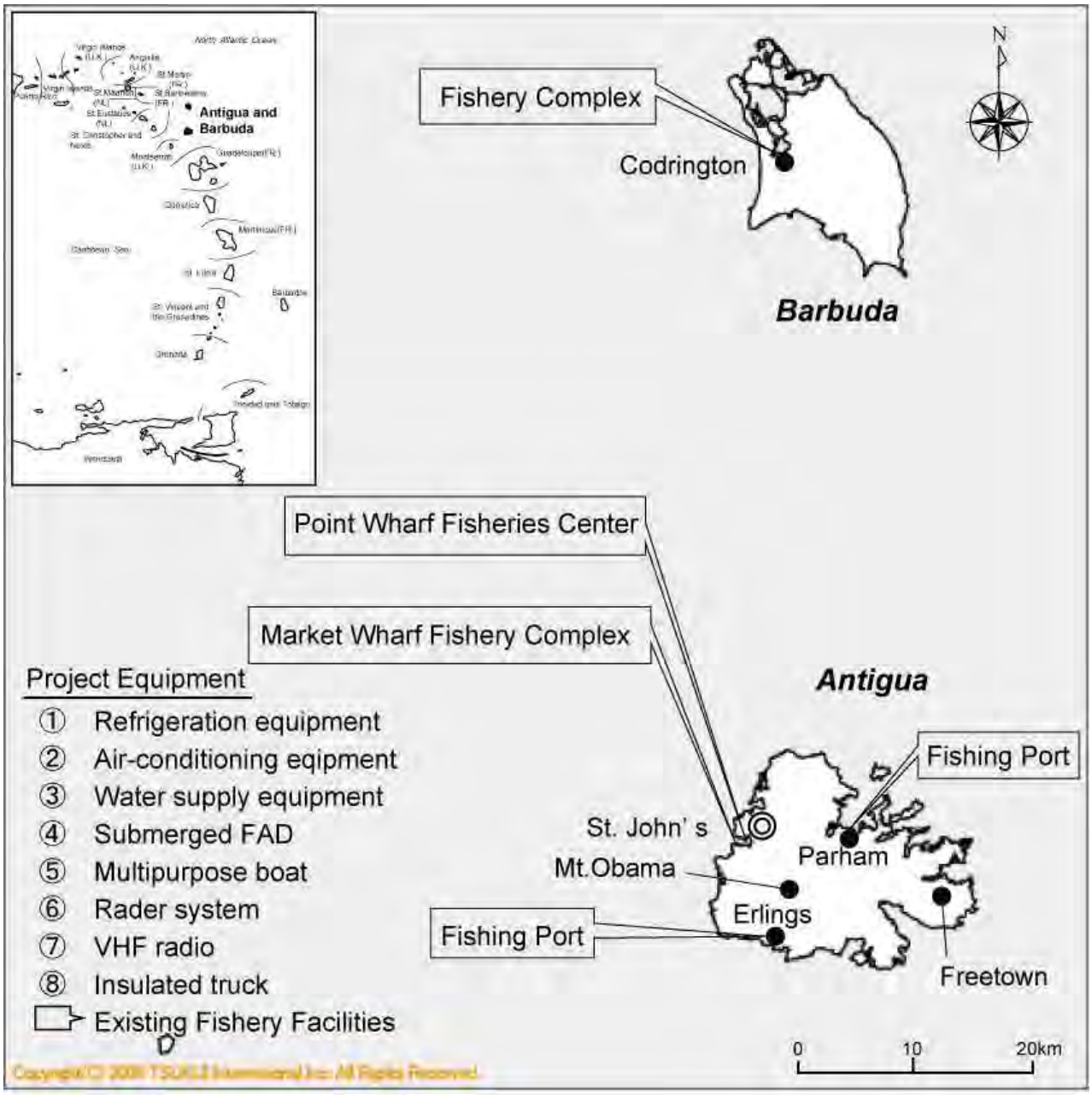
The following is a list of the anticipated quantitative effects:

Indicator	Baseline (2014)	Target (2019)
a) Annual ice sales (Total volume of Market Wharf, Parham and Urlings)	1,140t	2,000t
b) Total number of fishing boats entered to the submerged-type FADs per annum	0	700 vessels
c) Annual operating days of multipurpose boat	0	140 days
d) Total number of detections of the assumed illegal vessels per annum	0	200 times (There is a possibility that the number of illegal vessel detections may be lower than the target, by the effects of a deterrent through operation of surveillance radar.)
e) Annual operating days of Surveillance radar	0	350 days

The following is a list of the anticipated qualitative effects.

- Improved freshness of fishery products and consumer satisfaction therewith due to upgrades to refrigeration facilities (as revealed by from interview surveys).
- Spread of and enhanced understanding of managed fishery among fishermen due to the installation of submerged-type FADs (as revealed by interview surveys).
- Improved fishing technologies of the fishermen.
- Ability to collect data on fishing efforts around the FADs (e.g., number of boats in operation and hours spent within the FADs) due to the new surveillance radar.

CONTENTS



LOCATION MAP

LIST OF FIGURES & TABLES

ABBREVIATIONS

ABS	Acrylonitrite, Butadiene, Styrene
ABSAR	Antigua Barbuda Search and Rescue
AFL	Antigua Fisheries Limited
AIS	Automatic Identification System
APUA	Antigua Public Utilities Authority
ARPA	Automatic Radar Plotting Aid
BFTC	Basic Fisheries Training Course
CARIFICO	Caribbean Fisheries Co-Management Project (Technical Cooperation Project)
EC$	Eastern Caribbean dollars
	(EC$1 equivalent to approx. 38 Japanese yen at survey stage in 2014)
EEZ	Exclusive Economic Zone
EIA/TIA	Electronic Industries Alliance) / Telecommunications Industries Association）
ETSI	European Telecommunications Standards Institute
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
FCC	Federal Communications Commission
FRP	Fiber Reinforced Plastics
GNI	Gross National Income
GPS	Global Positioning System
GWP	Global Warming Potential
HACCP	Hazard Analysis for Critical Control Points
HCFC	Hydrochlorofluorocarbon
ITU	International Telecommunication Union
IUU	Illegal, Unreported and Unregulated
Lb.	Libra (pounds)
NOAA	National Oceanic and Atmospheric Administration
ODP	Ozone Depletion Potential
SUS	Stainless Steel
UPS	Uninterruptible Power Supply
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
WARC	World Radio Communication Conference

Chapter 1: Background of the Project

Japan has contributed to the development of the recipient country's fishery industry with grant aid projects and technical cooperation, but due to movements of fishing grounds stemming from marine phenomena believed to be caused by recent changed in climate change, damage and deterioration of fishery facilities from hurricanes (e.g., Ivan in 2004 and Earl in 2010) and other natural disasters, and the increase in fuel and other production costs, fish catches have plateaued, and it appears that some of the facilities that were built with Japanese grant aid are not being fully utilized. Amid this backdrop, JICA conducted a data collection survey during November 2013 and February 2014 to confirm the situation surrounding the fishery industry in the nations of the Eastern Caribbean, assess the current state of the fishery facilities and equipment installed using Japanese grant aid, and examine the possibility of future cooperation in the fishery sector.

As a result of these surveys, several needs, including upgrades to existing facilities and equipment and the installation of new facilities and equipment to respond to new issues related to change of fishing status and promotion of fishery management, have been confirmed.

In response to the request made by the Government of Antigua and Barbuda, JICA implemented this preparatory survey, to formulate the project for equipment deemed especially urgent, to examine the appropriateness and necessity of that equipment and to prepare the outline design for this project, taking into consideration of cooperation needs confirmed by the data collection survey.

Chapter 2: Contents of the Project

2-1. Basic Concept of the Project

2-1-1. Ultimate Objective and Project Objectives

In Antigua and Barbuda, fisheries complexes have been developed in five locations (Market Wharf, Point Wharf, Urlings, Parham and Codrington (Barbuda Island)) through past grant aid projects. Although these facilities have been used effectively to improve the distribution of fishery products in the country, the larger equipment, such as ice-making and refrigeration equipment, has aged and is suffering from reduced capacity due to the passage of time. As a result, insufficient ice and cold storage capacity have led to reduced fishing vessel operating rates and limitations on the storage and distribution of fresh fish in some regions.

The Government of Antigua and Barbuda has been tackling on sustainable fishery development through formulation and execution of *Fisheries Development Strategy 2011 – 2015*, a five-year plan for fisheries development, which includes the development goals of (1) Preparation of comprehensive Fisheries Management Plan, (2) Utilization of under-exploited species, (3) Infrastructure development (fishery complexes and hurricane shelters), (4) Revision of fisheries legislation, and (5) Development of National Plan of Action to Address IUU.

In concrete, to ensure the proper management of marine resources, it formulated new fisheries regulations in 2011 based on limited access, as opposed to the open access utilized before, and has been working to strengthen its fishery management capacity. At the same time, to rein in overfishing in its coastal waters, the country's government has begun using fish aggregating devices (FADs) to create offshore fishing grounds in an effort to promote a shift from reliance primarily on demersal fish to the catching of more oceanic pelagic fish. However, it faces many issues such as ensuring stable commercial fishing in offshore fishing grounds, developing underutilized resources and promoting their distribution, and monitoring illegal fishing.

To achieve the objectives outlined above, this project aims to improve fish distribution through the upgrading of refrigeration equipment at the four fisheries complexes, and to promote fishery management through control of fishing activities along with the creation of offshore fishing grounds and its regulations.

2-1-2. Project Overview

To achieve the objectives outlined above, this project calls for the upgrading of refrigeration equipment at the four fisheries complexes, the installation of two submerged-type FADs, the installation of a surveillance radar system, the procurement of a multipurpose boat and the appropriate operation and maintenance of all of these elements. The scope of cooperation will be the upgrading of refrigeration equipment, the installation of submerged-type FADs, the installation of a new surveillance radar system, and the procurement of a multipurpose boat.

2-1-3. Project Details

The equipment requested by the Government of Antigua and Barbuda is listed in the following table.

Table 1: Equipment requested by the Government of Antigua and Barbuda

Equipment requested	Remarks
a) Replacement refrigeration facilities	
1) Switching of refrigerants (R-22→R-404A) (Market Wharf, Point Wharf, Urlings, Parham)	Based on intent of recipient government intention in accordance with international agreements
2) Ice plants (flake ice; 6 tons/day x 2) (Market Wharf)	
3) Refrigeration equipment for cold storage (10 tons, -5° C) and plastic fish boxes (x36) (Market Wharf)	Upgrade existing facility (plate ice) Upgrade existing equipment
4) Ice plant (flake ice; 2 tons/day) and refrigeration equipment for cold storage (-5° C) (Urlings)	Expand from existing capacity of 1 ton/day (plate ice) Expand from existing capacity of 1.5 ton/day (plate ice)
5) Ice plant (flake ice; 2 tons/day) and refrigeration equipment for cold storage (-5° C) (Parham)	Upgrade existing equipment
6) Air conditioners (x25) (Point Wharf)	Upgrade originally installed equipment
7) Insulated truck (Capacity: 1,000 kg x 1) (Market Wharf)	
b) Replacement water supply facilities	Upgrade existing equipment
1) Reservoir tank ($36m^3$, including pump and pipes) (Market Wharf)	Expand from existing capacity of $6m^3$
2) Reservoir tank ($30m^3$, including pump and pipes) (Point Wharf)	Upgrade existing equipment (backup water source)
3) Reservoir tank feed pumps (x2) (Urlings)	
c) Surveillance radar system	Bring in new equipment
(Control center x 1, radar stations x 3, AIS transponders x 400)	Same as above
d) VHF radio system (VHF radio station x 1 (Parham))	Same as above
e) Submerged-type fish aggregating devices (x2)	Same as above
f) Multipurpose boat (x1)	

2-1-3-1. Upgrade of Existing Equipment and Machinery

In Antigua and Barbuda, fisheries complexes have been developed in five locations (Market Wharf, Point Wharf, Urlings, Parham and Codrington (Barbuda Island)) through past grant aid projects. Although these facilities have been used effectively to improve the distribution of fishery products in the country, the larger equipment, such as ice-making and refrigeration equipment, has aged and is suffering from reduced capacity due to the passage of time. As a result, insufficient ice and cold storage capacity have led to reduced fishing vessel operating rates and limitations on the storage and distribution of fresh fish in some regions By restoring equipment and machinery to its initial capacity and adding equipment in light of current needs, this project strives to improve fishery product distribution and stabilize fishery management.

Replacement of R-22 refrigerant in refrigeration equipment with R-404A

With regard to refrigerants, the National Ozone Unit formulated the "HCFC Phase Out Management Plan (HPMP)" and has been engaged in activities since January 2013. The aim of this plan is to establish import quotas in order to reduce the domestic consumption of HCFCs by 10% by 2015 and completely eliminate their use by 2030. This means the government will switch from the refrigerant (R-22) used in existing refrigeration facilities to a Freon replacement (R-404A) or natural refrigerants (e.g., ammonia). However, since there is a technical difficulty involved with handling ammonia, which is not widely available in the country, the implementing agency and administrative organization both wish to switch to R-404A.

(1) Market Wharf Fishery Complex (Project for Construction of St. John's Fish Landing and Marketing Facilities; completed in 1999)

Fifteen years have passed since this facility, which is managed and operated by Antigua Fisheries Limited (AFL), was completed.

Table 2: Status of existing equipment and machinery at Market Wharf Fishery Complex

Component	Physical condition	Status of use	Status of operation and maintenance	Remarks
a) Flake ice plant (6 tons/day x 2)	Due to the age of the ice plants (The Basic Design Survey Report called for two 3.5 ton/day machines, but two 6-ton/day machine were actually installed), one machine stopped working in 2009 and the other stopped working in October 2013. Since the American-made ice plant that AFL purchased with its own funds was a poor fit for the compressor, it malfunctioned in March 2014 and is currently out of order. After procuring parts from Japan in July 2014, one machine has been repaired and is currently operating.	The amount of ice produced that is assumed from ice sales over the past five years has fallen from 8.8 tons/day (2009) to 4.3 tons/day (2013).	Since the refrigeration facilities have been operated and maintained by AFL for more than 10 years with replacement and repair of equipment on its own accord, AFL has sufficient capacity to handle operations and maintenance. Since most of the refrigeration equipment is out of order, maintenance is outsourced as needed to keep costs down, but AFL plans to hire a full-time mechanic when the equipment is upgraded. Ranging between EC$ 2.34 and 2.89 million for the past three fiscal years, sales are trending downward, and every year, AFL loses between EC$10,000 and 100,000.	Due to the extreme shortage of ice, fishermen are forced to return before the day's end. Bringing the ice plants back online will help fisherman return to steady fishing.
b) Insulated truck (1,000 kg x 1)	Due to aging, the insulated truck that was initially brought in has been completely out of operation since 2012. It was scrapped because repair costs would have been too expensive.	The truck is out of commission. Over the past 12 years, the insulated truck was used to purchase and/or deliver 100 to 1,200 lbs. of fishery products every day. (No written record remains.) Products were also delivered in coolers strapped to the roof of the insulated truck.		A new truck would help improve distribution if catches from regional fishing ports can be shipped to market and delivered to hotels and restaurants around the island.
c) Refrigeration equipment for cold storage (-5° C) and plastic fish boxes (x 36)	The cold storage that was initially installed has been out of order since 2005 when workers were unable to bring it back online despite replacing a broken electromagnetic valve on the compressor. The cold storage (-5°C) that AFL used its own funds to install is still running.	The unit is being used to store ice coolers. The cold storage that AFL added is being used to store fish and bait.		AFL buys fish from fishermen then processes them for direct sale.
d) Reservoir tank (36 m^3) and water pipes	Over the course of time, water started leaking from the areas where bolts are attached to the reservoir tank, the pipes cracked, and the submersible pump malfunctioned, thereby leaving the unit out of order.	A small auxiliary reservoir tank (10 m^3; installed by AFL with its own funds) is currently being used.		For the past six months, there have been water outages averaging eight hours a day, so this tank needs to be replaced.

(2) Urlings Fishing Port (Artisanal Fisheries Development Project; completed in 2003)

Eleven years have passed since this facility, which is managed and operated by the Antigua Fisheries Division, was completed.

Table 3: Status of existing equipment and machinery at Urlings Fishing Port

Component	Physical condition	Status of use	Status of operation and maintenance	Remarks
a) Plate ice plant (2 ton/day)	This equipment is currently in operation. Since the ice plant uses groundwater, large calcium deposits form on the plates, and they take a long time to remove.	Based on a copy of ice sales records for March to July 2014 that was obtained, in the busiest month, an average of 378 kg of ice per day was sold. However, it must be kept in mind that the machine is frequently stopped for maintenance and that the bulk of fishing occurs in the latter half of the week.	Full-time maintenance technicians employed by the Fisheries Division come around to make repairs, but they must frequently remove calcium deposits, thus restricting the number of hours that ice plants can operate. Every time the machine stops when voltage drops, it must be restarted.	Many fishing boats from other districts come here to purchase ice. According to interviews with fishermen, it was found that the lack of ice limits how often they can go out fishing. (Fishermen who used to go out four times a week, only go out twice now.)
b) Refrigeration equipment for cold storage (-5℃)	The compressors and coolers have malfunctioned due to age.	Before going out of commission, this was the primary storage for fish catches.		Fish catches are kept on ice in coolers, but these are not big enough for large pelagic fish, which cannot be sold because they cannot be kept fresh. More pelagic fish will be landed here with the adoption of FAD fishing.
c) Reservoir tank feed pumps (x 2)	The tank malfunctioned several years ago, so the system has been remodeled to draw water directly from the tap water supply.	Out of commission.		It is desirable to secure a backup water supply when there are water shortages.

(3) Parham Fishing Port (Artisanal Fisheries Development Project; completed in 2003)

Eleven years have passed since this facility, which is managed and operated by the Antigua Fisheries Division, was completed.

Table 4: Status of existing equipment and machinery at Parham Fishing Port

Component	Physical condition	Status of use	Status of operation and maintenance	Remarks
a) Plate ice plant (2 tons/day)	In operation.	According to ice sales data from January 2011 ~ June 2014, an average of 822 kg of ice is sold per day during the busiest month; however, it must be kept in mind that most fishing occurs in the latter half of the week.	Full-time maintenance technicians employed by the Fisheries Division come around to make repairs, and the ice plant has been operating smoothly since it went into use.	
b) Refrigeration equipment for cold storage (-5℃)	The compressors and coolers have malfunctioned.	Before going out of commission, this was the primary storage for fish catches. Since the cold storage is broken, fish catches are stored in coolers; however, freshness suffers because there are not enough coolers.		More pelagic fish will be landed here, in addition to conch and demersal fish, with the adoption of FAD fishing.

(4) Point Wharf Fisheries Center (Project for Construction of Fisheries Center; completed in 2006)

Eight years have passed since this facility, which is managed and operated by the Antigua Fisheries Division, was completed. As part of follow-up cooperation, it has been decided that a new ice plant (2 tons/day) and sanitary inspection equipment will be installed.

Table 5: Status of existing equipment and machinery at Point Wharf Fisheries Center

Component	Physical condition	Status of use	Status of operation and maintenance	Remarks
a) Freezer (1.5 tons, -25°C) b) Refrigeration equipment for cold storage (60 m^3, -5°C)	No problems.	This equipment is used for processing frozen conch and demersal fish for export.	Full-time maintenance technicians employed by the Fisheries Division are assigned to the site, and they regularly inspect the refrigeration facilities and air conditioners in the seafood processing building and make repairs when necessary.	There are no issues with the physical condition of the equipment.
c) Air conditioning cooling units	With 16 air conditioners in the main building (Fisheries Division Office, Training Room, Quality Inspection Lab) and nine in the seafood processing building, there is a total of 25 air conditioners installed in the facility. Since spare parts could not be procured for the ceiling-mounted air conditioners, which were provided free by Daikin Taiwan, seven units (four in the main building and three in the processing building) have been replaced with other models (outdoor units and wall-mounted air conditioners ; R-22).	Wall-mounted air-conditioners and outdoor units (made by Pioneer USA and Fujitsu) were procured and installed independently.		They use R-22 refrigerant Since there are no spare parts for the originally installed Daikin air conditioners, they cannot be repaired in-country.
d) Reservoir tank (30 m^3, including pump and pipes)	Equipment in use. There are no problems with the physical condition (Capacity: 6 m^3)	Although there is a 4.8 ton reservoir tank in place, which accounts for 25% of daily water needs, the number of water outages has increased since the initial installation, and they sometimes last as long as eight hours a day.		There is a water outage, the water in the existing reservoir tank runs out in one hour and hinders seafood processing operations.
e) Wharf-top water pipe	None (to be newly installed)	Since there are no water pipes at the fish landing area next to the wharf, fishermen are inconvenienced by the fact they cannot take showers.		The operator of the Urlings Fisheries Complex installed a hose on the wharf on its own accord.

2-1-3-2. Equipment and Machinery envisioned for New Installation

To rein in over catch in its coastal waters, the country's government has begun using fish aggregating devices (FADs) to create offshore fishing grounds in an effort to promote a shift from reliance primarily on demersal fish to the catching of more oceanic pelagic fish. At the same time, to ensure the proper management of marine resources, it formulated new fisheries regulations in 2011 based on limited access, as opposed to the open access utilized before, and has been working to strengthen its fishery management capacity. However, it faces many issues such as ensuring stable commercial fishing in offshore fishing grounds, developing underutilized resources and promoting their distribution, and monitoring illegal fishing. Bringing in the new machinery listed below and effectively utilizing it is expected to strengthen the fishery management system of Antigua and Barbuda.

(1) Surveillance radar system

Antigua and Barbuda's Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IUU) was formulated and approved in April 2010, and the government has begun taking action on its own accord where possible. According to this plan, there were 129 cases of IUU reported between 1992 and May 2009, which can be broken down as follows: unlicensed fishing by a local vessel (46.5%), fishing by a foreign vessel (9.3%), fishing without a speargun fishing permit (14.0%), possession of illegal lobster (12.4%), possession of undersize conch (3.1%), vessel marking violation (4.7%) and vessel safety violation (10.1%). Of cases of

fishing by a foreign vessel, 78% originated in Guadeloupe (an overseas region of France), and the number of boats has doubled over the past 10 years. The plan also reported that 1,993 tons of fish were landed outside of Antigua and Barbuda (1,324 of which were landed in Guadeloupe) in 2006. Furthermore, it emphasized the low rate of domestic boat registration as a problem (34.4% to 57.8% between 2001 and 2008).

To improve upon this situation, the Plan of Action outlines six measures to be implemented for domestic fishing boats: 1) increase the number of coastal fisheries patrols, 2) increase the level of the minimum fine for first offense, 3) detain vessels, 4) improve monitoring of fishing vessel activity, 5) issues fisher photo identification cards, and 6) restrict concessions relating to fishing inputs to only owners of licensed fishing vessels. It also lists the following four measures for foreign fishing boats: 1) increase the number of offshore fisheries patrols, 2) increase the level of the minimum fine for first offense, 3) identify "hot spots" with the aim of increasing arrests, and 4) increase collaboration with French authorities and other local agencies. To strengthen action against IUU and encourage the export of fishery products to the EU, the Fisheries Division also supports the EU Regulation to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.

Actions to improve safety on the sea include the following: 1) increase number of vessel safety inspections, 2) increase the level of the minimum fine, 3) detain illegal fishing vessels, 4) require communication and safety equipment for annual licensing, 5) providing practical training to fishers regarding the use of Global Positioning System (GPS) receivers, and 6) train conch and lobster divers in diving safety.

The surveillance radar system will be an effective tool for conducting efficient coastal and offshore surveillance and patrol activities described in the aforementioned Action Plan. In case that this system is introduced, it will not only allow the Coast Guard to reduce operating expenses for its patrol vessels, it is expected to increase arrest rates for unlicensed fishing vessels. It will also enable the Fisheries Division to collect and analyze data on domestic fishing vessel operations that could potentially be used in the formulation of future Fishery Management Plans (e.g., fish catch volumes around the FADs).

a) Monitored waters and radar sites

Two areas have been selected for targeted monitoring: 1) the waters southeast of Antigua and the waters west of Barbuda, where there are many occurrences of illegal vessels, and 2) the waters around the FADs (to ascertain fish catch volume). As for radar installation sites, the following three sites have been proposed by Antigua and Barbuda side from among existing communications tower sites, existing fisheries complexes, and other government-owned land deemed suitable for installation.

Table 6: Outline of the planned radar installation sites

Planned site for radar installation	Site status	Areas that can be monitored	Possibility of using existing towers		Possibility of data transmission
			Radar	Microwave antenna	
Mt. Obama	Existing transmission tower (managed by LIME Co.)	Nearly the entire circumference of Antigua	Installation on the top of the tower possible	Installation on the north or east side of the tower possible	Direct microwave transmission to Fisheries Division possible
Freetown	Existing transmission tower (managed by APUA (public corporation))	Waters to the east of Antigua	Same as above	Could be installed on the west side of the tower	Microwave transmission possible via Mt. Obama
Codrington (Barbuda)	Existing transmission tower (managed by DIGICEL)	Nearly the entire circumference of Barbuda	Same as above	Installation on the south side of the tower possible	Microwave transmission possible via Mt. Obama

At all of these sites, the existing towers can be used, so the Fisheries Division will have to request official permission from the tower owners (LIME, APUA and DIGICEL). Since the government plans to share existing towers as much as possible, it expects to obtain permission without any problems, as long as there is no impact on existing antennae.

To identify vessels on the radar screen, fishing boats will need to be equipped with portable Automatic Identification System (AIS) transponders. Since regular boats (including pleasure boats) in the Caribbean are equipped with AIS transponders, they will be distinguishable from fishing boats; however, the identification of illegal vessels will require that all registered fishing boats carry portable AIS transponders at all times. At present, there are a total of 379 fishing boats—345 on Antigua and 34 on Barbuda—in operation. Of these, those that fish offshore are cabin cruisers (with inboard motors) and boats using the FADs (at present, 22 vessels). CARIFICO is currently working on installing 10 FADs, and two more FADs are examined under this project, so the number of fishing boats using FADs is expected to gradually increase going forward. Given this, the plan is to equip all fishing boats with AIS transponders to prove that they are licensed. That being said, since materials for individual fishing boats do not fall under the scope of this project, the Antigua and Barbuda Fisheries Division will need to encourage fishermen to install portable AIS transponders on their fishing boats.

The surveillance areas (radar wave reach distance) covered by each radar site are as shown in the figure below.

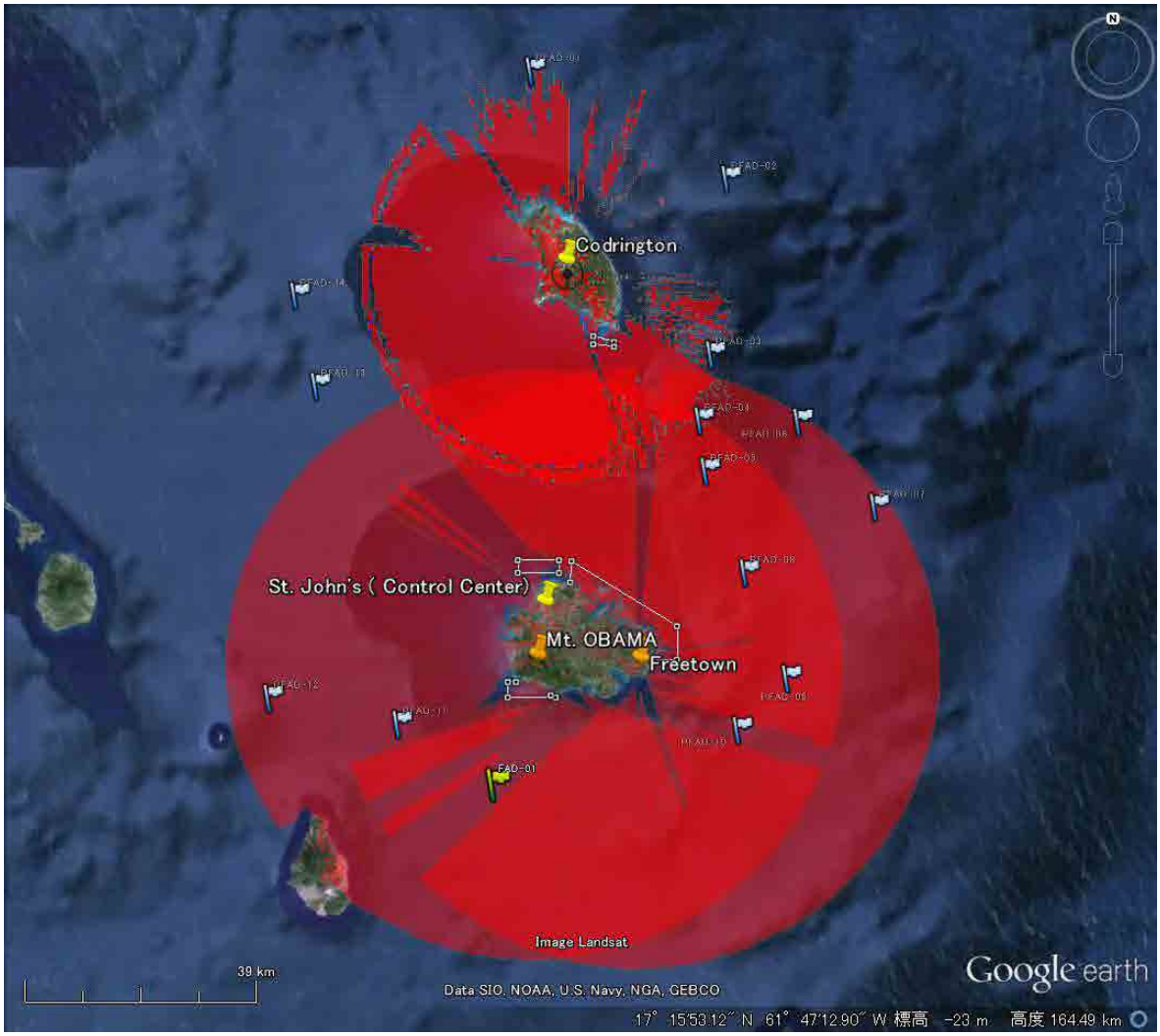


Figure 1: Areas that can be monitored by radar (based on simulation)

b) Operation and maintenance framework

In Antigua, the responsibility for monitoring illegal fishery belongs to the Fisheries Division, while that for surveillance and control of all vessels engaged in illegal activity (including fishing boats) and sea rescue falls to the Coast Guard (an arm of the Ministry of Defense). The Coast Guard possesses two small patrol boats (33-foot with three 300-hp outboard motors), of which one is ordinarily patrolling on the sea.

Both organizations are forward-looking to a framework in which both will operate the radar system in partnership, in case that this radar system is installed. Specifically, the Fisheries Division will aggregate data on daily numbers of fishing boats entering the area around each FAD, the lengths of time they stay there, and the directions they take when entering and leaving for fishery management around FADs. It will build a system for the automatic aggregation of data by personal computers. On the other hand, the Coast Guard will conduct radar surveillance on a 24-hour basis (three shifts per day). If any suspicious vessels are detected, it will dispatch a patrol boat to confirm the identity of the vessel and enforce regulations. If the Fisheries Division discovers a vessel that it thinks may be an illegal fishing boat, it will notify the Coast Guard of its position and request the dispatch of a patrol boat. The main monitoring room will be set up in the Fisheries Division. Images received by the room will also be viewable in real time on the Coast Guard's computers through an Internet link between the two. (The Fisheries Division is scheduled to upgrade to 4GB Internet in October 2014.) It is anticipated that the operational and maintenance cost of the system will be approximately US$1,000/month (US$300 x 3 sites). Currently, the Coast Guard consumes 3,200 gallons of fuel per month (US$16,000 to $20,000), so bringing this system online will allow the Coast Guard to reduce the fuel costs of its patrol boats.

The installation of the radar system will require all Fisheries Division personnel, including the Coast Guard supervisors, to undergo training in how to operate the system. Fishermen are encouraged to install radar reflectors on their boats in the Basic Fisherman Training Course (BFTC). When it installs this radar system, the Fisheries Division will add new training programs on portable AIS terminals, instead of on radar reflectors, and revise the Fisheries Regulations to obligate fishermen to carry the devices at all times. The Fisheries Division has already explained this to the fishermen by way of stakeholders meetings held during this survey period, and has confirmed their general approval.

(2) VHF Radio system

The Fisheries Division has installed VHF radio stations at the three fisheries complexes in Point Wharf (St. John's), Urlings and Codrington (Barbuda) (although the installation at Urlings is not yet complete). New VHF repeater stations are not required since an NGO called Antigua Barbuda Search & Rescue (ABSAR) has one on Monk's Hill and the Coast Guard has one on Mt. Obama.

On Antigua, VHF radios have been designated as legally required equipment for all fishing boats (including those using outboard motors), and fishermen who do not have these radios cannot renew their fishing permits. For this reason, all fishing boats are equipped with VHF radios. Along the coast, fishermen use their mobile phones to communicate with each other, but they use their radios when they are operating 10 or more miles offshore. The fishermen use their radios to exchange information on fishing grounds and contact each other during emergencies. Since there is no wireless radio station at the Parham Fisheries Complex, Fisheries Division plans to install one so that fishermen can communicate with the complex.

(3) Submerged-type fish aggregating device

Since several FADs have been swept away in short periods of time, Fisheries Division employees who have undergone training as part of JICA's technical cooperation and fishermen who understand the effectiveness of FADs have expressed an interest in submerged-type FADs. Submerged-type FADs are not easily susceptible to bad weather and are built so as not to be damaged by ships, so they are durable and effective at attracting fish over the long term. Adopting submerged-type FADs with long-term durability will contribute to greater stability in offshore pelagic fishing (creation of permanent fishing ground, stabilization of catch volume, and saving of operation cost of fishing boat) as part of the Fisheries Division's fishery management efforts.

a) Existing floating-type fish aggregating devices

Antigua and Barbuda only began adopting fish aggregating devices (FADs) in 2012. To date, one FAD was installed off the coast of Urlings, but it was swept away. It was reinstalled, but there are no FADs remaining at this point in time. In 2014, CARIFICO secured enough materials to build 10 FADs and is currently preparing to install them. The locations for the FADs have been tentatively planned, but CARIFICO intends to revise its plan as needed by installing two or three devices at a time and monitoring the situation.

Commercial fishing using FADs requires the permission of the Fisheries Division, and the rules concerning the installation and operation of FADs are stipulated in "Part VII: Artificial Reefs and Fish Aggregating Devices" of *Fisheries Regulations, 2013 No.2*. All FADs are licensed by the Fisheries Division, and fishermen who wish to use FADs must undergo training provided by the Fisheries Division before they can obtain a license. At present, there are 22 vessels in the country licensed to fish using FADs, of which eight to 10 are dedicated to FAD fishing operations. With the upcoming FAD installation, training sessions on the fabrication, installation, and operation of FADs are planned for 20 to 30 boats seeking new FAD fishing permits and 10 boats with existing FAD permits, not including those 10 dedicated FAD fishing boats.

b) Installation plan

On the Atlantic Ocean side, a proposal was raised by the Fisheries Division to install a FAD 11 nautical miles northeast from Indian Town Point in eastern Antigua. These are the same waters where France had previously installed a FAD, and they are known to have been highly productive. However, the grade on the sea floor in these waters is steep, and the installation of submerged-type FADs becomes more difficult the greater the variation in sea depth is. (Sites with a radius of 300 m and depth variation within 30 m must be selected.) As such, a plan to install at the point of 12 nautical miles east of Indian Point Town will be examined, where the sea floor gradient is gradual, has been selected as the installation location. On the Caribbean Sea side, a plan to install at the point of 11 nautical miles southwest of Urlings will be examined, where the Fisheries Division's previous FAD was installed. Both sites are easily accessible from all districts of Antigua.

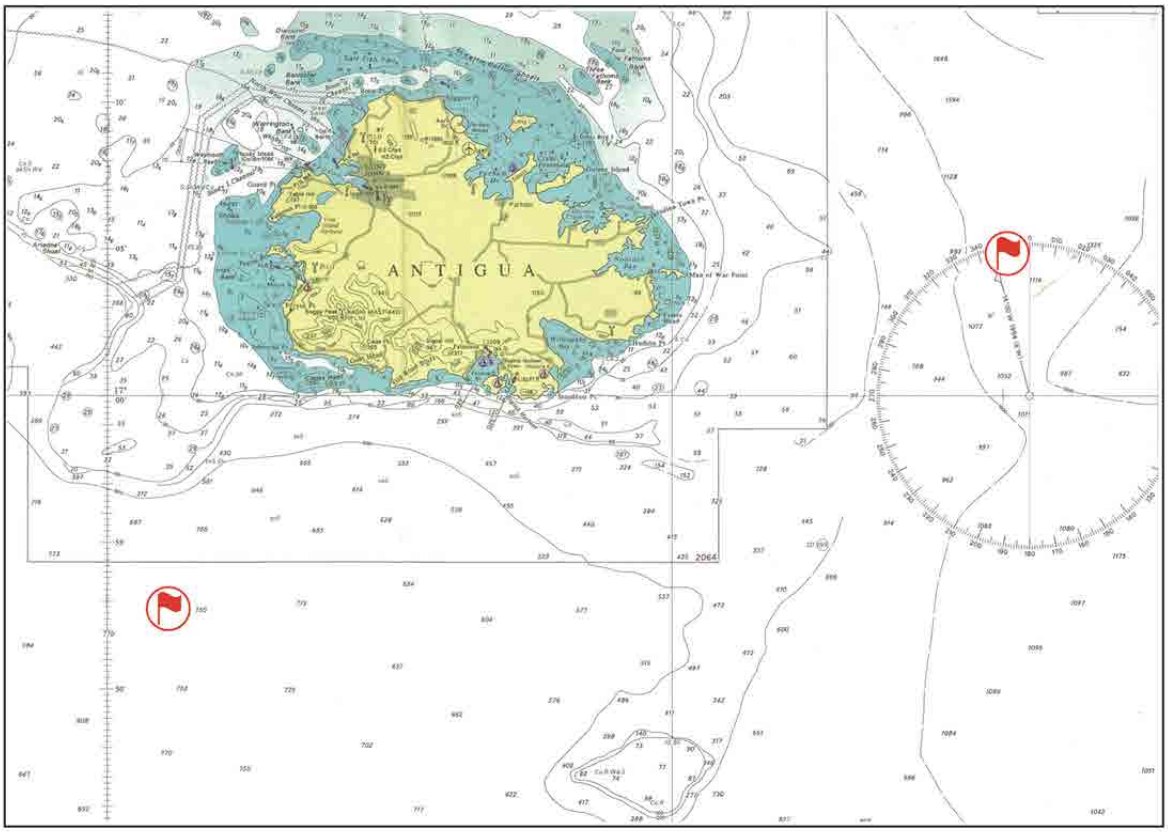


Figure 2: Planned installation sites for the submerged-type FADs

Submerged-type FADs are not affected by the passage of large vessels or hurricanes and can last more than 10 years. Therefore, their introduction will contribute to greater stability in offshore pelagic fishing as part of fishery management.

c) Operation and maintenance framework

The floating-type FADs to be installed by CARIFICO will be managed by the Fisheries Division. A framework is in place whereby fishing boat operators will accumulate experience by helping with the fabrication and installation of the FADs and cooperate with the Fisheries Division to maintain them. The installation and management of the submerged-type FADs will employ the same format. The plan is for fishermen with FAD fishing permits to voluntarily participate in the installation work, thereby developing a sense of ownership of the FADs.

(4) Multipurpose boat

a) Operational status of existing boats

At present, the Fisheries Division owns five small boats (14 to 25-foot; all equipped with outboard motors), but two of them have become inoperable due to age.

Table 7: Status of boats owned by the Antigua and Barbuda Fisheries Division

Type of vessel	Primary equipment	Status of use
28-foot FRP boat (CARIFICO boat; made in Colombia; introduced in 2013)	100-horsepower outboard motor x 2	This boat is used for trial pot fishing, but due to the size of the boat, only four pots can be carried at once. Thus, moving the fishing equipment between fishing grounds subject to surveys is burdensome. With regard to FAD installation work as well, work space and hull capacity is limited.
25-foot FRP boat (JICA-procured boat; made in Trinidad and Tobago)	90-horsepower outboard motor x 1	This boat cannot be used because there are structural cracks in the hull.
22-foot FRP boat (boat donated by South Korea)	130-horsepower outboard motor x 1	This boat was received in the 1990s and was used to conduct coastal environment surveys, but it is no longer in use due to its age.
24-foot Boston Whaler	200-horsepower outboard motor x 2	This boat is still used for MPA surveillance.
14-foot canoe	15-horsepower outboard motor x 1	This boat is used to conduct coastal environment surveys.

b) Operating plan for the new boat

The multipurpose boat is planned to use for the following three objectives.

1) At-sea training for fishermen (BFTC special course)

In accordance with the Fisheries Regulations enacted in January 2013, all fishermen in Antigua must complete a designated training course before they can obtain or renew their fishing licenses. The at-sea training is a special course for fishermen who already have their fishing licenses. It is a practical course that involves the actual operation of a fishing boat. Since all of the Antiguan Fisheries Division's boats are small boats with outboard motors, it is unable to conduct practical training sessions with more than a few participants on board. In case that a multipurpose boat is introduced, five participants can be on board along with the two crew members (i.e., the captain and the trainer), thus allowing the implementation of practical at-sea training involving the operation of a boat. There are six six-day training sessions held every year, including operations and navigation training, FAD fishing training, and diamond back squid (DBS) fishing training.

2) FAD Fishing

The adoption and management of FAD fishing will require the installation, monitoring, and maintenance of FADs. To date, two FADs have been installed using fishermen's boats, but given the lack of space on their boats, the task was not easy with low work efficiency paying much attention considering safety issues. In case that a multipurpose boat is introduced, which will have space to load and transport FAD materials, will allow for safe and reliable installation. The plan is to install 10 FADs over the course of the year. Monitoring (which will include confirmation of the status of the floating components of the installed FADs, confirmation of the status of fishing boat operations, and confirmation of fish types using catch tests and fish finders) will be conducted along with repairs, such as the reinforcement of damaged sections of the floating components, about once a month.

3) Using pot fishing to survey reef fish and lobster catches

This was a basic survey on resource and fishing ground management conducted as part of CARIFICO to encourage joint management with the fishermen. Demersal fish and lobster resources in the continental shelf reef areas will be ascertained over the long term using pot fishing. This survey will provide basic information for the management of resources and fishing grounds by comparing catches from within and outside restricted fishing areas, in particular, to ascertain the effectiveness of fishing restrictions and to help set restricted and open fishing areas and fishing ground rotations.

For safety reasons, the Fisheries Division's small boats can only hold a limited number of pots (1.5 m x 1.8 m x

0.5 m), thus making it difficult to move between waters under surveys. Since the multipurpose boat will have sufficient deck space, it will allow for safe and efficient surveys if it is introduced under the Project. Catch surveys will be conducted every two weeks, and reef fish surveys will be conducted twice a month for two days at a time. One two-day lobster survey will be conducted about once a month for two days at a time.

Table 8: Operation Plan of Project Multipurpose Boat

Purpose	Number of Operation days			Operation Schedule											
	Days/ time	Times/ year	Total	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. Training for fishermen on board (BFTC Special course)															
(Basic navigation: 2, FAD fishing: 2, DBS fishing: 2)	6	6	36 days												
2. Development of FAD Fishing															
Deplyment of FAD: loading materials on board:1,	2	10	20 days												
Deployment: 1, Monitering of FAD	2	12	24 days												
3. Research fishing with fish pots															
- for reef fish	2	20	40 days												
- for lobster	2	10	20 days												
Total number of operation days			140 days												

If the new boat is adopted, the CARIFICO boat will be used for ongoing DBS tests and for at-sea training for the BFTC (which is currently only held in the classroom).

c) Operation and maintenance framework

The Fisheries Division currently employs three boat operators (including one with engine repair experience) and two engine repair technicians. The most experienced operator and technician will be assigned to man the multipurpose boat full-time. The remaining two boat operators and engine repair technician will operate and maintain the existing three boats. The Coast Guard's head technician (who teaches engine repair for the BFTC) has agreed to provide engine repair support, so there will be no issues in terms of the operation and maintenance of this boat. Out of the annual operation cost of the boat (approx. 120,000 – 130,000), the fuel is supplied from the Government and ice and bait can be also procured from the existing fisheries complex at free of charge. Therefore, it is necessary to squeeze fishing material cost (EC$12,000 per year) only from the budget allocated to the Fisheries Division. Although tt is necessary for the Fisheries Division to spend it from the budget of other material (EC$34,000 – 185,000), it will be possible to be fully managed by the Fisheries Division, since the above fishing material cost occupies 6 – 35% of the actual budget allocated,

2-2. Outline Design of the Japanese Assistance

2-2-1. Design Policy

(1) Refrigeration facilities

Basic policy

There are five refrigeration facilities in Antigua and Barbuda that were provided with grant aid from Japan.

All of the target facilities for cooperation of the project are currently using R-22, so refrigerants will be switched to R-404A. Air cooling will continue to be employed as the method of condensation, and all refrigeration facilities will be replaced. However, since the refrigeration facilities at the seafood processing plant in the Point Wharf

Fishery Complex remain in good physical condition, they will continue to be operated using R-22 refrigerant.

Due to the properties of R404A, switching refrigerants from R-22 to R-404A increases motor output by around 20%. In order to hold down electricity consumption, motors with the same output as the existing equipment will be used so long as they can satisfy current production capacity. Thus, when an existing one ton/day ice plant is switched to R-404A, ice output is likely to decrease by 20% (0.8 tons/day) because the motor output will be the same.

If additional production capacity is required, equipment that can meet that capacity shall be selected, motor output will be increased, and the electrical equipment will be retrofitted as necessary by changing wiring materials etc.

Design policy

1) The size, capacity and specifications of the refrigeration facilities will be rational in light of user intentions, catch volume over time and other factors.
2) Equipment will not be replaced solely for the purpose of changing refrigerant.
3) Existing ice storage and cold storage structures (in all cases, installed by assembling prefabricated heat-insulating panels) will be used as is.
4) As water quality of well water as one of the sources of public waters in Antigua is hard water with high concentrations of calcium, an easy-to-maintain ice-making method will be selected.
5) Since the facility faces the ocean, highly rust-proof materials will be selected and appropriate rust-proofing measures will be taken to combat salt damage from the ocean winds.
6) Work will center on equipment replacement, so no particular permits for construction or other work will be required; however, since power consumption will increase due to the higher cooling capacity of some equipment, changing wiring materials and other items with local government expenditure will be considered.
7) There are several companies that provide refrigeration equipment, but they all primarily handle air conditioner installations. With regard to ice making and refrigeration equipment, some businesses assisted Japanese companies in past grant aid projects, but almost none of them have construction experience. Refrigerator vendors rely on local construction companies to install refrigerators in the private sector as well. Consequently, the Japanese equipment company will lead installation work, while the local businesses will provide support.
8) For the refrigerants in the refrigeration facilities, R-404A will be used, in consideration of the intension of the Government of Antigua and Barbuda..
9) In the selection of equipment and machinery, convenience for local users will be maintained by respecting the devices and systems of existing facilities for which local personnel have acquired sufficient maintenance skills and by primarily using Japanese equipment that is similar to existing equipment.
10) In all cases, since construction will consist of the retrofitting of existing equipment that is in operation, considerations will be taken to ensure that equipment can remain in operation during construction as much as possible. Work at the three sites scheduled for retrofitting will be conducted in sequence so as to avoid a situation in which there is no ice or cold storage available anywhere on Antigua at any given time, thereby minimizing the impact on the users of the facilities.

(2) Water supply equipment

Annual rainfall on Antigua is low at 1,000 mm, and since the island is flat, there are few reservoirs. This situation

leads to chronic water shortages. This trend is particularly strong in the dry season, and water shortages are one of the biggest problems faced by the fisheries industry, which is a major consumer of water. Among the four fisheries complexes aside from the one on Barbuda, water shortages are particularly pronounced at the seafood processing plant in the Point Wharf complex. There is a four-ton water receiving tank (capacity: 6 m^3) here, but the water in the tank runs out in one hour when there is a water outage. To cover water volume required for fish processing work for 4 – 5 hours per day, new 30 m^3 tank (20-ton), which is 5 times in the capacity of the existing tank, will be installed here to replace this 6 m^3 tank, and the feed pump will be replaced.

In Urlings, which uses well water, water is provided directly to users without passing through a water receiving tank that was provided through grant aid. To respond to water shortages in the dry season, a broken feed pump will be replaced so that use of the water receiving tank can be resumed.

(3) Surveillance radar system

Basic policy

Equipment will be designed, installed and operated in compliance with the relevant laws of Antigua and Barbuda.

Antigua and Barbuda are relatively flat. The highest point in the country is Mt. Obama (Boggy Peak), at approximately 400 m. The island of Barbuda is even flatter than Antigua. The plan for radar installation is to use existing towers as much as possible..

The core telecommunications line in Antigua and Barbuda is a microwave link, and people connect to the Internet using WiMAX. Aside from some key communications functions, there is no fiber optic network. As such, the transmission of data from radars to monitoring stations will require the installation of exclusive microwave lines. To receive microwave signals from Mt. Obama, a free-standing tower equipped with a microwave device will need to be installed at the Point Wharf Fisheries Complex.

Design policy

1) Radar equipment

- Compact, lightweight radar equipment will be selected.
- The equipment must be able to sufficiently cover the waters to be monitored.
- Efforts will be made to ensure that the operation of surveillance monitors can be conducted as simply as possible.
- Devices will be either EIA/TIA (USA) or ETSI (Europe)-certified.

2) Radar towers

- The government will seek to share existing towers to the maximum extent possible.

(4) VHF radio system

Design policy

1) VHF repeater

There is an existing VHF repeater installed by the Coast Guard of Antigua and Barbuda on Mt. Obama. A new VHF repeater will not be installed in order to avoid interference with this repeater.

2) VHF radio base station

- The existing VHF radio at the Point Wharf Fisheries Center will be used as is.

- A new VHF radio will be installed at the Parham Fishing Port.
- Since there is already one VHF radio set in Urlings Fishing Port, new radios do not need to be provided.

3) VHF radio equipment

- Radios must cover international marine band channels.
- Radios must have sufficient transmission capacity.
- Radios must have sufficient reception to maintain communications.
- Radios must be either EIA/TIA (USA) or ETSI (Europe)-certified.

(5) Submerged-type fish aggregating devices

Design policy

1) Since tropical storms and hurricanes pass through the waters around the Eastern Caribbean islands, equipment will need to be durable enough to withstand high waves during hurricanes.
2) The sites for submerged-type FAD installation will be in sea areas that are accessible from fishing villages. One FAD will be installed on the Caribbean Sea side of Antigua, and one will be installed on the Atlantic Ocean side.
3) Submerged-type FADs are devices and technologies that were developed in Japan. They will be procured from a manufacturing company in Japan that has many years of actual experience manufacturing and installing them.
4) Of the structural components of submerged-type FADs, the concrete blocks that will serve as anchors can be manufactured locally. Thus, they will be manufactured by a local business.
5) The floating-type FADs to be procured by CARIFICO will be administered by the Fisheries Division. A framework is in place whereby fishing boat operators will accumulate experience by helping with the fabrication and installation of the FADs and cooperate with the Fisheries Division to maintain them. The installation and management of the submerged-type FADs will employ the same format. Fishermen with FAD fishing permits will be encouraged to voluntarily participate in the installation work, thereby developing a sense of ownership of the FADs.
6) To ensure the effectiveness and durability of the submerged-type FADs, experienced technicians will construct a model of a FAD that is frequently utilized in Japan and has demonstrated durability of at least 10 years using materials of the same quality.
7) Technicians from the company to manufacture the submerged-type FADs will prepare components locally, conduct depth and sea-bottom topography surveys at the installation points, fix anchor ropes, guide installation work at the work sites, and check installation.

(6) Multipurpose boat

Basic policy

With regard to boat size, the boat will be the smallest possible that can safely operate while having enough space to accommodate the necessary crew and equipment.

Crew sizes have been planned as follows based on the details of operations. The maximum crew size for FAD installation work shall be eight.

Table 9: Planned number of passengers for the multipurpose boat

Details of operations	Crew size	Remarks
BFTC Special Course	7	Operator/trainers: 2, participants: 5
FAD installation	8	Operator/trainers: 2, cooperating fishermen: 6
FAD monitoring	5	Operator/trainers: 2, cooperating fishermen: 3
Catch surveys using pots	4	Operator/surveyors: 4

Design policy

1) The waters around Antigua and Barbuda are located in the trade winds. With normal wind speeds of 5 to 10 m/s east to southeast, boats are subject to the impact of open-sea swells and waves. The multipurpose boat to be adopted shall have sufficient stability, restoring force, and seaworthiness to withstand swells and waves.
2) The smallest possible multipurpose boat shall be adopted so as to avoid the burden of excessive operational expenses. To control fuel costs, which will account for most of the direct operational expenses, the main engine will only have the minimum necessary output and will not need to have high speed capability. Fishing trips in Antigua and Barbuda are primarily day trips. As a rule, the multipurpose boat will also only make day trips, and because it will be the smallest size possible, it will not have sleeping quarters.
3) In Antigua and Barbuda, there are no builders of the small fiberglass reinforced plastic (FRP) fishing boats of the planned size and equipped with inboard motors. The same applies to its neighboring countries, so a Japanese builder of FRP fishing boats with many years of actual experience manufacturing boats of the same size as the planned boat will be tasked with building the boat.
4) As for crew for the boat, three boat operators (including one with engine repair experience) and two engine mechanics are required. The Coast Guard's engine mechanic (who teaches engine repair for the BFTC) will be able to provide engine repair support.
5) The planned boat will comply with Japan's safety regulations for small craft.
6) The hull of the boat will be made from fiberglass reinforced plastic (FRP), a material with long-term durability that will not corrode. Since building the boat with a hull mold based on a new design is likely impossible in terms of both cost and procurement time, an existing model that is suitable for the boat's intended operations will be selected from available models with existing hull molds. Then possible revisions and fittings will be added to the selected model.

2-2-2. Basic Plan (Equipment Plan)

The following table lists the equipment that falls under the scope of cooperation for this project.

Table 10: Equipment that falls under the final scope of cooperation

Category	Site	Equipment	Quantity
Refrigeration facilities	Market Wharf	Ice plant (flake ice, 4.5 tons/day)	2
		Refrigeration equipment for cold storage ($40m^3$, ±0°C)	1 set
		Insulated truck (2 tons)	1
	Point Wharf	Air conditioners (indoor and outdoor units x 19)	1 set
	Parham	Ice plant (flake ice, 1 ton/day)	2
		Refrigeration equipment for cold storage ($30m^3$, ±0°C)	1 set
	Urlings	Ice plant (flake ice, 1 ton/day)	2
		Refrigeration equipment for cold storage ($30m^3$, ±0°C)	1 set
Water supply system	Market Wharf	Reservoir tank ($36m^3$, including pump)	1
	Point Wharf	Reservoir tank ($30m^3$, including pump)	1
	Urlings	Feed pump (pressure-sensitive)	2
Surveillance radar system	Freetown	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna)	1 set
	Mt. Obama	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna x 6)	1 set
	Codrington	Radio station equipment (radar, radar antenna, AIS transmitter, VHF antenna, processor unit, power source, microwave antenna x 2)	1 set
	Point Wharf	Monitoring station equipment (monitors x 3, computers x 3, switching hubs x 3, microwave antennae x 3 pairs, tower x 1)	1 set
VHF radio system	Parham	VHF radio x 1, VHF antenna x 1, power source x 1	1 set
Submerged-type fish aggregating device	Atlantic Ocean side	Submerged-type FAD (Depth: 1,300m)	1
	Caribbean Sea side	Submerged-type FAD (Depth: 850m)	1
Multipurpose boat	Point Wharf	Length overall: 11m, Width: 2.8m, Depth: 1.4m; 115 horsepower diesel engine)	1 vessel

2-2-2-1. Refrigeration facilities

The specifications for facilities to be introduced under this project can be found in the attached comparison table, but the shared specifications upon which they are based are as follows:

1. Refrigerant: R-404A
2. Equipment for retrofitting: All applicable equipment will be upgraded. In particular, the electric control panel, which could likely still be used, will be replaced since the new equipment will result in changes to the method of control. Existing equipment will be used for the pre-fabricated cold storage and ice house, but additional materials may be approved if partial renovations are deemed necessary.
3. Retrofitting process: Since the existing facilities are currently in operation, a retrofitting process that minimizes the impact on said operation will be employed.
4. Disposal of old refrigerant: Disposal of old refrigerant will take place prior to replacement work. Transport of recovered refrigerant to the designated location will be included in the project.
5. Removal of existing equipment: As is the case for refrigerant, removal of existing refrigeration equipment will include transport to the designated location.

Design conditions (common items only)

External air temperature:	+35° C
Water temperature:	+28° C
Water quality:	Tap water
Power source:	AC 415 V x 60 Hz x 3 phases x 4 wires; AC 230 V x 60 Hz x 1 phase
	* Antigua and Barbuda is the only Caribbean island nation that uses 60Hz.
Cooling method:	R-404A direct expansion sensation method
Condensation method:	Air cooling

1) St. John's Fish Landing and Marketing Facilities (Market Wharf Fishery Complex)

This facility has capacity to make seven tons of ice per day (the report says there are two 3.5-ton/day ice plants, but actually there are two 6-ton/day machines) and a 40 m^3 cold storage (-5°C) unit. Since 2009, ice making capacity has declined due to old age and physical damage, reaching to 4.3 ton/day in 2013. Judging that it is appropriate to recover ice sales volume to the level of 2009, current ice-making capacity has been estimated at nine tons/day (4.5 tons/day x 2) based on AFL's past ice sales record (see table below). Concurrent with this upgrade, electrical equipment will be updated as necessary by changing wiring materials etc.

Table 11: AFL ice sales and estimates of required ice volume

Month / Year	2009	2010	2011	2012	2013
January	244,510	214,285	170,325	179,383	89,398
February	237,435	176,555	141,755	157,318	80,740
March	248,045	178,100	201,220	179,370	85,305
April	251,300	221,790	222,825	174,236	92,425
May	248,685	247,465	182,005	196,705	126,820
June	243,825	230,810	135,385	202,345	106,955
July	327,650	322,945	179,365	234,195	160,675
August	303,170	276,740	120,910	242,998	156,645
September	212,950	168,640	107,941	181,473	140,983
October	245,695	164,850	193,099	131,186	71,800
November	259,110	159,635	197,962	70,165	11,895
December	243,555	186,690	173,316	89,865	240
Total	3,065,930	2,548,505	2,026,108	2,039,239	1,123,881
Ave. Ice sale volume per day in peak month	10,922	10,765	7,428	8,100	5,356
Volume of ice or AFL own use (Approx. 30% of total)	4,681	4,614	3,183	3,471	2,295
Total volume of ice use per day (lb/day)	15,602	15,378	10,611	11,571	7,651
Ditto (kg/day)	7,068	6,966	4,807	5,242	3,466
Working efficiency of ice plant	80%	80%	80%	80%	80%
Required cpapacity of ice plant (ton/day)	8.8	8.7	6.0	6.6	4.3
Remarks: EC$10/50Lb.(Selling price of ice)					

Source: Volume of ice sold calculated from AFL's ice sales records.

The existing cold storage was completely out of order, and has been used as storage of large insulated boxes for keeping ice. As cold storage is not functioned, annual fish processed / sales volume at AFL was only 54.2 tons in average of last 3 years (2011 – 2013). It is expected by AFL that more fish will be able to procured, stored and sold through recovery of the original function of cold storage. Furthermore the AFL plans to directly import frozen

squid, which has been imported via a third party, so as to reduce the purchase price. From these aspects, the existing cold storage is to be recovered.

Since the retrofitting will be conducted without suspending ice-making operations, the ice plants will be replaced one at a time at each site before moving to the next site. Since the existing refrigeration equipment in the cold storage is installed in a narrow space, the compressor unit and air condenser will be installed on the roof of the cold storage.

The cooling capacity of the cold storage will fall about 20% (inside temperature: -5° C → ±0° C) when the refrigerant is switched from R-22 to R404A, but since the existing facility is currently operated at ±0° C, and there are no problems maintaining the freshness of fish catches, a motor with the same capacity will be used.

The insulated truck that was initially brought in (500 kg; no cooling unit) has been used for more than 10 years but had already been scrapped. Since the insulated truck's cooled container could only hold small loads, coolers were sometimes stacked on top of the container for transport. AFL's current customer list includes 26 hotels and 58 other clients (including individuals). To respond to customer demand for delivery, we will procure a bigger insulated truck (load capacity of 1 – 2 ton; no cooling unit) as a replacement.

Table 12: Summary of plan for refrigeration facilities (Market Wharf Fishery Complex)

Equipment description	Existing equipment details (Refrigerant: R-22)	Converted equipment details (Refrigerant: R-404A)
Ice plant	Plate ice (12 tons/day: 6 tons/day x 2)	Flake ice (9 tons/day: 4.5 tons/day x 2)
Refrigeration equipment for cold storage	Capacity: 40 m^3; Temperature: -5°C Plastic fish boxes (500 W x 800 L x 200 D) x 36	Capacity: 40 m^3; temperature: ±0°C or lower Same as left (with sturdy handles)
Insulated truck	Load capacity: 500 kg x 1 (Fifteen years have passed since the truck was provided, so it has been scrapped.)	Load capacity: 2,000 kg (max.) x 1

Because, as is stated in the design policy, the change in refrigerant will have no impact on maintenance capacity, there is no need for a "soft component." Furthermore, it is also considered that no spare parts other than standard accessories will be necessary.

2) Parham Fishing Port

At present, there is one 1.5-ton/day plate ice plant, but ice demand has been revised as follows in light of current fishing boat operations.

Table 13: Current ice demand at Parham Fishing Port

Consumer	Breakdown	Ice demand (lbs/week)	Ice demand (lbs/day)	Ice demand (kg/day)
Purse seiners	750 lb/day x 3 days per week x 1 boat 100 lb/day x 3 days per week x 3 boats	2,250 900		
Fishing boats for pot fishing/diving	50 lb/day x 4 days per week x 18 boats	3,600		
Conch fishing boats	750 lb/day x 4 days per week x 4 boats	12,000		
Fish retailers	250 lb/day x 6 days per week x 2 people	3,000		
Total		21,750	3,107	1,408

Due to fluctuations in demand for and loss of ice, not all of the ice that is made gets used. Generally speaking, if 70~80% of the ice made gets used, that should be more than sufficient. As such, 1,408 kg/day ÷ 80% ≒ 1,760kg/day. In addition, since private demand for ice rises during festival periods (13 days a year), the current

capacity of 1.5 tons/day will be expanded to two tons/day (1 ton/day x 2 machines). Based on the preferences of the Fisheries Division and fishermen, the ice type will be switched from plate ice to flake ice.

The facility was designed so that the refrigeration equipment for cold storage could also be used for the ice house, but the refrigeration equipment has not been used to cool the ice house for several years in order to reduce electricity costs. For this reason, the new cold storage will have its own refrigeration equipment. The cooling capacity of the cold storage will fall about 20% (inside temperature: -5° C → ±0° C) when the refrigerant is switched from R-22 to R404A, but since this poses no issues in terms of the storage of fish catches, a motor with the same capacity will be used. Also, because the change in refrigerant will have no impact on maintenance capability, there is no need for a "soft component." Furthermore, it is also considered that no spare parts other than standard accessories will be necessary.

Table 14: Summary of plan for refrigeration facilities (Parham Fishing Port)

Equipment description	Existing equipment details (Refrigerant: R-22)	Converted equipment details (Refrigerant: R-404A)
Ice plant	Plate ice (1.5 tons/day)	Flake ice (2 tons/day)
Refrigeration equipment for cold storage	Capacity: 30 m^3; temperature: -5°C Refrigeration equipment also used for the ice house	Capacity: 30 m^3; temperature: ±0°C or lower Refrigeration equipment only used for cold storage

3) Urlings Fishing Port

At present, there is one 1 ton/day plate ice plant in use. However, ice demand has been revised as follows in light of current fishing boat operations.

Table 15: Current ice demand at Urlings Fishing Port

Consumer	Breakdown	Ice demand (lbs/week)	Ice demand (lbs/day)	Ice demand (kg/day)
Large fishing boats	(150 lbs/day for use in fishing boats + 100 lbs/day for cold storage after landing) x 3 days/week x 5 boats	3,750		
Small fishing boats	150 lb/day x (current 2 days → 4 days/week) x 25	15,000		
Total		18,750	2,679	1,214

As with Parham, due to fluctuations in demand for ice, not all of the ice that is made gets used. Generally speaking, if 70~80% of the ice made gets sold, that should be more than sufficient. As such, 1,214 kg/day ÷ 80% ≒ 1,518 kg/day. In addition, since private demand for ice rises during festival periods (13 days a year), and since it is highly likely that catches of pelagic fish will increase with FAD fishing operators using the port as a base, the current capacity of one ton/day will be expanded to two tons/day (1 ton/day x 2 machines). Based on the preferences of the Fisheries Division and the fishermen, the ice type will be switched from plate ice to flake ice.

Table 16: Summary of plan for refrigeration facilities (Urlings Fishing Port)

Equipment description	Existing equipment details (Refrigerant: R-22)	Converted equipment details (Refrigerant: R-404A)
Ice plant	Plate ice (1 tons/day)	Flake ice (2 tons/day)
Refrigeration equipment for cold storage	Capacity: 30 m^3; temperature: -5°C Refrigeration equipment also used for the ice house	Capacity: 30 m^3; temperature: ±0°C or lower Refrigeration equipment only used for cold storage

As with Parham, the facility was designed so that the refrigeration equipment for cold storage could also be used for the ice house, but the refrigeration equipment has not been used to cool the ice house for several years in order to reduce electricity costs. For this reason, the new cold storage will have its own refrigeration equipment.

Likewise, the need for a “soft component" and spare parts to be kept on hand is the same as Parham.

On Antigua, fishing boats do not necessarily purchase ice or land catches in a set location. In Urlings, fishing boats from other districts have come to the Complex to purchase ice since it opened, but the number of such boats is on the rise. Even if ice-making capacity is expanded from one to two tons per day at Urlings and from 1.5 to two tons a day at Parham, the addition of an ice plant at Urlings will not affect other regions, as capacity at Market Wharf will be reduced from 12 to nine tons a day.

4) Point Wharf Fisheries Center

There are freezers and cold storage units in the HACCP-compliant seafood processing plant; however, since there are no issues with their physical condition, they will continue to use R-22 refrigerant. As such, they will fall outside of the purview of this project. The original ice plant (which is out of order) is a popular type usually used at restaurants called a cubic ice; however, because a new 2-ton/day flake ice plant will be installed in a follow-up project, no new machines will be installed as part of this project.

On the other hand, air-conditioning equipment is installed in two locations in the complex: the Fishery Center, which houses the Fisheries Division and seafood inspection room, and the seafood processing plant, which processes and freezes fishery products.

Given that obtaining spare parts for the existing air-conditioning equipment has proven difficult, the retrofitting work will utilize equipment that has been procured locally.

In the Fishery Center, ceiling blower units are used throughout the building. All 14 units are separate-type air conditioners (some have their outlets installed separately). Although the cooling capacity varies from room to room, it is generally between 7 and 10 kW per unit. Meanwhile, in the seafood processing plant, some of the air conditioners are through-the-wall units, while others are ceiling blower units similar to those in the Fishery Center. The cooling capacity of the smaller units is 2 kW, while that of the ceiling blower units is around 3 kW. It should be noted, however, that the air-conditioning temperature is set low at 18°C to preserve the freshness of processed goods (generally, office air conditioners are set at 26°C).

It deserves mentioning that air-conditioning equipment is already being retrofitted independently in some rooms. These units will be excluded from the project.

Table 17: Summary of plan for air conditioners (Point Wharf Fisheries Center)

Equipment description	Before retrofitting (refrigerant: R-22)	After retrofitting (R-410)
Fisheries center main building	Ceiling blowing units Units with separately installed outlets are installed in the large Fisheries Division staff room.	Some independent retrofitting work has been completed, and therefore no work will take place outside the 1st-floor meeting room and 2nd-floor large staff Fisheries Division staff room. The air-conditioning system will be the same as the existing system.
Fish processing plant	Through-the-wall units are used in the office and pantry. Ceiling blowing units are used in other areas.	Work will take place in all areas except the plant manager’s office, where equipment has been replaced. The air-conditioning systems will be the same as the existing systems.

Because the change in refrigerant will have no impact on maintenance capacity, there is no need for a “soft component.” Furthermore, it is also considered that no spare parts other than standard accessories will be necessary.

2-2-2-2. Water supply facilities

Each of the existing fisheries complexes receives its water from the public water supply (administered by APUA), but water outages are a big issue in the dry season. All of the facilities take measures to counter this; however, at the seafood processing plant in Point Wharf, the amount of water that the initially installed water receiving tank can hold is used up after about one hour of processing work. Water outages sometimes last up to eight hours a day, so keeping in mind the normal amount of processing time, the original 6 m^3 water receiving tank will be replaced with a tank with five times the capacity (30 m^3), thus providing up to 10 tons of water. In addition, the attached feed pump will be replaced.

In Urlings, which uses well water, water is provided directly to users without passing through the water receiving tank. Users will be encouraged to resume using the tank as a means to combat water shortages in the dry season. The water receiving tanks will not be retrofitted, but a new feed pump will be installed to replace the pressure-sensitive pump that is currently out of order. Furthermore, since calcium buildup on the ice plate in the ice plant reduces ice-making capacity, the installation of a water softener was considered. However, this idea was abandoned because a) the machine will be converted to a flake ice plant, which can eliminate the built-up calcium on drum by scraping ice, and b) it would add to the equipment that needs to be maintained. If the provision of spare parts is limited to one year in the Water Supply Plan, there will be no need, in particular, for spare parts and no need for a "soft component."

2-2-2-3. Submerged-type fish aggregating devices

Design Conditions

a) Maximum wave height and wave cycle

A maximum wave height of 12 meters and wave cycle of 12 seconds are set as design conditions. These figures were arrived at by considering the 30-year probabilities for offshore wave height and cycle that were used as conditions for past grant aid-based fishery facilities construction in the countries of the Eastern Caribbean and then selecting equivalent values.

b) Tidal current

A tidal current of five knots is set as a design condition. This is the surface tidal current value used as a design condition for submerged-type FADs in the sea areas around Okinawa, which have similar topographic conditions and where numerous submerged-type FADs are installed.

c) Basic requirements for the submerged-type FADs to be used

The FADs will have a structure that is resistant to the effects of ocean waves and cannot be damaged by passing vessels. They will possess long-term durability and effectiveness in attracting fish. Experienced technicians will construct a model of a FAD that is frequently utilized in Japan and has demonstrated durability of at least 10 years using materials of the same quality.

d) Number of FADs to be introduced:

A total of two FADs (one on the Caribbean Sea side and one on the Atlantic Ocean side) will be introduced to ensure that fishing boats from multiple fishing villages will be able to travel to and utilize them.

General Specifications

Submerged-type fish aggregating device: 2

Basic structure: To be comprised of a floating component (reef), tether, and anchor for fixing the device in

place.

- Float shape and size: The floating component will have a segmented or integrated FRP frame. It will form a vertical cylinder when installed in the water. It will have a diameter of 1.5 to two meters and a length of five to seven meters.
- Float part of the floating component: Water pressure-resistant ABS spherical float; the necessary number to be lashed to an FRP frame.
- Mooring rope: To be constructed of synthetic fiber rope with sufficient strength and durability. The upper portion of the tether will be covered with a resin exterior material that will include SUS wire to prevent friction with fishing gear, etc.
- Anchor: Concrete block with sufficient weight to fix the FAD in place. A stainless steel anchorage ring or truck tire for tying the mooring rope will be embedded into the top of the concrete block together with reinforcing bars. Suspending bars will be similarly prepared in four locations. Concrete strength: 180 kg/cm^2.
- Marking buoy: A marking buoy with a dry-battery type buoy light will be attached to the top of the floating component for the convenience of local fishing boats. The marking buoy is a consumable item, and its tether strength will be such that the tether will break without harming the floating component if it becomes entangled with a fishing boat.

2-2-2-4. Multipurpose boat

Design Conditions

a) Basic hull form

The most standard boat type—comprised of a pilothouse at the center, an engine room under the aft deck, and work decks located fore (foredeck) and aft (afterdeck) of the wheelhouse—will be used. The deck structure will have walkways on both sides of the pilothouse and the engine room hatch to allow the crew to move back and forth between the bow and stern.

b) Boat measurements

The largest number of people and greatest amount of materials will be on deck when the boat is installing floating-type FADs. Keeping in mind that the crew will need to load and offload materials, the dimensions of the decks and the hull size will be as follows.

Each floating-type FAD anchor requires 16 sandbags weighing 60 to 65 kg, which amount to a total of one ton in weight. These bags will be loaded by distributing eight bags to each side of the afterdeck. Accordingly, a placement area measuring approximately 1 x 2 meters will be required on either side. Thus, when the loading and installation work space is included, the afterdeck will need to have a space measuring 2.5 meters in width by 2 meters lengthwise.

The length of the anchor rope for a floating-type FAD must be 1.5 times the water's depth. Thus, if the installation location has a depth of 2,500 meters, the rope would need to be 3,750 meters long. Using rope with a diameter of 10 mm or 12 mm, this translates to eleven 360-meter coils, which will be connected in succession and piled on the forward deck as they are unwound, taking care to ensure they do not tangle. To ensure enough space so that the floating component, which will be composed of the anchor rope and five to seven plastic spherical floats, does not

become entangled, an anchor rope/float space measuring approximately 2.5 meters wide x 1.5 meters long will be secured on the foredeck together with a passageway/work space measuring 2.5 wide x 1 meter long. Accordingly, the foredeck will have an effective width of 2.5 meters between the bulwarks and a length of approximately 2.5 meters (= 1.5 + 1 meters).

The pilothouse will have a maximum occupancy of two people. It will have a floor area of approximately 1.3 meters wide x 1 meter long. The engine room hatch will have the same width of 1.3 meters and a length of 4 meters (matching the length of the engine room). The fore area of the foredeck must have an overhang of approximately 1.5 meters that will serve as a bow storehouse and bow flare (splashboard).

When all of the above-mentioned lengths are totaled together, the result is a hull length of 11 meters. The beam will be approximately 2.8 meters, which is arrived at by adding together the effective width between the bulwarks of 2.5 meters and the bulwark width of 0.15 meters (which becomes 0.3 meters for both).

Fishing gear: The boat will be equipped with reels for DBS fishing and a line hauler for pot fishing.

The boat will comply with Japan's safety regulations for small craft.

General specifications

Multipurpose boat: 1 boat

(Main items)

Hull material:		FRP (fiberglass reinforced plastic)
Boat type:		Single deck boat with a wheelhouse at midship
Measurements	Length:	Approx. 11 meters
	Beam:	Approx. 2.8 meters
	Depth molded:	Approx. 1.4 meters
Main engine:		Water-cooled six cylinder, naturally aspirated marine diesel engine
		Rated output: 115 horsepower/2,550 rpm
Hydraulic system:		Line-hauler for pot fishing: 1 set at portside with a davit for hauling pot.
		Reel for fishing: 1 set at starboard (Reel exchangeable)
		Capstan: 1 set at bow deck
General service pump:		Driven by a power take-off from the main engine
Bilge pump:		Electric pump
Navigational equipment:		Magnetic compass, GPS/fish-finder, radar, VHF radiotelephone
Steering mechanism:		Manual hydraulic steering system
Insulated ice storage room:		Approx. 1.3 m^3, located under the foredeck
Awning:		Over the afterdeck

2-2-2-5. Surveillance radar system

Basic System

A monitoring station will be installed inside the Point Wharf Fisheries Complex. The details regarding the radar system components and networks are as follows.

Table 18: Radar system components

Site	Functions	Components
Point Wharf Fisheries Complex	Monitoring station (A new tower will be built)	PCs x 3, monitors x 3 , switching hub
Mt. Obama	Radar site (An existing tower will be used)	Radar antenna + radar unit, AIS receiver + VHF antenna, processing unit; power source
Freetown	Radar site (An existing tower will be used)	Same as above
Codrington	Radar site (An existing tower will be used)	Same as above

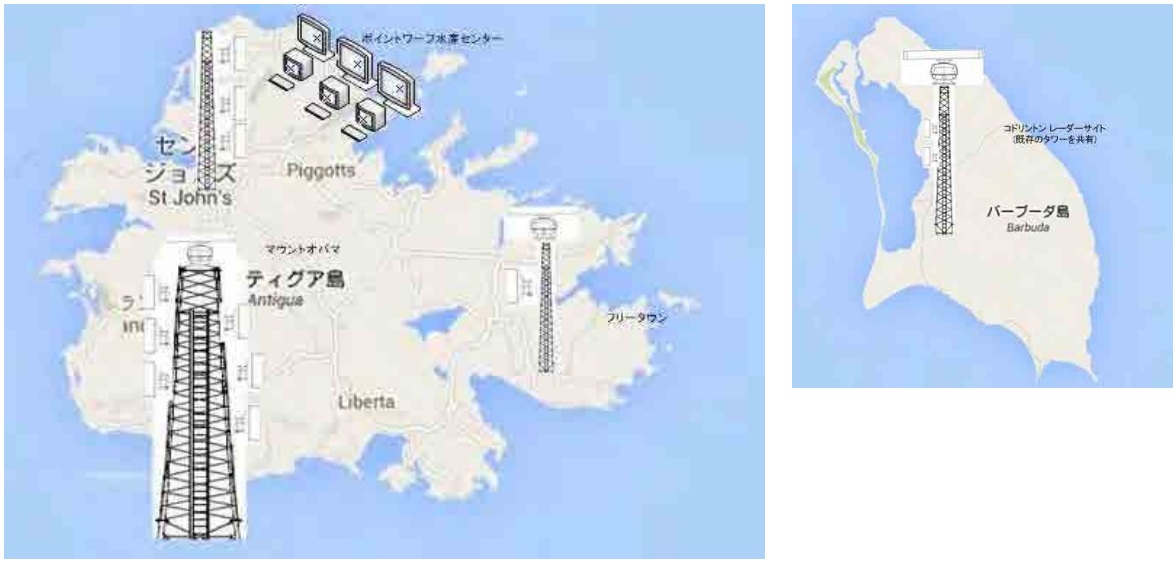


Figure 3: Radar system and network

Data Transmission System

Because the transmission of data from each radar site to the monitoring stations will utilize a self-maintained microwave link, (disk-shaped) microwave antennae will be installed. Microwave data transmission requires there to be no obstacles between antennae, and antenna must be installed in locations with a clear line of sight. On land, transmission between paired antennae is possible; however, because the transmission of data (over the ocean) between the islands of Antigua and Barbuda (which are 60 km apart as the crow flies) results in signal reflection off the surface of the ocean, the recipient ends up receiving two waves of data—the direct wave (i.e., the wave transmitted by line-of-sight propagation) and the reflected wave. Therefore, the wave reflected off the ebbing and flowing ocean creates interference and reduces the signal quality. To reduce this interference, two pairs of antennae will be installed at different heights.

Figure 4: Microwave data transmission routes

Table 19: Microwave link reliability

Route	Mt. Obama - Point Wharf Fisheries Complex	Mt. Obama - Freetown	Mt. Obama - Codrington
Effective fade margin	34.1 dB	28.9 dB	36.4 dB
Reliability in rain	99.9%	99.9%	99.9%

Specifications and Configurations of the Systems

(1) Coastal surveillance system and monitoring equipment

The coastal surveillance system and monitoring equipment will monitor vessels captured on radar and possesses the following functions:

a) Capturing target vessels with Automatic Radar Plotting Aid (ARPA) (manual / automatic);
b) Capturing target vessels with AIS;
c) Sounding an alarm and alerting operators when a target vessel captured with ARPA or AIS enters, leaves, or stops within a point of interest;
d) Recording and output of vessel information and track of target vessels captured with ARPA or AIS;
e) Recording and playback of monitoring status;
f) Remote control of radar on/off switch, sensitivity, and range adjustment;
g) Superimposing recorder echo and AIS/ARPA data onto marine chart data of the monitored waters.

Equipment for monitoring the system shall meet the following specifications.

1)	PC	Equipped with surveillance software that satisfies the conditions above
	Display	At least 20"
	Language	English
	OS	Windows 7 Professional / Windows 8.1 Pro License and Media
	Processor	Intel® Xeon® Processor E3-1225 v3
	Memory	8 GB (2x4 GB) 1,600 MHz DDR3 Non-ECC
	Graphics card	1 GB AMD FirePro™ V4900

	HDD	500GB
2)	External hard drive	
	Capacity	3 TB
3)	UPS	
	Output voltage	AC100V
	Output capacity	1,000 VA 700 W
4)	Secondary equipment	Connectors, cables etc., required for installation

(2) Coastal surveillance system and sensors

1)	Radar	
	Output	25 kW
	Antenna type	6.5-foot open array
	Frequency	X band
2)	AIS transmitter	
	Antenna type	Dipole antenna
	Impedance	50 ohms
	Frequency	156 to 162 MHz
	Channel spacing	25 kHz / 12.5 kHz
3)	Electric power control unit	
	Power source	AC 100 V 50 Hz／60 Hz
4)	AC transformer	
	Output voltage	AC100V
5)	Switching hub	
	Ports	5 ports (RJ-45)
6)	Secondary equipment	Connectors, cables, antenna stands etc., required for installation

(3) Microwave communication system 1 (Path A, B, C, D)

1)	Wireless radio	
	- Frequency range	4.5 – 4.8 GHz
	- Configuration	1 + 0
	- Modulation scheme	16 QAM. 32 QAM, 64 QAM, 128 QAM or higher
	- Maximum frequency bandwidth	56 MHz
	- Frequency stability	+/-2.5 ppm or lower
	- Channel spacing	250 KHz
	- Receiving sensibility	-75 dBm @ 64 QAM or lower
	- Transmission output	+20 dBm @ 64 QAM or lower
	- Data transmission rate	20 Mbps or higher
	- Power consumption	75 W or less, 220~240 VAC
	- Housing configuration	IDU (1 set) + ODU (1 set)
2)	Antenna	
	- Type	Parabolic antenna
	- Size (diameter)	0.6 m
	- Antenna gain	25 dBi or higher
	- Frequency range	4.4 to 5.0 GHz
3)	48V DC power supply	
	- Input voltage	220-240V AC
	- Output voltage	48V DC
	- Output current	3A or higher
	- Cabinet	19" EIA racks x 2U or fewer

4) Coaxial cable (IF)

- Size	8 DHFAE or equivalent
- Sheath material	Polystyrene
- Impedance	50 ohms

5) Construction materials

- Materials for installation	Connectors, cables etc., required for installation

(4) Microwave communication system 2 (Path E)

1) Wireless radio

- Frequency range	4.5 – 4.8 GHz
- Configuration	1+1 (Diversity scheme)
- Modulation scheme	16 QAM. 32 QAM, 64 QAM, 128 QAM or higher
- Maximum frequency bandwidth	56 MHz
- Frequency stability	+/-2.5 ppm or lower
- Channel spacing	250 KHz
- Receiving sensibility	-75 dBm @ 64 QAM or lower
- Transmission output	+20 dBm @ 64 QAM or lower
- Data transmission rate	20 Mbps or higher
- Power consumption	75 W or less, 220 to 240 VAC
- Housing configuration	IDU (1 set) + ODU (2 sets)

2) Antenna

- Type	Parabolic antenna
- Size (Diameter)	1.8 m
- Antenna gain	35 dBi ~
- Frequency range	4.4 to 5.0 GHz

3) 48V DC power supply

- Input voltage	220-240V AC
- Output voltage	48V DC
- Output current	3A or higher

4) Coaxial cable (IF)

- Size	8 DHFAE or equivalent
- Sheath material	Polystyrene
- Impedance	50 ohms
- Cable length	100 m

5) Construction materials

- Materials for installation	Connectors, cables etc., required for installation

(5) Tower (Point Wharf)

1) Type	Free-standing, three-legged tower for satellite dish antennas

2) Specifications

- Height	Approx. 30m
- Survival wind speed	70 m/s
- Equipment to be attached	Satellite dishes (Diameter (ϕ): 1.2m) x 3 (Installation height: 15~20m)
- Wind load	200kg/m^2 (per satellite dish)
- Material	Hot-dip galvanized steel (Zinc coating thickness: at least 500g/m^2)
- Sway	Not more than 3°
- Base area	10m x 10m

3) Attachments

- Main equipment for tower foundation	1 set
- Twin obstruction warning light	LED, AC90~250V and clamp x 1 set

- Lightning rod, steel ground plate, tower ground wire	1 set
- Ladder	1 set
- Fittings for installation of satellite dish antenna	Anchor bars for satellite dish (ϕ 70mm×2m) x 3 Extended anchor bars for satellite dish x 6 Metal fittings for anchor bars for satellite dish antenna (for fixing to steel tower and anchor bars of ϕ 70mm) x 1

The detection range of the radar differs depending on the size of the target vessel (i.e., radar cross-section), the altitude of the antenna site, and wave and weather conditions.

a) Determining detection range based on target vessel size and antenna site altitude

The most commonly used smaller fishing boats in Antigua and Barbuda are 23-25-foot boats with outboard motors, while the larger fishing boats are 30-50-foot cabin cruisers. Keeping this in mind, we simulated the maximum detection ranges from each radar site, as shown in the table below.

Table 20: Maximum detection ranges based on target vessel size and site altitude

Target vessel	Radar cross-section	Maximum detection range (nautical miles)[1]			
		Test location (Altitude: 26m)	Codrington (Altitude: 50m)	Freetown (Altitude: 130m)	Mt. Obama (Altitude: 400m)
25-foot FRP boat with outboard motor (no wheelhouse)	4.3m^2	8.0 (10.1)	10.9 (13.7)	16.6 (20.9)	13.6 (17.1)
25-foot FRP boat with outboard motor (with wheelhouse)	7m^2	8.5 (10.7)	11.9 (15.0)	18.0 (22.7)	15.5 (19.5)
45-foot cabin cruiser	12m^2	10.5	13.5 (15.0)	21.0 (23.4)	22.0 (24.5)

*1: The maximum detection range represents the distance at a detection probability of 50% (the number of times out of 25 that vessels appear on the monitor at minimum brightness).

*2: Figures in parentheses are estimates based on demonstration tests conducted in Japan (Test boat: 25-foot FRP boat with wheelhouse, radar cross-section: 7m^2, antenna altitude: 26m).

Based on these simulation results (estimate based on the actual measurement data), in case of a 25-feet FRP outboard motor boat which is the most difficult to detect because of the smallest cross section to reflect to a radar, the detectable areas by each radar site were examined and the results are as shown on the figure right and the table below. As for surveillance of waters with high frequency of illegal fishing boats, it is possible to detect the boat up to about 20 miles offshore, that can cover almost all exclusive economic zone (EEZ) in the south-east of Antigua Island. In the western water of Barbuda Island, however, it can be detected up to 12-mile offshore that covers only a part of the country's EEZ. As for surveillance of FAD surrounding waters for estimate of fishing efforts, it will be able to detect all fishing boats operating around the existing FADs including submerged type FADs (11 – 12 miles offshore), which are scheduled to be installed under the Project.

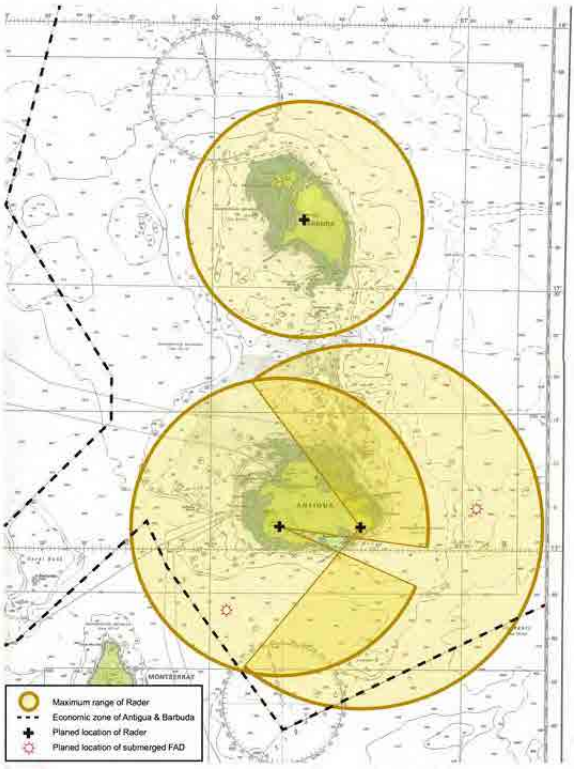


Figure 5: EEZ of Antigua and Barbuda and radar detectable range (in case of a 25-feet outboard motor boat)

Table 21: Detectable range by each radar in the important surveillance zones

Objectives	Priority surveillance zone	Detectable area of 25-feet FRP outboard motor boat by each radar		
		Codrington (Altitude: 50m)	Freetown (Altitude: 130m)	Mt. Obama (Altitude: 400m)
Water zone having high frequency of illegal fishing boats	Southeast water of Antigua (15 – 20 miles from shore)	-	About 20 miles from shore (except about 1 mile on land)	-
	West water of Barbuda (30 – 35 miles from shore)	About 12 miles from shore (except about 1 mile on land)	-	-
FAD surrounding waters for estimate of fishing efforts	10 – 15 miles off Urlings	-	-	About 15 miles from shore (except about 2 miles on land)
	10 – 15 miles off Indian Town Point	-	About 19 miles from shore (except about 2 miles on land)	-

b) Determining detection range based on precipitation and wave conditions

Keeping in mind the size of fishing boats in Antigua and Barbuda, simulations of maximum detection ranges were conducted taking into consideration the impact of rainfall intensity and wave height, respectively. The results are shown in the tables below.

Table 22: Maximum detection range per rainfall intensity level (Antenna altitude: 130m)

Target vessel	Radar cross-section	Maximum detection range (nautical miles)[1]			
		Rainfall intensity (0 mm/hr)	Rainfall intensity (0.5 mm/hr)	Rainfall intensity (1 mm/hr)	Rainfall intensity (3 mm/hr)
25-foot FRP boat with outboard motor (no wheelhouse)	$4.3m^2$	16.6	7.5	4.9	N/A
45-foot cabin cruiser	$12m^2$	20.5	12.5	8.0	2.0

*1: The maximum detection range represents the distance at a detection probability of 50% (the number of times out of 25 that vessels appear on the monitor at minimum brightness).

Based on these simulation results, it is likely that the radar detection range will decrease dramatically in rainy weather. According to climate data for Antigua and Barbuda (retrieved from V. C. Bird International Airport), annual rainfall is 1,049mm, which means there are 124.7 days with at least 1mm of rain and 26.3 days with at least 10mm of rain. Assuming a steady rainfall of 1mm per hour, the radar would be unusable for an average of 1,000 hours a year. This is equivalent to 11.4% of the 8,760 hours in an entire year (365 days x 24 hours), so the radar could be used for the remaining 88.6% of the time. In actuality, rainfall in the tropical oceans is typified by squalls, or short periods (1-2 hours) of intense rain, so the number of hours during which the radar was affected by rainfall would likely be lower than the figure mentioned above.

Table 23: Maximum detection range per wave height level (Antenna altitude: 130m)

Target vessel	Radar cross-section	Maximum detection range (nautical miles)[1]			
		Seastate 1 (Wave height: 0 - 0.1m)	Seastate 2 (Wave height: 0.1 - 0.5m)	Seastate 3 (Wave height: 0.5 - 1.25m)	Seastate 4 (Wave height: 1.25 - 2.5m)
25-foot FRP boat with outboard motor (no wheelhouse)	$4.3m^2$	16.0	16.4	N/A	N/A
45-foot cabin cruiser	$12m^2$	21.0	20.7	20.5	N/A

*1: The maximum detection range represents the distance at a detection probability of 50% (the number of times out of 25 that vessels appear on the monitor at minimum brightness).

These simulation results suggests small boats in waves of 0.5m or higher and large boats in waves of 1.25m or higher would be difficult to detect on radar. According to offshore wave data collected hourly by an observation buoy located 110 miles southwest of Antigua (Station 42060; 16.332N 63.24W; sea depth: 1,570m)[5] between 2009 and 2013, waves measuring 1.5m or higher (i.e., the height at which fishing boats refrain from leaving port) occurred about 35% of the time (about 125 days a year), while waves measuring 2m or higher occurred about 8% of the time (about 30 days a year). Waves measuring 1.5m or higher tend to occur more frequently between December and February as a result of low pressure systems, but the seas in the area are otherwise calm. Hurricanes and tropical storms also cause occasional high waves between May and November. In the countries of the Eastern Caribbean, many fishing boats refrain from leaving port on days when waves exceed 1.5m, so there is little need for radar detection capabilities on these days. As such, high waves are not expected to have much impact on the smooth operation of the radar system.

2-2-2-6. VHF radio system

(1) System overview

A VHF radio station will be installed at Parham Fishing Port, the only one of the five fisheries complexes that does not yet have one. The existing VHF radio repeaters on Mt. Obama and Monk's Hill will be used.

Table 24: Summary of plan for VHF radio

Site	Function	Required equipment	Expected reach
Parham	VHF radio station	VHF radio, VHF antenna, power source	Approx. 14 miles

(2) Equipment configuration

1) Wireless radios 1 set
2) 12V DC power supply 1 set
3) Lightning rod 1 set
4) Omnidirectional antenna 1 set
5) Coaxial cable 1 set
6) Antenna pole 1 set
7) Construction materials 1 set

(3) Equipment specifications

1) Wireless radio equipment
- Frequency range 156 to 173.425 MHz (VHF)
- Channel spacing 25 KHz
- Transmission output 25W and higher

2) 12V DC power supply and charger
- Input voltage 220-240V AC
- Output voltage 13.2 - 13.8V DC
- Output current 20A or higher

3) Lightning rod
- Frequency range DC - 1,000 MHz
- VSWR 1.2 or lower
- Insertion loss 0.3 dB or lower

[5] National Data Buoy Center (NOAA) buoy

4) Omnidirectional antenna

- Frequency range	156 to 162.5 MHz unadjusted
- VSWR	1.5 or lower at 156 to 167 MHz
- Antenna type	1/2 λ
- Antenna gain	2.1 dBi or higher

5) Coaxial cable

- Loss at 400 MHz	72 dB/km or lower
- Impedance	50 ohms

6) Antenna pole

- Pole length	4 m or more
- Mount	Vertical wall-mounting type

7) Construction materials

- Materials for installation	Connectors, cables etc., required for installation

2-2-3. Outline Design Drawing

(1) Refrigeration facilities

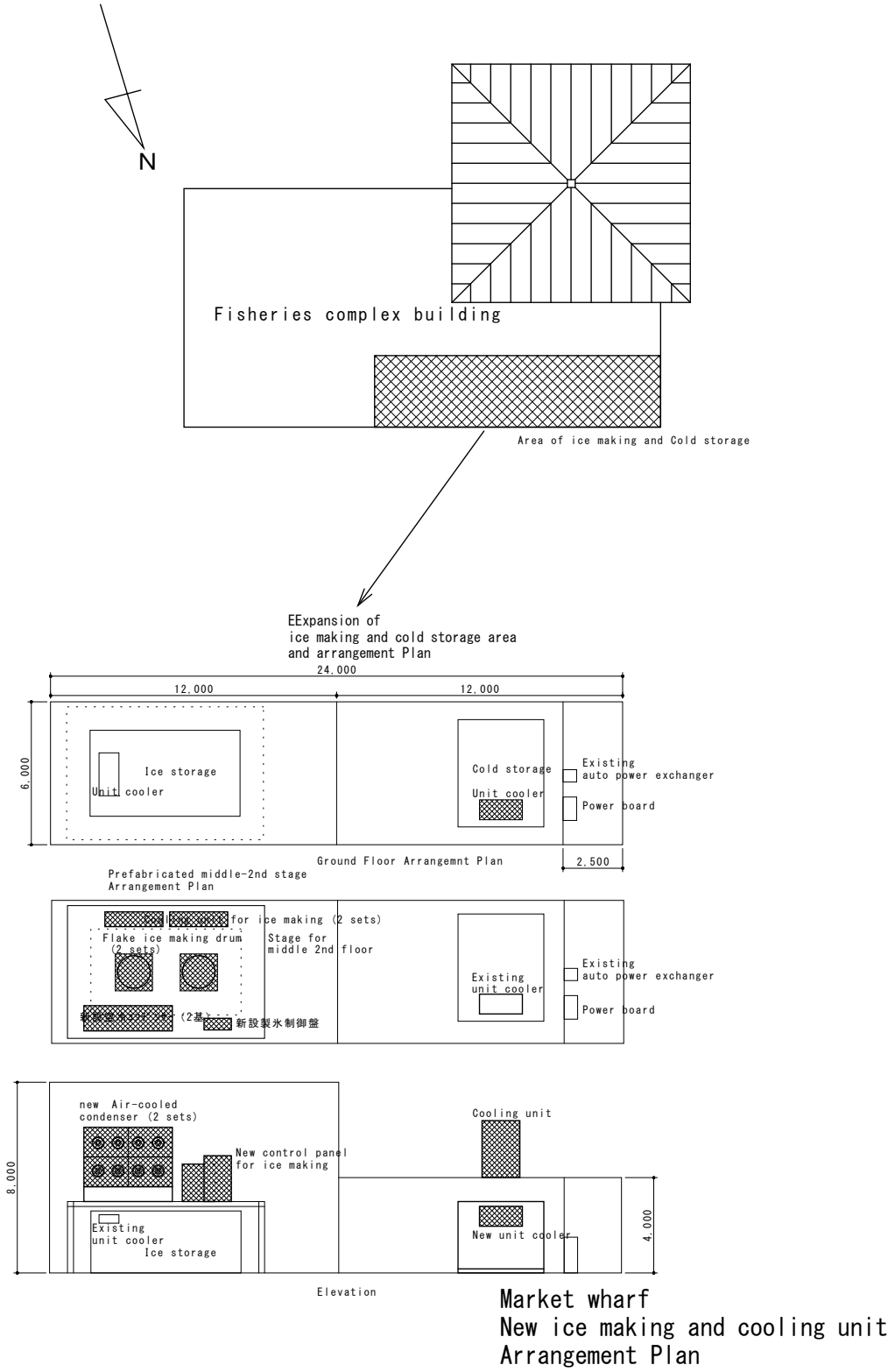


Figure 6: Refrigeration facilities at the Market Wharf Fishery Complex

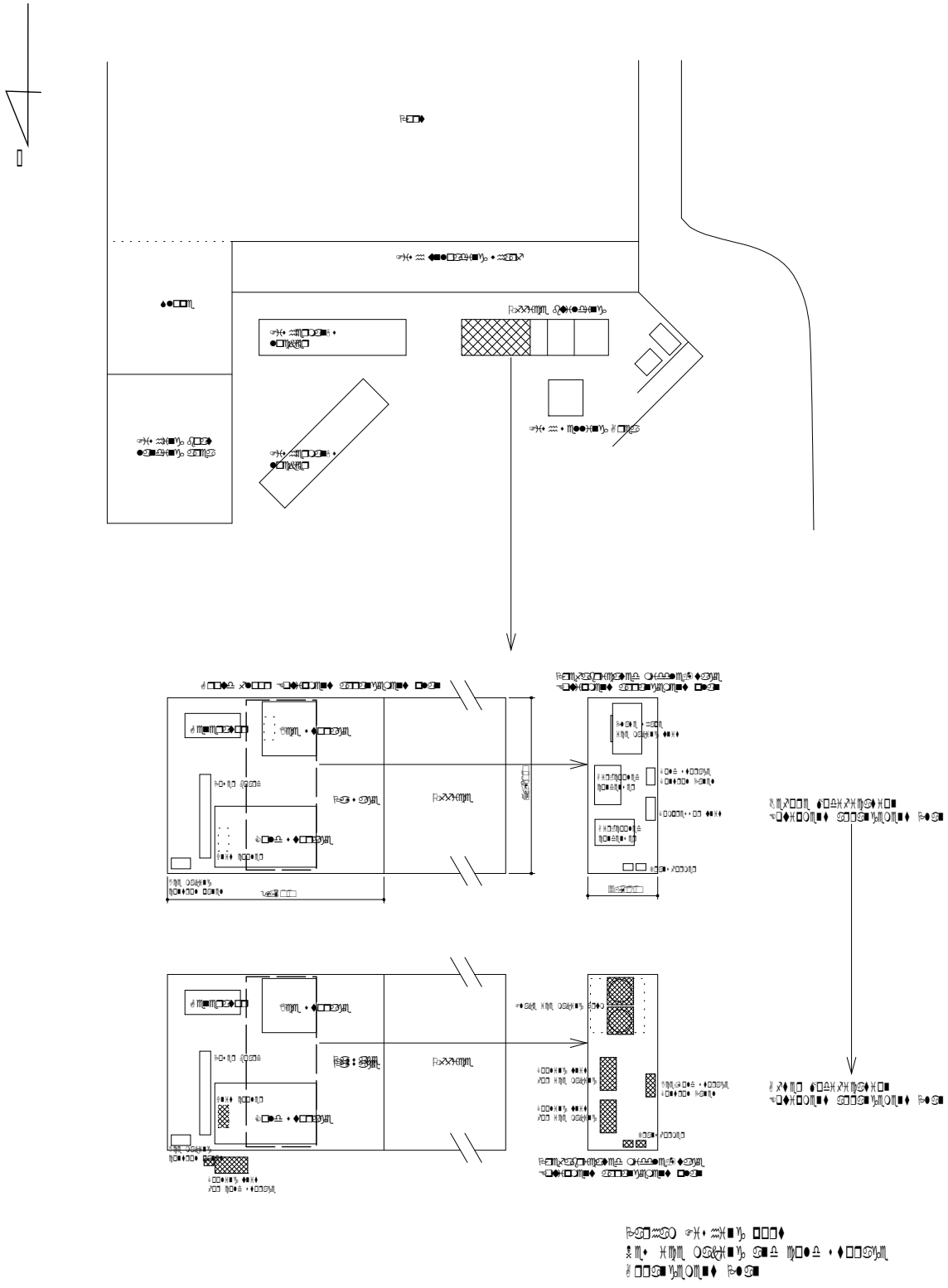


Figure 7: Refrigeration facilities at Parham Fishing Port

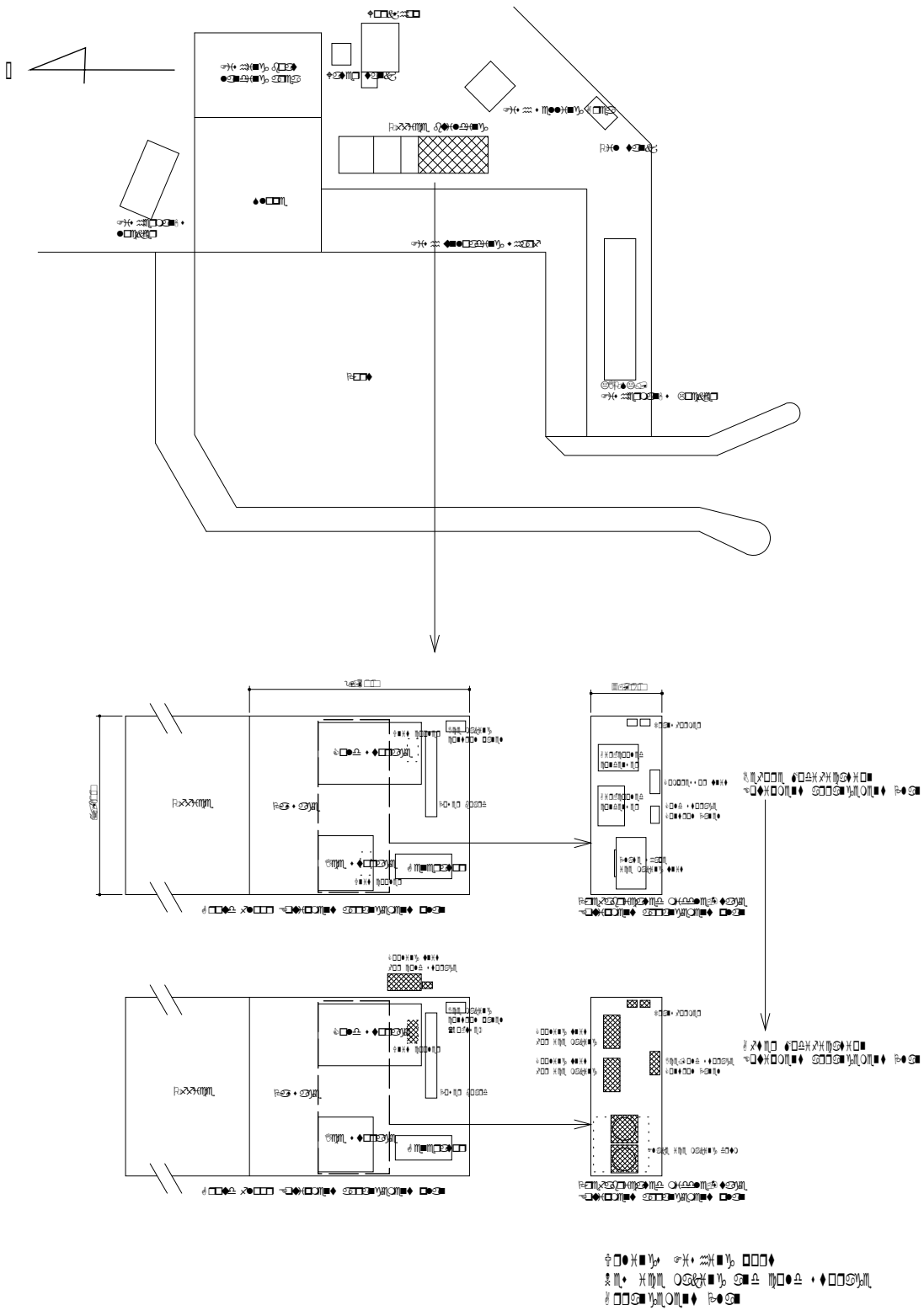


Figure 8: Refrigeration facilities at Urlings Fishing Port

(2) Surveillance radar system

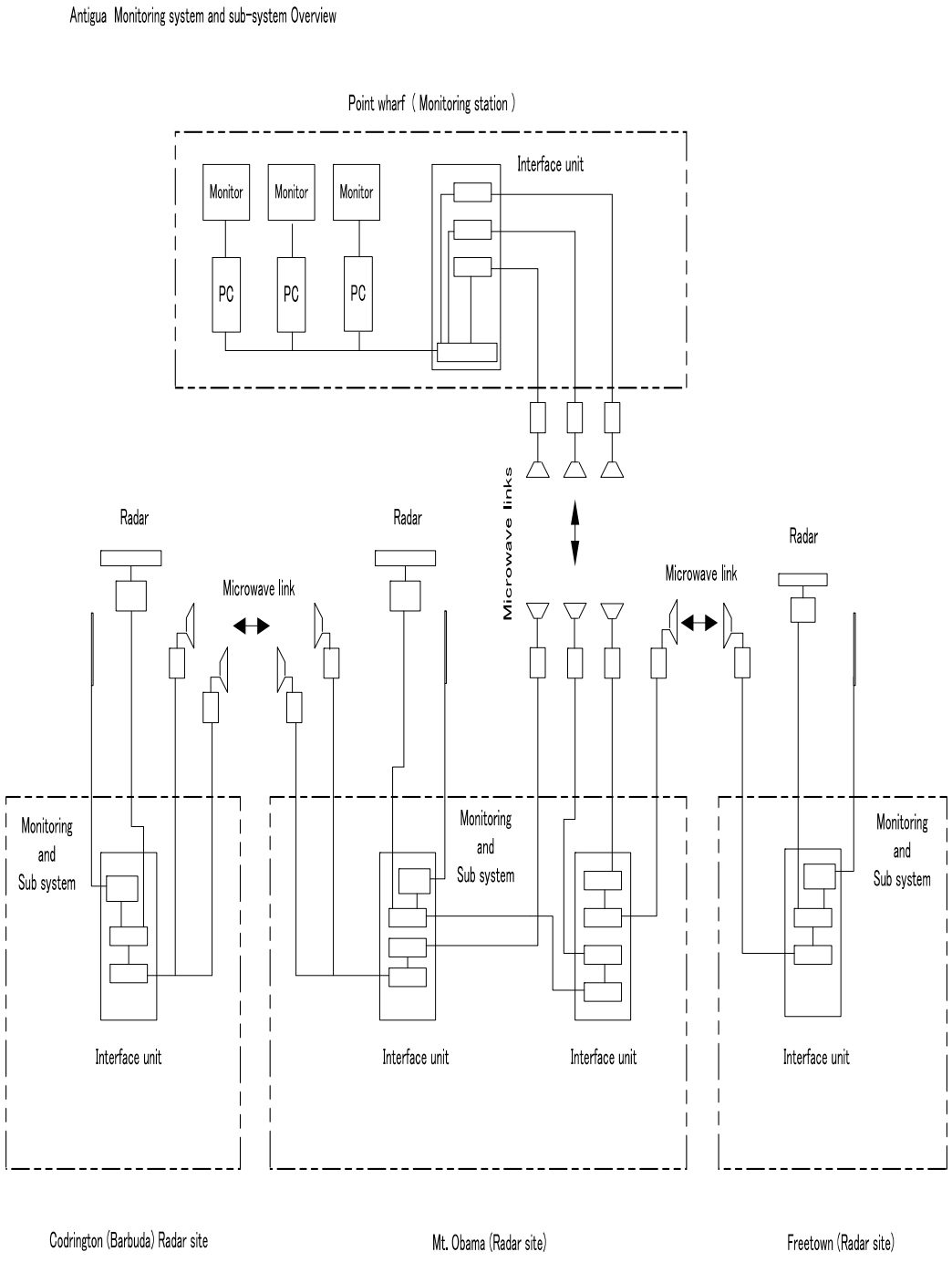


Figure 9: Surveillance radar system and network

Mt. Obama Radar site image

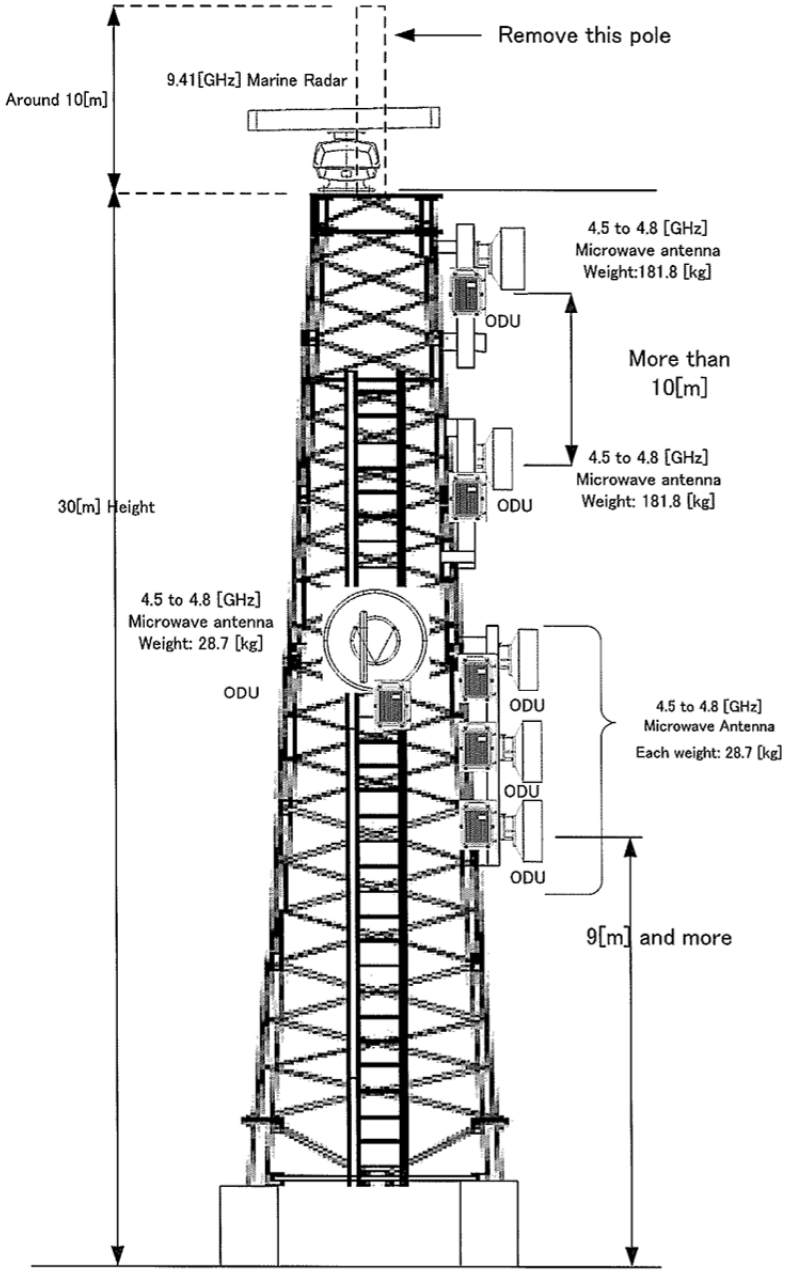


Figure 10: Image of radar installation to the existing tower (Mt. Obama)

Freetown Radar site image

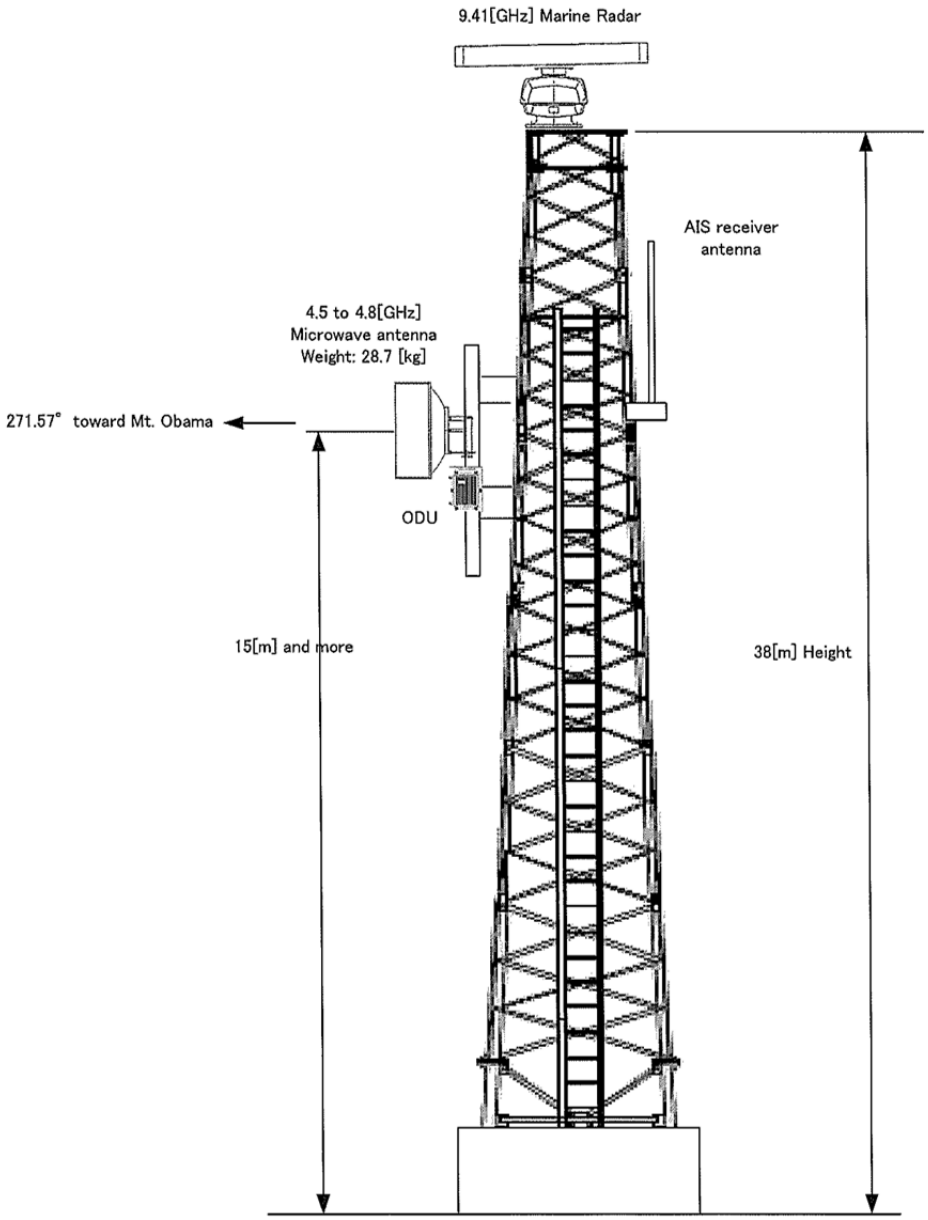


Figure 11: Image of radar installation to the existing tower (Freetown)

Codrington Radar site image

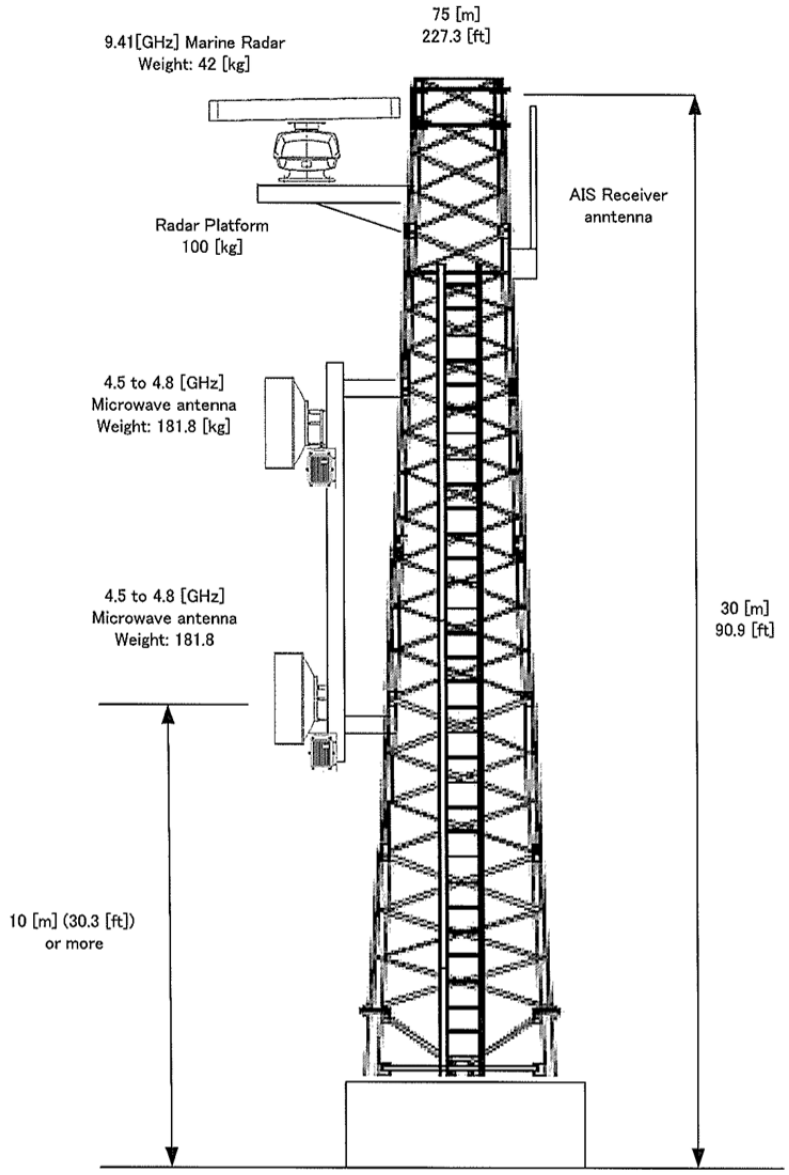


Figure 12: Image of radar installation to the existing tower (Codrington)

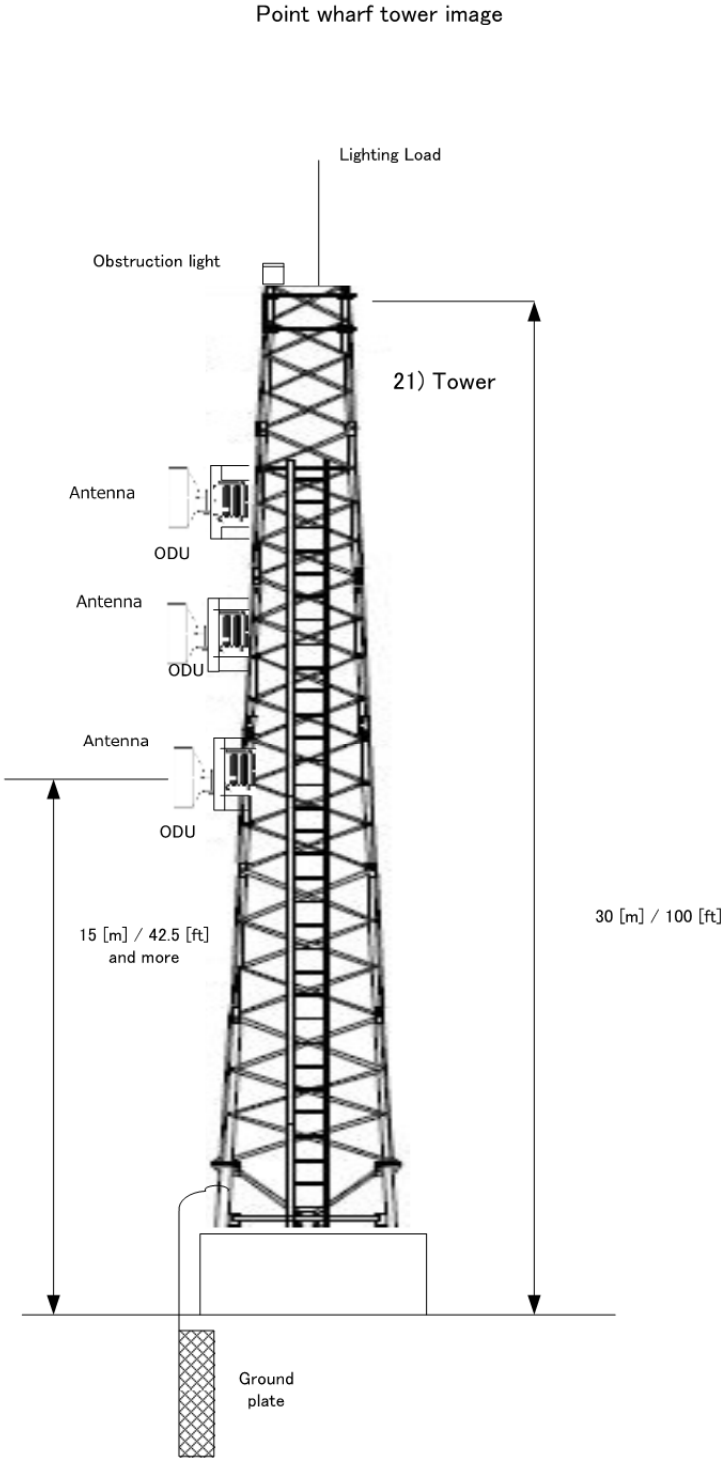


Figure 13: Image of microwave antenna installation to new tower (Point Wharf)

(3) Submerged-type fish aggregating devices

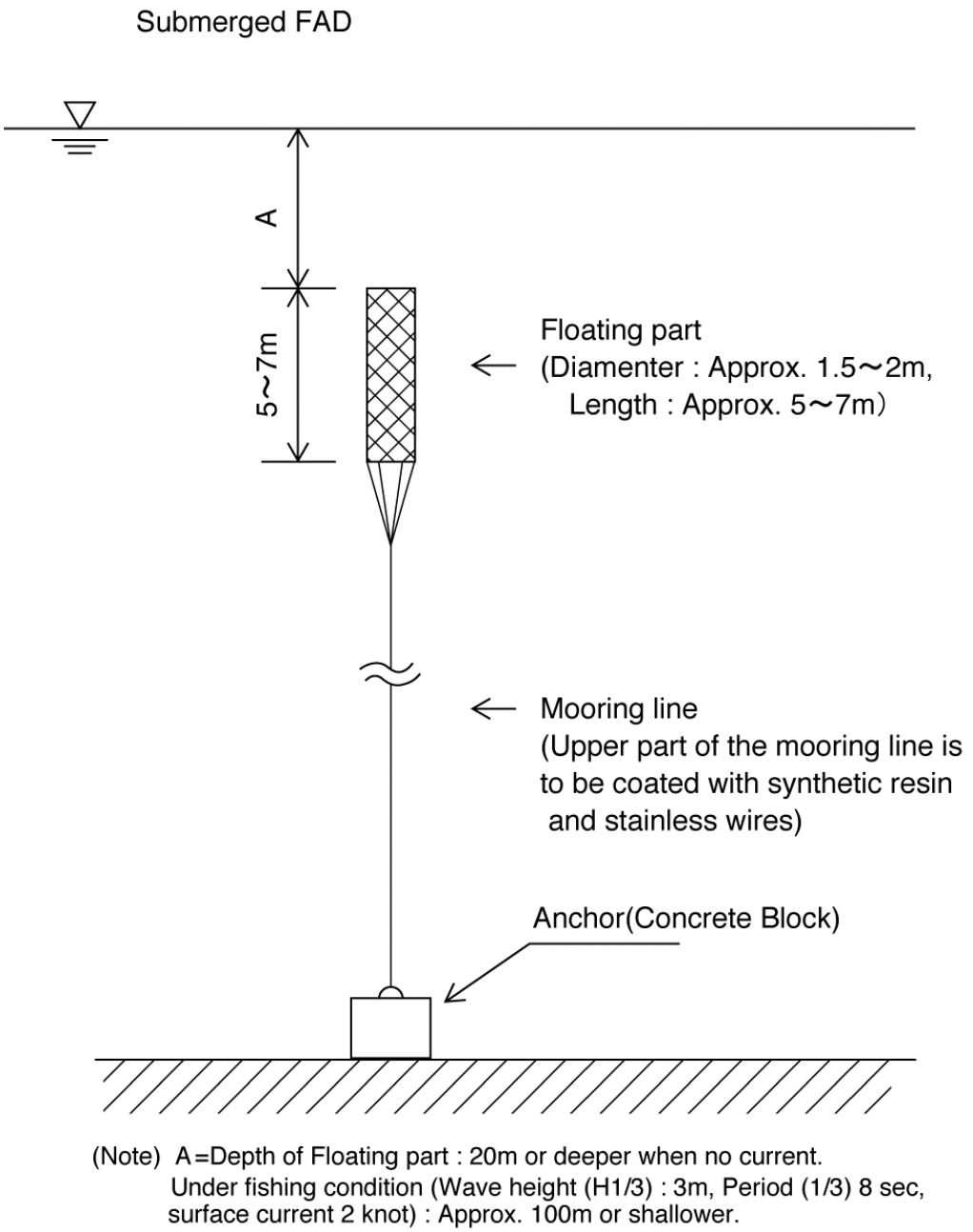


Figure 14: Submerged-type fish aggregating device schematic

(4) Multipurpose boat

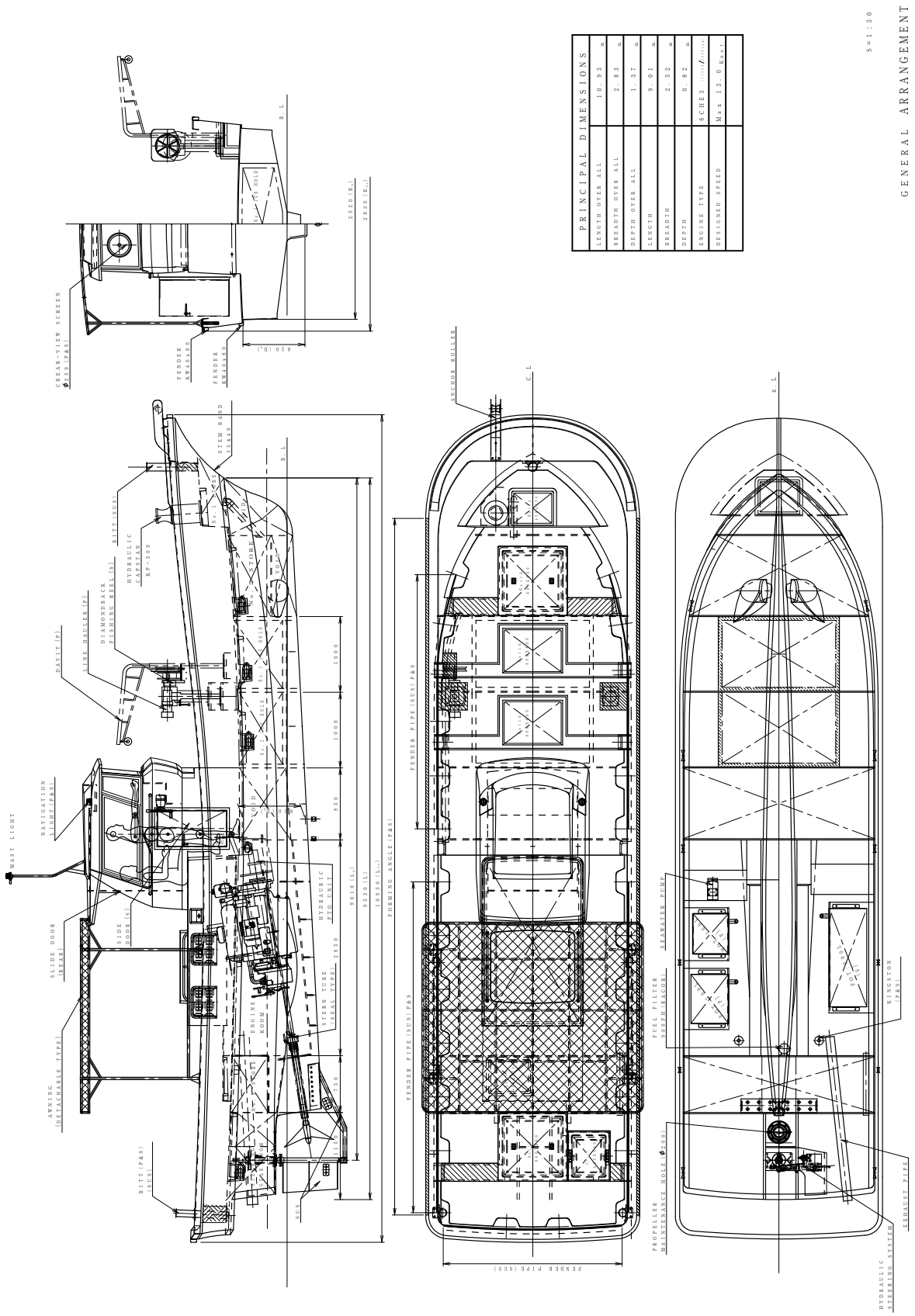


Figure 15: General arrangement plan of the multipurpose boat

2-2-4. Implementation Plan

2-2-4-1. Implementation Policy

(1) Refrigeration facilities

a) Given that replacement devices will be brought in for existing facilities and be installed together with plumbing work, it is preferable to use the same devices as the existing devices wherever possible for this Project. In addition, due to a lack of devices from manufacturers who maintain local agencies, Japanese products having the same structure and component composition as existing devices will be procured whenever possible.

b) Selection of device specifications and device procurement will be made so as to ensure that the capacitance of newly introduced devices does not increase.

c) Consideration must be given to seawater salt damage, as the installation locations will be near the coastline. Stainless steel products and products treated with salt-resistant coatings will be procured to minimize damage to materials.

(2) Radar / radio

a) Stable operation will be assured for the network system.

b) The devices will have the performance and functionality required to meet the objectives.

c) A highly reliable network system will be selected.

d) The network system will be built to endure long-term operation.

e) Consideration will be given to installation that facilitates maintenance.

(3) Multipurpose boat

a) This boat shall comply with Japan's safety regulations for small craft. The boat will be made by a Japanese builder of FRP fishing boats with many years of actual experience designing and manufacturing boats having the same size and equipment as the planned boat.

b) Blueprints will be inspected and approved beforehand, and inspections during the boat's construction will be conducted as needed. Upon completion, the boat and fishing equipment will be tested at sea to verify performance.

c) The boat size will be as small as possible. Equipment shall be kept to a minimum and be easy-to-handle. Necessary instructions and manuals for the equipment will be provided in English.

d) A technician from the shipbuilder will be dispatched to Antigua and Barbuda to check the boat and engine before it is transferred, ensure that all equipment is in working order, conduct at-sea operation of the vessel and fishing equipment with Fisheries Division staff, and provide explanations and guidance concerning the equipment to Fisheries Division staff.

e) As for sea transportation from Japan, due to the dimensions and shape of the boat, it cannot be loaded in a standard container. Thus, from an early stage, it will be necessary to secure a means of transport. This should include searching for a mixed-load carrier or other vessel traveling to the Caribbean Sea, with the possibility of transferring cargo along the way taken into account.

(4) Submerged-type fish aggregating device

a) A manufacturer possessing specialized technical knowledge for the design, manufacture, and installation of submerged-type FADs and having long and abundant actual experience with them will be selected.

b) FADs will be installed based on instructions provided by technicians to be dispatched by the manufacturer. Installation based on the technicians' instructions will take place after the technicians make final confirmation of the installation location's depth through a sounding/sea bottom topography survey at the planned location, determine the tether length, and then tie the tether.

2-2-4-2. Implementation Conditions

(1) Refrigeration facilities

a) The new devices that will be installed on the second floor stage differ in basic shape from the existing ones, so measures must be taken to ensure that no problems arise during onsite installation.

b) The simple lift that will be used to load and unload machinery onto and off of the second floor stage must be adjusted to be able to sufficiently withstand said tasks and ensure no accidents occur.

c) During installation, full attention will be paid to connections to existing power sources and water intakes, and efforts will be made to ensure that there are no inconsistencies.

(2) Radar / radio

a) A comprehensive evaluation method will be established for the network system.

b) Efforts will be made to secure the blueprints, structural drawings, and other materials related to tower design for the existing towers.

c) Installation will be accurately conducted under the supervision of an expert.

(3) Multipurpose boat

a) Thorough safety measures will be taken when loading and offloading the boat, and the transport schedule will be carefully managed.

(4) Submerged-type fish aggregating devices

a) There are no sounding devices available in Antigua that are capable of sounding in deep water, and thus sounding equipment must be brought from Japan for the depth survey. The same is true for current measurement equipment.

b) Installation will require a barge crane to load and transport submerged-type FAD components as well as a tugboat, work-boat, and survey boat. All will be arranged for and prepared before the scheduled installation dates.

c) Consideration must be given to the arrangement of extra days for times when offshore work cannot proceed due to weather or ocean conditions.

2-2-4-3. Scope of Works

If this project is implemented based on grant aid from the Government of Japan, the scope of works will be as follows:

(1） Work undertaken by the Japanese side

a) Procurement, testing, transport, installation, trial operation, and acceptance inspection of equipment and machinery;
b) Provision of services connected with detailed design and procurement/installation supervision;
c) Handling of procedures and acquisition of permits and approvals that are associated with manufacturing on the Japanese side;
d) Procurement of other required ancillary equipment and machinery and ancillary work.

(5) Work undertaken by the Antiguan and Barbudan side

e) Securing of permits for the installation of VHF radio and microwave antennae on existing towers (Mt. Obama: LIME; Freetown: APUA; Barbuda: DIGICEL) and the undertaking of necessary electrification work;
f) Securing of a permit to build a steel tower at the radar monitoring control center (Point Wharf Fisheries Complex);
g) Securing of permits to use radar and radio frequencies;
h) Sharing of radar images with the Coast Guard (i.e., purchase and installation of equipment required to enable data sharing);
i) Disposal of equipment and machinery (industrial waste) after removal (The Japanese side will handle removal and transport to the designated site in the country)
j) Destruction of recovered refrigerant (Japan will handle recovery and transport to the designated site in the country):
k) Payment of electricity and water fees needed for the installation of refrigeration facilities.
l) Explanation to and securing of agreements from facility users

2-2-4-4. Consultant Supervision

Based on the content of the project's design, the consultant will conduct thorough examinations of the manufacturing details, details of device installation work, the work process plan, and the quality plan provided on the following page. The consultant will then engage in appropriate procurement management and installation management.

(1) Refrigeration facilities

The procurement of parts presents no particular problem, as they will be procured from Japan. However, given complaints from the recipient country that suppliers (including those in Japan) are unidentified, the consultant shall note suppliers' names as well as the addresses, telephone numbers, and e-mail addresses of the departments in charge in the Completion Report.

(2) Radar / radio

Keeping in mind the timing, procurement will be managed to allow the implementation of a preliminary system

test. Radar and radio will be managed as part of the network system.

(3) Multipurpose boat

As part of management duties in Japan, the consultant will inspect and approve drawings and conduct inspections during construction (inspection during hull lamination and installation of the main engine). The consultant will also be present during sea trials at the time of completion and verify the boat's performance. As part of onsite management, the consultant will check the boat's hull, machinery, and equipment; support preparations for sea trials; check boarding and operation of equipment for the sea trials; supervise and support guidance on equipment operation; and report to the Fisheries Division.

(4) Submerged-type fish aggregating devices

As part of management duties in Japan, the consultant will inspect and approve drawings and conduct an inspection at completion. In onsite management, the consultant will support the sounding/sea bottom topography surveys at the scheduled installation sites by the manufacturer's technicians and confirm sounding results, support installation work, confirm the completion of installation, and provide an explanatory report to the Fisheries Division.

2-2-4-5. Quality Control Plan

Full quality control will be practiced during the project in accordance with the following guidelines:

(1) Refrigeration facilities

a) The consultant will clearly note on tender documents not only numerical values for cooling capability, etc., that will provide technical justification in line with project plans but also but also standards for materials.
b) The inspection clearance forms will be submitted by manufacturers for all pressure devices for equipment.
c) The consultant will attend with a local mechanic attached to the Fisheries Division for pressure tests and performance tests conducted for refrigerant pipes that are characteristic of refrigeration equipment, to confirm that new equipment maintains the same level of performance as replaced equipment.

(2) Radar / radio

a) The consultant will confirm the performance of the equipment and system to the sake of quality assurance. To assure the quality of the network system, it will be temporarily assembled before installation to check its operation and performance. The data transmission software and surveillance software will also be checked to ensure operability.
b) To assure the quality of the radios, devices with an FCC ID (the American standard for radio equipment) or a CE mark (the European conformity standards for telecommunications equipment) will be used.
c) The materials for the new tower will be temporarily assembled before shipment.

(3) Multipurpose boat

The consultant will inspect drawings and conduct inspections while the boat is under construction, including inspections when the hull is laminated and the engine is installed. At completion, the consultant will also check fittings and attend an at-sea test to confirm vessel operation and performance and check the usability of the fishing

equipment.

(4) Submerged-type fish aggregating devices

The consultant will conduct documentary inspections and floating component inspections. The consultant will be present for the sounding/sea bottom topography surveys to take place during local installation, confirm the results of sounding, be present during installation work, and confirm completion of installation.

2-2-4-6. Procurement Plan

In general, equipment and machinery that can be easily repaired with locally available parts will be selected and procured. However, items for which there is no local agency or that have insufficient local availability will be procured from Japan or a third country. The source of procurement of major equipment are as shown below:

Table 25: Source of procurement of major equipment

Name of equipment	Source of procurement		
	Local	Japan	Third Country
Refrigeration facilities		○	
Air-conditioning facilities	○		
Water supply facilities		○	
Submerged-type FADs	○	○	
Multipurpose boat		○	
Surveillance radar system		○	
VHF radio system		○	○
Insulated truck		○	○

(1) Refrigeration facilities

Since the Fisheries Division has already been purchasing and replacing the parts by procuring directly from Japan if necessary, it is enough to include spare parts for 1 year as standard accessories of manufacturers.

(2) Radar / radio

Spare parts for surveillance radar system and VHF radio are not required. It is necessary to replace a magnetron and a motor brush inside the radar unit once every 1 – 2 years, but it will be possible to procure and replace through a local agency. Actual work for replacement of these parts will be able to be done by the mechanics of the Fisheries Division if initial operational guidance is provided by the manufacturer.

(3) Multipurpose boat

Spare parts for the main engine will be procured. Under the Operational Plan for the boat, it will be operated for approximately 1,000 hours per year. Therefore, standard spare parts required for 3,000 hours (three years) of operation will be procured.

(4) Submerged-type fish aggregating devices

Equipment and materials to be used in the project will be manufactured to have 10-year durability. Accordingly, no replacement parts will be needed. In actuality, the FADs will be unserviceable once they are installed.

2-2-4-7. Operational Guidance Plan

(1) Refrigeration facilities

a) Because equipment that is very close to the existing devices will be used, no particular problems will exist in terms of operational management. However, guidance will be provided to ensure that the particulars and instruction manuals of the new equipment are closely followed.

b) In particular, explanations and guidance will be provided with sufficient time given to restoration methods in response to emergency shutdowns that could occur during water or power supply outages.

c) Operations logs provide the only source of evidence that can be used to ascertain events leading up to accidents. Therefore, thorough guidance on the method for keeping such logs will be provided, as will guidance that will give workers skills for remaining vigilant against accidents.

(2) Radar / radio

Once the radar surveillance system is installed, the operators will need to become proficient in the initial operation of the software. The Government of Antigua and Barbuda will select operators, and a technician from the manufacturer will be dispatched to provide training upon installation.

Since the surveillance radar system will be merged with the AIS system, training for the initial operation of both systems will be provided simultaneously. Concrete items for which guidance will be provided include surveillance monitor operation, radar magnetron maintenance, operation of AIS transponder, microwave antenna inspection and maintenance, system inspection and maintenance, and inspection and maintenance record-keeping.

Regarding the VHF radio to be installed in Parham, there will be no operational issues as long as guidance is provided on the initial operation upon the completion of installation. VHF operators will be required to keep logs. It is recommended that operators fully understand the principles of how the equipment functions before operating the system and that the engineer from the manufacturer be involved in the formulation of the Operational Plan.

(3) Multipurpose boat

The technician dispatched from the manufacturer will check the hull, engine and equipment, and during the at-sea test, provide explanations and initial operational guidance to the Fisheries Division staff. In addition, he will provide guidance to ensure that Fisheries Division staff become proficient in operating the main engine, fishing equipment and navigational gauges.

(4) Submerged-type fish aggregating device

No specific operational guidance is required.

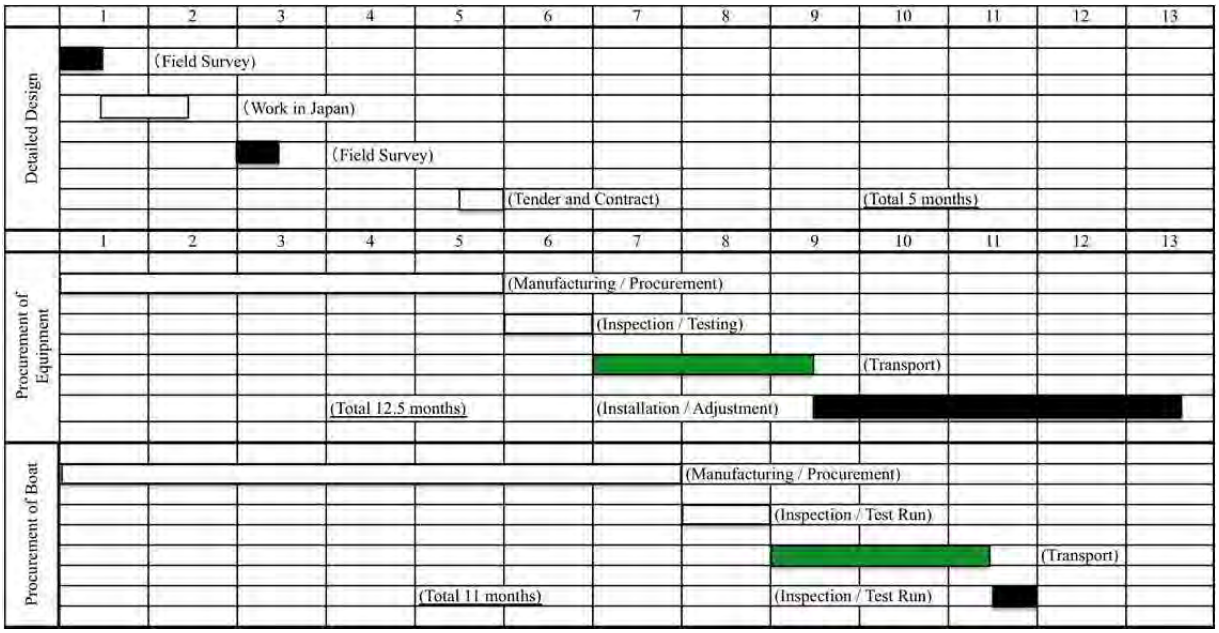
2-2-4-8. Soft Component (Technical Assistance) Plan

No “soft component” will be executed by the consultant. However, the manufacturer of the surveillance radar system will provide technical assistance (including the development of a data processing system) for one month. Because the Fisheries Division has experience using similar equipment and machinery, simply having each manufacturer provide initial operating instructions will present no problems in terms of operation and maintenance.

2-2-4-9. Implementation Schedule

The project will require five months for the implementation design and 12.5 months for procurement of equipment and machinery. The work implementation schedule will be as shown in the following table.

Table 26: Work implementation schedule



2-3. Obligations of Recipient Country

The recipient country will be responsible for the following items. The execution of these items should present no problems for Antigua and Barbuda in terms of the capabilities of its Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs (responsible agency) and Fisheries Division (implementing agency).

Recipient country responsibilities	Implementation period
a) Import clearance procedures for project equipment and machinery into Antigua and Barbuda and exemption from import duties	Before equipment and machinery arrive at the port
b) Tax exemption measures for project equipment and machinery to be procured in Antigua and Barbuda	Before equipment and machinery are procured in-country
c) Acquisition and provision of places for installation of project equipment and machinery • Places for installing refrigeration facilities (inside existing fisheries complexes) • Places for installing surveillance radars and ancillary equipment to existing towers • Preparation of a surveillance radar monitoring room (inside Fisheries Division office in Point Wharf) • Installation site for new tower (Point Wharf) • Safe storage space for the multipurpose boat	Before equipment and machinery are installed in-country
d) Procedures required for installation of project equipment and machinery; submission of applications for approvals and permits and acquirement of permits • Permits for shared use of existing towers (Mt. Obama, Freetown, Codrington); • Construction permit for the new tower (Point Wharf) • Permits to use radio frequencies (for radar, microwave and VHF radios)	Before public announcement of bids for equipment and machinery
e) Registration of multipurpose boat and insulated truck	At the time of equipment and machinery delivery
f) Development of the environment at places for installation of project equipment and machinery • Supply of water and electricity to refrigeration facilities • Supply of electricity to surveillance radars and sites	At the time of equipment and machinery installation
g) Sharing of radar images with the Coast Guard • Purchase and installation of equipment required to enable data sharing (Coast Guard) • Provision of a fiber optic network connection between the Fisheries Division and the Coast Guard	Before inspection and transfer of equipment and machinery
h) Facilitate the procurement of portable AIS transponders for fishing boats (x400) 100 in the initial year and 100 per year for the next three years	Before inspection and transfer of equipment and machinery
i) Disposal of equipment and machinery (industrial waste) after removal (The Japanese side will handle removal and transport to the designated site in the country)	In accordance with recipient government standards
j) Destruction of recovered refrigerant (Japan will handle recovery and transport to the designated site in the country):	In accordance with recipient government standards
k) Explanation to and securing of agreements from facility users	Before public announcement of bids for equipment and machinery
l) Provision of permit for installation of submerged-type FADs	Before public announcement of bids for equipment and machinery

2-4. Project Operation Plan

In general, the Fisheries Division will handle the operation and maintenance of equipment and machinery after completion of the project. However, the equipment and machinery to be installed at the Market Wharf Fisheries Complex will be managed and maintained by Antigua Fisheries Limited (AFL). The Fisheries Division and AFL will be able to sufficiently operate and maintain equipment installed under this project with their existing staff, so no additional employees will need to be hired. The following figure outlines the framework for the operation and maintenance of the various equipment.

Table 27: Operation and maintenance of equipment provided under this project

Component	Site	Equipment/machinery	Operations	Maintenance
Refrigeration facilities	Market Wharf	Ice plant, cold storage, insulated truck	AFL	AFL (outsourced)
	Parham	Ice plant, insulated truck	Parham Fishing Port	Fisheries Division (1 freezer repair technician)
	Urlings	Ice plant, insulated truck	Urlings Fishing Port	Same as above
	Point Wharf	Air conditioning equipment	Fisheries Division	Same as above
Water supply system	Market Wharf	Reservoir tank, pump	AFL	AFL
	Urlings	Feed pump	Urlings Fishing Port	Fisheries Division
	Point Wharf	Reservoir tank, pump	Fisheries Division	Fisheries Division
Submerged-type FADs	Caribbean Sea-side, Atlantic Ocean-side		(with fishermen)	(with fishermen)
Multipurpose boat	Point Wharf		Fisheries Division (3 boat operators)	Fisheries Division (2 engine repair technicians)
Surveillance radar system	Point Wharf, Mt. Obama, Freetown, Codrington		Fisheries Division (in cooperation with Coast Guard)	(same as left)
VHF radio station	Parham		Parham Fishing Port	(same as left)

2-5. Project Cost Estimation

2-5-1. Initial Cost Estimation

(1) Expenses borne by the Government of Antigua and Barbuda: EC$97,000 (approx. ¥3.7 million)

a) Electrification to radar installation sites (4 sites): EC$20,000

b) Purchase of PCs (3 PCs) needed for sharing of radar images (for the Coast Guard): EC$15,000

c) Commission charge for issuance of the Authorization to Pay (A/P): EC$62,000

(2) Conditions for estimation

a) Time of estimate: August 2014

b) Exchange rates: US$1 ＝¥102.87
EC$1＝¥38.26

c) Procurement period: Detailed designs and equipment procurement periods are as noted in the Implementation Schedule.

d) Other matters: Estimation shall be conducted based on the Grant Aid Cooperation scheme of the Government of Japan

2-5-2. Operation and Maintenance Costs

(1) Refrigeration facilities

a) Market Wharf (4.5 ton/day ice plant x 2; cold storage x 1)

Item	Breakdown	Annual estimated cost (EC$)
Electricity	Electricity charges: Electric power consumption: Ice plants (25 kW) x 2, cold storage (8.0 kW) x 1 Ice plant operation time: 24 hours; actual cold storage operating time: 16 hours (25 x 2) 24 hr/day x 30 days = 36,000 kWh, 8 x 16 hrs x 30 days = 3,840 kWh; total: 39,840 kWh Electricity charges: Basic charge: EC$45; contract capacity charge: EC$8/kVA (70 kVA＝EC$560) Usage fee: EC$0.45/kWh (up to 100 kWh), EC$0.42/kWh (100-200 kW), EC$0.38/kWh (200 kWh or more) Total monthly payment: 45 + 560 + (100 x 0.45 + 100 x 0.42 + (39,840-200) x 0.38) = EC$15,755.20	189,062
Water	Water consumption: (4,500 x 1.05) x 2/day x 30 days = 283,500 L, 283,500/4.5 = 63,000 gallons Water charges: Meter use charge: EC$1; basic charge: EC$50; usage fee: EC$50/1,000 gallons Total monthly payment: 1+50+ (50 x 63,000/1,000)＝EC$3,201	38,412
Maintenance expenses	Annual maintenance expenses: 300/month x 12 = EC$3,600 Fund to cover major repair costs every five years (yearly): 300/months x 12 = EC$3,600	7,200
Total		234,674

b) Urlings (One ton/day ice plant x 2; cold storage x 1)

Item	Breakdown	Annual estimated cost (EC$)
Electricity	Electric power consumption: Ice plants (5.0 kW) x 2, cold storage (5.0 kW) x 1 Ice plant operation time: 24 hours; actual cold storage operating time: 16 hours (5x2) 24 hr/day x 30 days = 7,200 kWh, 5x16 hr x 30 day s= 2,400 kWh; total: 9,600 kWh Electricity charges: Basic charges: EC$45; contract capacity fee: EC$8/? KVA(20 kVA ＝EC$160) Usage fee: EC$0.45/kWh (up to 100 kWh),	46,368

	EC$0.42/kWh (100-200 kW), EC$0.38/kWh (200 kWh or more) Total monthly payment: 45 + 160 + 100 x 0.45 + 100 x 0.42 + (9,600 - 200) x 0.38= EC$3,864	
Water	Water charges: Water usage fees: (1,000 x 1.05) x 2/day x 30 days = 63,000 L; 63,000/4.5 = 14,000 gallons Meter fees: EC$1; basic charges: EC$50; usage fees; EC$50/gallon Total monthly payment 1+50+(50/1,000 x 14,000) = EC$751	9,012
Maintenance expenses	Annual maintenance expenses: 100/month x 12 = EC$1,200 Five-year large-scale repair fund (yearly): 200/months x 12 = EC$2,400	3,600
Total		58,980

c) Parham (One ton/day ice plant x 2; cold storage x 1)

Item	Breakdown	Annual estimated cost (EC$)
Electricity	Electric power consumption: Ice plants (5.0 kW) x 2, cold storage (5.0 kW) x 1 Ice plant operation time: 24 hours; actual cold storage operating time: 16 hours (5x2) 24 hr/day x 30 days = 7,200 kWh, 5x16 hrs x 30 days = 2,400 kWh; total: 9,600 kWh Electricity charges: Basic charges: EC$45; contract capacity fee: EC$8/kVA (20kVA＝EC$160) Usage fee: EC$0.45/kWh (up to 100 kWh), EC$0.42/kWh (100~200 kW), EC$0.38/kWh (200 kWh or more) Total monthly payment: 45 + 160 + (100 x 0.45 + 100 x 0.42 + (9,600 - 200) x 0.38) = EC$3,864	46,368
Water	Water consumption: (1,000 x 1.05) x 2/day x 30 days = 63,000 L; 63,000/4.5 = 14,000 gallons Water charges: = EC$850/month Meter use charge: EC$1; basic charge: EC$50; usage fee: EC$50/1,000 gallons Total monthly payment: 1+50+ (50 /1,000)＝EC$751	9,012
Maintenance expenses	Annual maintenance expenses: 100/month x 12 = EC$1,200 Five-year large-scale repair fund (yearly): 200/months x 12 = EC$2,400	3,600
Total		58,980

d) Point Wharf (Air conditioning equipment)

Item	Breakdown	Annual estimated cost (EC$)
Electricity	Electric power consumption: A/C 0.55 kW x 5 units, 0.75 kW x 1 unit, 1.5 kW x 1 unit, 2.2 kW x 2 units, 3 kW x 6 units, 4.5 kW x 4 units Operation time: 8 hours / day x 20 days per month 45.4kW x 8 hours x 20 days = 7,264 kWh Electricity charges: Basic charges: EC$45; contract capacity fee: EC$8/kVA(20 kVA＝EC$160) Usage fee: EC$0.45/kWh (up to 100 kWh), EC$0.42/kWh (100~200 kW), EC$0.38/kWh (200 kWh or more) Total monthly payment: 45 + 160 + 100 x 0.45 + 100 x 0.42 + (7,264 - 200) x 0.38) = EC$2,816	33,792
Maintenance expenses	Annual maintenance expenses: 50/month x 12 = EC$600 Fund to cover major repair costs every five years (yearly): 100/month x 12 = EC$1,200	1,800
Total		35,592

(2) Surveillance radar

Item	Breakdown	Annual estimated cost (EC$)
Electricity	Electric power consumption: Codrington: Radar 300W, microwave 200W Mt. Obama: Radar 300W, microwave 650W Freetown: Radar 300W, microwave 100W Point Wharf: Microwave 300W, PC monitors 450W Monthly electricity charges: Codrington: Basic charges: 45 + contract capacity fee: 120 + usage fee: 136.80 = EC$301.80 Mt. Obama: Basic charges: 45 + contract capacity fee: 120 + usage fee: 246.24 = EC$411.24 Freetown: Basic charges: 45 + contract capacity fee: 120 + usage fee: 109.44 = EC$274.44 Point Wharf: Basic charges: 45 + contract capacity fee: 120 + usage fee: 205.20 = EC$370.20 Total: EC$1,357.68 / month (24 hours x 30 days per month)	16,292
Maintenance expenses	Magnetron replacement (once every two years) \150,000 x 3 / 2 years (EC$12,000/ 2 years)	6,000
Total		22,292

(3) Multipurpose boat

Direct expenses (i.e., fuel, ice, bait and fishing gear) for 124 days of operation per year are estimated to cost EC$127,758, of which EC$54,880 will be for fuel. Since the main engine will not need to be overhauled for three to four years, repairs will be limited to filter, oil, and belt changes, resulting in an annual cost of approximately EC$3,000.

	Breakdown	Annual cost (EC$)
a) At-sea fisherman training	Fuel cost: EC$2,195/session x 6 per year (= 659 L of diesel fuel/session)	13,170
	Ice cost: EC$1,325/session x 6 per year (=3,000 kg of ice/ session)	7,950
	Fishing gear cost: EC$300/session x 6 per year	1,800
b) Pot fishing tests		
1) Reef fish	Fuel cost: EC$802/test x 20 per year (240 L for each two-day session)	16,040
	Ice cost: EC$1,766/test x 20 per year (2,000 kg for each two-day session)	35,320
	Bait cost: EC$280/test x 20 per year (20 kg for each two-day session)	5,600
	Fishing gear cost: EC$300/session x 20 per year	6,000
2) Lobster	Fuel cost: EC$802/test x 10 per year (240 L for each two-day session)	8,020
	Bait cost: EC$140/test x 10 per year (10 kg for each two-day session)	1,400
	Fishing gear cost: EC$300/session x 10 per year	3,000
c)FAD-related		
1) Installation	Fuel cost: EC$1,027/trip (Caribbean Sea and Atlantic Ocean) x 5 (= 308 L of diesel fuel per trip	5,134
2) Monitoring	Fuel cost: EC$1,043/trip (two days) x 12 per year	12,516
	Ice cost: EC$884/trip (two days) x 12 per year	10,608
	Fishing gear cost: EC$100/trip (two days) x 12 per year	1,200
Maintenance	Replacement of filters, oil change, replacement of belts	3,000
Total		130,758

Note: Operational expenses do not include personnel expenses.

(4) Submerged-type fish aggregating devices

The main components of the submerged-type FADs will not require maintenance expenditures. If a marking buoy is attached to the floating component due to the need to improve convenience in fishing boat operation and aid fishery management, maintenance expenditure must include funding for replacement of buoys that are lost. Based on the frequency of past losses of floating-type FADs, it is assumed that a buoy will need to be replaced every three months, which will generate a yearly cost of EC$2,800 per unit (EC$5,600 for 2 units of FADs). However, replacement and maintenance will be handled by the fishing boats that engage in FAD fishery, and therefore no fuel expenditure will be required.

The Fisheries Division will procure cylindrical reflectors, battery-powered flashing lights, floats, and other buoy parts, and using fishermen will assemble them. One buoy set will cost approximately EC$600. When multiplied by four times per year, the cost will come to EC$2,400. On top of this, the replacement of batteries every two weeks will cost EC$400 annually. It should be noted that solar batteries become damaged when a marking buoy becomes submerged. For this reason, the above calculation assumes the use of batteries (automatic flashing day and night) with a certain degree of water pressure resistance (around 50 to 80 m).

Chapter 3: Project Evaluation

3-1. Preconditions

The preconditions for the implementation of this project, which include the customs clearance and tax exemption measures to be enacted by the Government of Antigua and Barbuda, are outlined below.

(1) Ice plants and water supply facilities
   a) Securing of sites for the disposal and processing of equipment and machinery
   b) Acquisition of sites for the appropriate management and processing of recovered refrigerants

(2) Submerged-type fish aggregating devices
   a) Issuance of permits for the installation of submerged-type FADs in the planned areas

(3) Multipurpose boat
   (2) Securing of safe storage space for the multipurpose boat

(4) Surveillance radar system / VHF radio system
   a) Construction permit for the new tower (Point Wharf)
   b) Permits for the installation of equipment at existing towers (Freetown, Mt. Obama and Codrington)
   c) Permits to use radio frequencies for radar and microwave antennae
   d) Holding of public hearings with local residents and securing their approval for the installation of equipment

3-2. Necessary Inputs by Recipient Country

The necessary inputs of the Government of Antigua and Barbuda to achieve and sustain the effectiveness of this project are outlined below.

(1) Ice plants and water supply facilities
   a) Assignment of a dedicated freezer repair technician (Point Wharf)
   b) Securing of budget funds for electricity, spare parts purchases etc.

(2) Submerged-type fish aggregating devices
   a) Continuous implementation of fisherman training for FAD fishing
   b) Re-installation of FAD site marking buoys (if they are washed away)

(3) Multipurpose boat
   a) Assignment of dedicated crew (boat operator and engine repair technicians)
   b) Securing of budget funds for fuel and boat maintenance and repair

(4) Surveillance radar system
   a) Procurement and distribution of AIS transponders to registered fishing vessels
   b) Installation of equipment at the Coast Guard and establishment of fiber-optic internet connection with the Fisheries Division
   c) 24-hour surveillance of radar monitors by the Coast Guard
   d) Assignment of a fishery surveillance officer (radar operator) at the Fisheries Divisions and analysis of collected data

3-3. Important Assumptions

The assumptions that must be made in order to achieve and sustain the effectiveness of this project are outlined below.

a) Wind, waves and currents exceeding the design conditions (i.e., historic maximum values recorded within the past 30 years) will not occur.
b) Fishing grounds will not move and fishery resources will not decline due to climate change or other impacts.
c) The number of fishermen and fishing vessels will not drastically decline due to socio-economic changes.
d) The budget of the Fisheries Division will not be drastically cut due to the deterioration of national finances.

3-4. Project Evaluation

3-4-1. Relevance

The *Fisheries Development Strategy 2011 – 2015*, the country's 5-year development plan gave the objectives such as the utilization of unused fishery resources, the infrastructure development, and the improvement of data collection and fishery information system. Based on the Castries Declaration (2010) on eradication of IUU fishing, the country formulated a new fisheries regulation in 2013 and has been tackling on strengthening of fishery management capabilities. The Project will contribute to realization of efficient fish distribution through the improvement of functions of fish distribution facilities (infrastructure), which were introduced by Japan's past grant aid cooperation, as well as to promotion of fisheries management through introduction of a surveillance radar system, a multipurpose boat and submerged-type fish aggregating devices (FAD), in conformity with the objectives set forth in the above national plan.

Since the Japan's Rolling Plan for Antigua and Barbuda adopted "fishery" as an important sector, "support to sustainable development of fisheries" as a development issue, and "programme for support to development of fisheries and fishing community" as a cooperation programme, the Project, which will contribute to sustainable development of fisheries, is conformed to Japan's policy of 'Official Development Assistance' (ODA).

Furthermore, Antigua and Barbuda has an important cooperative relation with Japan in fishery sector, so that the implementation of the Project is deemed as appropriate.

3-4-2. Effectiveness

(1) Quantitative effects

a) Ice sales

The ratio of actual ice sales to fish catch volumes (ice-to-fish ratio) over the past five years can be found in the table below. Although fish catch volumes are on the rise, ice sales have plateaued. As such, the ice-to-fish ratio continues to fall year-on-year. Since we cannot claim there to be a clear correlation among fish catch volume, ice sales and ice-to-fish ratio, it is not acceptable to use the ice-to-fish ratio as an impact indicator for ice plants. Therefore, ice sales will be applied as an indicator.

With this project, we anticipate ice sales in Market Wharf to improve to the same level as 2009 (approx. 1,400 tons/year) when the existing ice plant was in operation. In Parham, ice-making capacity will increase from 1.5 tons to 2 tons/day, so we expect ice sales to reach 1.3 times the 2012 sales mark (approx. 320 tons/year).
Ice-making capacity will increase from 1.5 tons to 2 tons/day in Urlings as well, but water quality issues required efforts to be expended on maintenance, thereby reducing the operating capacity of the existing ice plant. As such, the target for annual ice sales will be the same as that in Parham (approx. 320 tons/year). Therefore, the ice sales target for all three locations combined will be defined as at least 2,000 tons/year.
Baseline figure is set for 1,140 tons/year, which is an average ice sales volume during 3 years from 2010 to 2012.

	2009	2010	2011	2012	2013
Fish catch volume (tons/year)	2,490	2,293	3,192	5,696	N/D
Ice sales (tons/year)	(1,389)	(1,154)	(1,103)	(1,162)	(737)
・Market Wharf	1,389	1,154	918	924	509
・Parham	-	-	185	238	228
・Urlings	-	-	N/D	N/D	-
Ice-to-fish ratio (%)	55.8	50.3	34.6	20.4	-

b) Total number of vessels using FADs

The Fisheries Division has conducted FAD fishing training in the past and has already granted FAD fishing permits to 22 fishermen. The plan is to hold FAD training for 10 existing FAD fishermen and 20 new FAD fishermen (Total: 30 fishermen) each time a FAD is installed. This suggests that 60 FAD fishing permits (20 per year x 3 years) will be available.
FAD fishing vessels do not engage in FAD fishing every day, but they fish elsewhere, or fish both inside and outside the FADs, on some days depending on market demand, fishing ground condition and/or fish catch level. Since FADs are relatively new in Antigua and Barbuda, there is insufficient data on the frequency of FAD fishing vessel operations. Therefore, the frequencies of fishing around FADs are estimated based on the records in the Commonwealth of Dominica where data on FAD fishery is relatively accumulated. According to the records in the Commonwealth of Dominica, 178 FAD fishing vessels made 1,741 trips to FADS in 2013. This record shows that each vessel took 9.8 trips of FAD fishing per year. Referring this record, assumed that each fishing vessel who get license for FAD fishery in Antigua and Barbuda will take at least 9 trips per year to the fishing grounds formulated by the project submerged FADs, then it is expected that the target for the total annual number of vessels using FADs can be defined as at least 700[6].
In connection with the activities of CARIFICO, the Fisheries Division is currently guiding to all the licensed fishing vessels for FAD fishery to keep record on a log book, so that the frequencies using FADs by each vessel will be able to obtained from these log books at the time of 3 years after completion of the Project.

[6] No. of fishing vessels with a license for FAD fishery at the time of 3 years after the completion of the Project: 82 vessels (22 currently registered vessels + 60 new vessels) x 9 trips/year = 738 vessel-time.

c) Multipurpose boat operating days

The adoption of a multipurpose boat will enable the effective operation of at-sea training for the BFTC special course, FAD installation and monitoring, and trial pot fishing (for reef fish and lobsters). The target for total annual days of operation shall be set at 140 days: 36 days for at-sea training, 44 days for FAD installation and monitoring, and 60 days for trial pot fishing.

d) Surveillance radar operating days and number of illegal vessel detections

After the installation of the surveillance radar, the system is scheduled to operate for 350 days a year, excluding 15 days for maintenance and inspection. Once the surveillance radar system is in place, it will be possible to make assumptions as to whether a vessel is a illegal vessel based on the activity patterns on the radar screen. When vessels enter territorial waters from the direction of neighboring countries, such as Guadeloupe and St. Martin, and leave in the same direction they came from, they can be assumed to be engaged in illegal fishing. Given this, the number of illegal vessel detections will be defined as an impact indicator. If the number of vessels entering and exiting from certain directions is input into the system as a parameter, they can be counted automatically, and the system can sound alarms at the same time.

In 2011, the 379 fishing vessels in operation in Antigua and Barbuda caught 3,192 tons of fish (8.4 tons per vessel/year). Meanwhile, one report states that while 3,092 tons of domestic fish were caught in 2006, 1,992 tons were landed outside of the country by foreign fishing vessels engaged in illegal fishing. If we assume that each of these illegal foreign vessels caught the same amount of fish as domestic fishing vessels on average, this means that there were 237 (= 1,992 tons ÷ 8.4 tons) illegal fishing vessels in 2006. It can be assumed that same number of illegal vessels exist even now, since the strength of control of illegal vessels has not been drastically changed.

Given this, the target value for the number of illegal vessel detections will be set at 200 per year, by installation of surveillance radars in the Project. However, once the surveillance radar is installed and its existence becomes well known in neighboring countries, this could help prevent illegal fishing, so we believe that the number of illegal vessel detections will fall over the medium to long term.

Given this, the following have been defined as impact indicators for this project.

Indicator	Baseline (2014)	Target (2019)	Monitoring method
a) Annual ice sales	1,140 t	2,000t	Ice sales data (Fisheries Division, AFL)
b) Total number of fishing boats entered to the submerged-type FADs per annum	0	700 vessels	Data collected from FAD fishermen's log books (Fisheries Division)
c) Annual operating days of multipurpose boats	0	140 days	Multipurpose boat log book (Fisheries Division)
d) Total number of detections of the assumed illegal vessels per annum	0	200 times (There is a possibility that the number of illegal vessel detections may be lower than the target, by the effects of a deterrent through operation of surveillance radar.)	Radar operations log (Fisheries Division)
e) Annual operating days of surveillance radar	0	350 days	Radar operations log (Fisheries Division)

(2) Qualitative effects

The following is a list of the anticipated qualitative effects of this project.

- Improved freshness of fishery products and consumer satisfaction therewith due to upgrades to refrigeration facilities (as revealed by surveys).
- Spread of and enhanced understanding of managed fishery among fishermen due to the installation of submerged-type FADs (as revealed by interview surveys).
- Improved fishing technologies of the fishermen through fishermen’s training conducted by introducing a multipurpose boat.
- Ability to collect data on fishing efforts around the FADs (e.g., number of boats in operation and hours spent within the FADs) due to the new surveillance radar.

APPENDICES

Appendix 1. Member List of the Study Team

JICA

Name	Role	Organization	Field Survey
Mr. Yoshihisa MASANAGA	Team Leader	Deputy Director, Field Crop Based Farming Area Division, Rural Development Department, JICA	1st
Mr. Isao KOYA	Team Leader	Senior Advisor to the Director General, Rural Development Department, JICA	2nd
Mr. Hiroyuki TANAKA	Cooperation Plan	Advisor, Grant Aid Project Management Division 3, Financial Cooperation Implementation Department, JICA	2nd

Consultant

Name	Role	Organization	Field Survey
Mr. Hiroshi FUKAO	Chief Consultant / Operation and Management Plan	OAFIC Co., Ltd.	1st and 2nd
Mr. Junichiro MORI	Refrigeration Facilities Plan / Cost Estimate 1	OAFIC Co., Ltd.	1st
Mr. Kazumi IIDA	Fishery Related Equipment Plan / Environmental & Social Consideration / Cost Estimate 2	OAFIC Co., Ltd.	1st
Mr. Kazuo TAKEDA	Fishing Boat Surveillance Plan / Cost Estimate 3	OAFIC Co., Ltd.	1st

Appendix 2. Study Schedule

【1st Field Survey】

	Date		Activity (JICA)	Activity (Consultant)	
				Chief Consultant	Other members
1	7/21	Mon		15:05 Narita→14:49 New York (DL172)	
2	7/22	Tue	0:30 Haneda→17:55 Seattle 21:58→06:06 New York 08:55→13:09 Saint Maarten 16:00→16:40 Antigua (DL580/DL1542/DL461/ LI501)	07:00 New York→10:54 San Juan 14:40→16:05 Antigua (DL2365/LI563)	
3	7/23	Wed	Antigua Fisheries Division: Explanation of IC/R. Site survey.		
4	7/24	Thu	Site survey		
5	7/25	Fri	Discussion on scope of project. Signing on Minutes of Discussion.		
6	7/26	Sat	09:55 Antigua→ 10:25 St. Kitts (LI310)		
7	7/27	Sun	Rest		
8	7/28	Mon	St. Kitts Department of Marine Resources: Explanation of IC/R. Site survey.		
9	7/29	Tue	Discussion on scope of project. Signing on Minutes of Discussion. 21:50 St. Kitts → 22:20 Antigua (LI369)		15:05 Narita→14:49 New York (DL172)
10	7/30	Wed	06:00 Antigua →06:40 Dominica (LI361) Dominica Fisheries Division: Explanation of IC/R. Site survey.		07:00 New York→10:50 San Juan 14:20→16:05 Dominica (DL315 / LI565)
11	7/31	Thu	Site survey (Fond St. Jean、Morne Espanol、Marigot、Portsmouth)		
12	8/1	Fri	Discussion on scope of project. Signing on Minutes of Discussion.		Site survey (Roseau) on refrigeration facility, fishing boats/fishers, and rader sites.
13	8/2	Sat	Document Arrangement		
14	8/3	Sun	07:00 Dominica → 09:35 Port of Spain (LI361)	Rest	
15	8/4	Mon	10:30 Courtesy call to EOJ	National holidy in Dominica (August Monday)	
16	8/5	Tue	00:35 Port of Spain → 05:50 New York 09:40 → 12:46 Seattle 15:01 → (BW520/DL480/DL167)	Visit NTRC. Hearing to local construction companie. Refrigeration facitiies syrvey and stakeholders meeting (Marigot).	
17	8/6	Wed	16:55 Narita	Visit Coast Guard. Hearing to local construction companies. Stakeholders meeting (Roseau).	
18	8/7	Thu		Survey on radar sites (Fond St. Jean,Petit Savanne). Refrigeration facitiies syrvey and stakeholders meeting (Portsmouth).	
19	8/8	Fri		Wrap-up meeting at Dominica Fisheries Division and data collection. Courtesy call to the Minister.	
20	8/9	Sat		15:35 Dominica→16:15 Antigua (LI364)	
21	8/10	Sun		Rest	
22	8/11	Mon		Meeting at Antigua Fishereis Division. Site survey (Point Wharf/Market Wharf). Visit LIME.	
23	8/12	Tue		Site survey and stakeholders meeting (Urlings and Parham). Visit Ministry of Information, Telecommunication, Broardcasting , Science and Technology.	
24	8/13	Wed		Survey on radar sites (Mt. Obama, Freetown). Hearing to local construction companies. Survey on boats and FADs of Fisheries Division.	
25	8/14	Thu		Visit Coast Guard, APUA and private construction companies. Survey on operation plan of multipurpose boat.	
26	8/15	Fri		Meeting with AFL Chairman. Document arrangement.	
27	8/16	Sat		Site survey (Barbuda Island).	
28	8/17	Sun		Rest	
29	8/18	Mon		Wrap-up meeting with Antigua Fisheries Division and data collection.	
30	8/19	Tue		09:55 Antigua→10:25 St. Kitts (LI310). Meeting at St. Kitts Department of Marine Resources. Hearing to local construction companies.	
31	8/20	Wed		Visit Dept. of Physical Planning and Environment, Coast Guard, and The Cable. Site survey (Basseterre) on refrigeration facility.	
32	8/21	Thu		Survey on radar sites (Dieppe Bay, Bayfords, Ottley's Level). Stakeholders meeting (Old Road).	
33	8/22	Fri		Wrap-up meeting with Dept. of Marine Resources. Meeting with LIME.	
34	8/23	Sat		Site survey (Nevis Island). Visit VON Radio and radar site.	
35	8/24	Sun		Rest	
36	8/25	Mon		Survey on FAD fishing and boats of DMR. Discussion on operation plan of multipurpose boat.	
37	8/26	Tue		Data collection at DMR. Meeting with DIGICEL. Hearing to local construction companies.	
38	8/27	Wed		14:55 St. Kitts→15:25 Antigua 17:25→20:00 Port of Spain (LI315 / LI309)	09:00 St. Kitts→09:30 Antigua 10:30→11:55 San Juan 14:29 →18:30 Atlanta (LI521 / LI362 / DL1595)
39	8/28	Thu		Courtesy call to Embassy of Japan in Trinidad	13:47 Atlanta →(DL295)
40	8/29	Fri		06:00 Port of Spain→09:10 Antigua 10:30→11:55 San Juan 16:30→20:20 New York (LI310 / LI362 / DL332)	16:30 Narita
41	8/30	Sat		14:50 New York→(DL473)	
42	8/31	Sun		17:35 Narita	

【2nd Field Survey】

	Date		Activity (JICA)		Activity (Chief Consultant)
1	11/24	Mon			Naritra→New York
2	11/25	Tue	Haneda→Los Angeles→Miami→Antigua→Dominica		New York→San Juan→Antigua→Dominica
3	11/26	Wed	Dominica Fisheries Division: Explanation of outline of Preparatory Survey Report (Draft). Site obervation (Roseau). Survey on Yamaha local agents.		
4	11/27	Thu	Discussion and signing on Minutes (Dominica). Site observation (Portsmouth, Anse de Mai, Marigot)		
5	11/28	Fri	Site observation (Stowe, Fond St. Jean, Scotts Head)		
6	11/29	Sat	Dominica→Antigua→St. Kitts (LI580/LI312,08:50/09:30, 10:35/11:05)		
7	11/30	Sun	Rest		
8	12/1	Mon	St. Kitts Department of Marine Resources: Explanation of outline of Preparatory Survey Report (Draft).		
9	12/2	Tue	Discussion and signing on Minutes (St. Kitts).		
10	12/3	Wed	St. Kitts→Antigua(LI521, 09:00/09:30). Antigua Fisheries Division: Explanation of outline of Preparatory Survey Report (Draft). AFL: Explanation of equipment for AFL. Site observation (Point Wharf, Market Wharf, Keeling Point).		
11	12/4	Thu	Site observation (Parham, Urlings)		
12	12/5	Fri	Discussion and signing on Minutes (Antigua).		
13	12/6	Sat	Antigua→Port of Spain	Rest	Antigua→St. Martin
14	12/7	Sun	Rest	Antigua→Dominica→San Juan→Santo Domingo	St. Martin→New York
15	12/8	Mon	Embassy of Japan in Trinidad	JICA Office in Dominican Republic	Lv. New York
16	12/9	Tue	Port of Spain→New York→	Santo Domingo→New York→	Ar. Narita
17	12/10	Wed	Ar. Narita	Ar. Narita	

Annex 3. List of Parties Concerned in the Recipient County

Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs

Ms. Milinette Ambrose	Permanent Secretary
Fisheries Division	
Ms. Cheryl Jeffrey-Appleton	Chief Fisheries Officer
Mr. Philmore James	Deputy Chief Fisheries Officer
Mr. Looby George	Fisheries Officer
Mr. Joseph Trevor	Fisheries Officer
Mr. Hilroy Simon	Fisheries Officer
Mr. Forguson Everton	Maintenance Engineer
Mr. Ryan Elton	Manager - Point Wharf Fish Processing Unit
Mr. Wesley Simon	Manager - Urlings Fishing Port
Mr. Conrad Simon	Manager - Perham Fishing Port
Mr. Roy Morris	Fisheries Assistant - Barbuda
Antigua Fisheries Limited (AFL)	
Mr. Julian Suwanton	Chairman
Ms. Mavis George	Manager
Technical Cooperation Project "Caribbean Fisheries Co-Management Project"	
Mr. Mitsuhiro Ishida	JICA Expert

Ministry of Information, Broadcasting, Telecommunication, Science and Technology

Mr. W. Daryl Jackson	Telecommunication Consultant
Mr. William Henry	Assistant Telecommunication Officer

Antigua and Barbuda Defense Force Coast Guard

Mr. Willock L.T.	Operations Officer

Antigua Public Utilities Authority (APUA)

Mr. Dalma Hill	Telecom Manager

Private Companies

Mr. Denfield Roberts	HOD SSD Antigua - LIME
Mr. Lesroy Harrigan	Property Supply Engineer - LIME
Mr. Eustace Roberts	Managing Director – Roberts Construction & Engineering Co., Ltd.
Mr. Newton Charles	Director - HNS & Associates
Mr. Maeglem Roberts	Director - M. Roberts Construction
Mr. Navin Singh	Island Manager - DEVCON Ltd.
Mr. Kyoron L. Simon	Manager – Total Development Solutions
Mr. David Armsry	Managing Director – Refrigeration Services Ltd.
Mr. Winston Steel Michel	Managing Director - WR Steele Refrigeration & Air-Conditioning Services
Mr. Landon Gage	Chief Technician – Gage's Air Conditioning & Electrical Sales and Services
Mr. Casper Philip	Technical Manager – Antigua Era Services

Appendix 4. Minutes of Discussion (M/D)

(1) At the First Field Survey

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR IMPROVEMENT OF FISHERY EQUIPMENT AND MACHINERY
IN
ANTIGUA AND BARBUDA

The Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to conduct a Preparatory Survey for "the Project for Improvement of Fishery Equipment and Machinery in Antigua and Barbuda" (hereinafter referred to as "the Project") and sent the survey team (hereinafter referred to as "the Team") to Antigua and Barbuda, headed by Mr. Yoshihisa MASANAGA, Deputy Director, Rural Development Department, JICA. The Team is scheduled to stay in the country from 22nd to 26th of July and from 9th to 19th of August, 2014.

The Team held a series of discussions with officials concerned of the Government of Antigua and Barbuda (hereinafter referred to as "GOAB") and conducted field surveys at the study area.

As a result of the discussions and the field surveys, both parties confirmed the main items described in the attached sheets.

St. John's, 25th of July, 2014

Mr. Yoshihisa MASANAGA Leader, Preparatory Survey Team, Japan International Cooperation Agency	Ms. Cheryl Appleton Chief Fisheries Officer Fisheries Division, Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs Antigua and Barbuda

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ATTACHMENT

1. Title of the Project

Both sides confirmed that the title of the Project was "the Project for Improvement of Fishery Equipment and Machinery in Antigua and Barbuda".

2. Objective of the Project

Both sides defined the objective of the Project as to improve fishery product distribution and fisheries management, by upgrading and replacing of equipment/machinery and its accompanying facilities that were previously installed by Japan's Grant Aid, as well as, by installing new equipment/machinery responding to new needs on fisheries management.

3. Responsible and Implementing Agency

The responsible agency shall be the Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs.
The implementing agency shall be the Fisheries Division under the Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs.
The organization chart of the Ministry of Agriculture, Land, Fisheries and Barbuda Affairs, and the Fisheries Division is shown in Annex-1.

4. Project site

The Project site is shown in Annex-2.

5. Items requested by the Government of Antigua and Barbuda

After discussion, both sides confirmed the items requested by the Antigua and Barbuda side. They are listed in Annex-3.
However, Annex-3 shall be revisable, if both sides ascertain needs to new items, which are consistent with the objective of the Project, in the course of this survey.

6. Japan's Grant Aid Scheme

The Antigua and Barbuda side understood the Japan's Grant Aid Scheme explained by the Team as described in the Annex-4 and shall take the necessary measures as specified in the Annex 5 for smooth implementation of the Project.

7. Further schedule of the Study

(1) Based on the survey results, JICA will prepare the draft report including the outline design of the Project and dispatch a mission in order to explain its contents tentatively scheduled in November, 2014.
(2) Once both sides agree in principle on the contents of the report, JICA will finalize the report and send it to the Antigua and Barbuda side by the end of March, 2015.

8. Environmental and social considerations

In order to ensure that appropriate environmental and social considerations are to be made for the Project, the Antigua and Barbuda side agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in addition to the national environmental laws and regulations in Antigua and Barbuda.
It was affirmed that the Fisheries Division would take charge of conducting the Environmental Impact Assessment and obtain an environmental permission from the Antigua and Barbuda's authorities concerned before the implementation of the Project.

9. Other important issues

(1) Official request letter for Grant Aid from Japan

The Antigua and Barbuda side agreed that the GOAB should submit "Application Form for Grant Aid from Japan" to the Government of Japan (hereinafter referred to as "GOJ") through diplomatic channel during the survey. The list of items requested as Annex-3 should be attached to the application form.

(2) Decision of the final items of the Project

The Antigua and Barbuda side understood the followings:

a. After this survey, JICA would prepare the outline design and estimate costs of the Project through further studies in Japan.
b. The GOJ would scrutinize the outline design and costs, taking the Japanese side's budget into consideration.
c. Through these processes, the Japanese side would decide the final items of the Project.
d. Therefore, all items listed in Annex-3 might not be assured to be the final items.

(3) Disposal of equipment/machinery/facilities

The Antigua and Barbuda side agreed that if it is necessary to dispose for implementation of the Project any fishery equipment/machinery/facility installed by the previous Japan's Grant Aid, the GOAB should inform the GOJ through the diplomatic channel based on the Exchange of Notes (E/N) before disposing it.

(4) Explanation to stakeholders

The Antigua and Barbuda side agreed that the GOAB should explain to the stakeholders concerned the equipment/machinery/facilities that would be disposed for the Project before starting the Project, and to ensure that they could obtain substitutes.

(5) Undertakings to be taken by GOAB

The Antigua and Barbuda side understood that the GOAB should take necessary measures by its own expenses if existing equipment/machinery/facilities should be disposed and/or enough space should be assured for implementation of the Project.
However, both sides agreed that they would explain to their own Government the appropriateness that installation of new equipment/machinery/facilities and disposal of existing equipment/machinery/facilities should be implemented as a work in the Project, if installation and disposal is inseparably related to each other.

(6) Questionnaires

The Team requested the Antigua and Barbuda side to submit answers to Questionnaires mentioned in Inception Report by 18th of August.
The Antigua and Barbuda side agreed with this request.

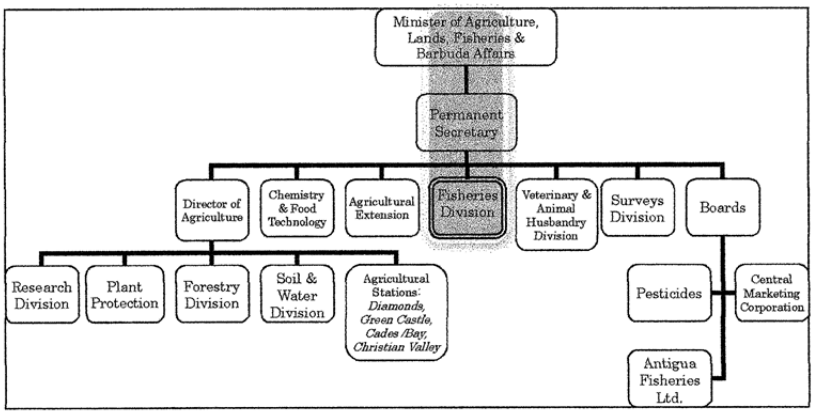
END

Annex 1	Organization charts
Annex 2	Location of the Project site
Annex 3	List of items requested by the Government of Antigua and Barbuda
Annex 4	Japan's grant aid scheme
Annex 5	Major undertakings to be taken by each Government

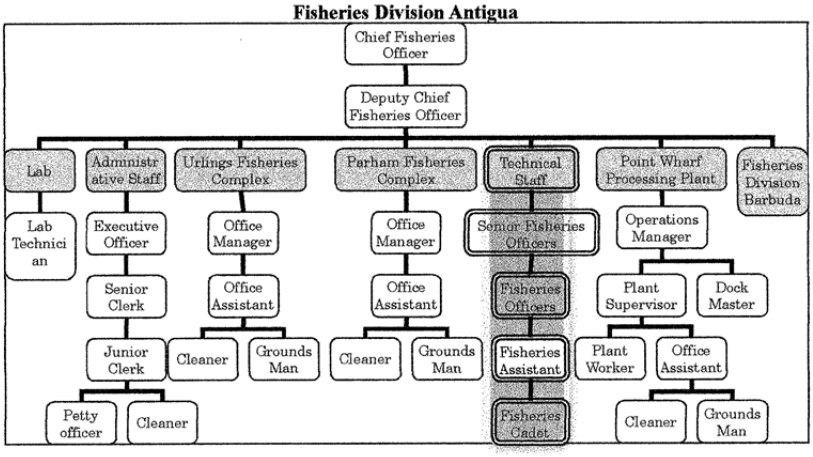
Annex 1

Organization charts

Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs

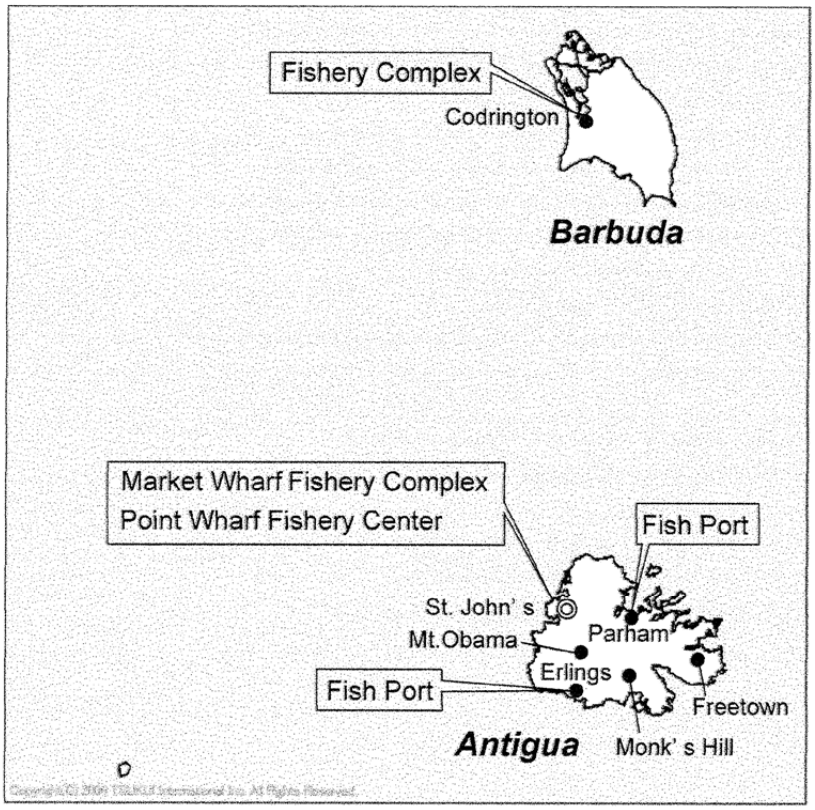


Fisheries Division Antigua



Annex 2

Location of the Project site



Antigua and Barbuda

Annex 3

List of items requested by the Government of Antigua and Barbuda

[Replacement of existing equipment and its accompanying facilities]

① Replacement of Refrigeration and Marketing Equipment

1) Ice plant (6 ton/day x 2) for Market Wharf
2) Cooling unit and refrigeration pan (36 pcs.) for Market Wharf
3) Ice plant (1.5 ton/day) and cooling unit for cold storage for Urlings
4) Ice plant (1 ton/day) and cooling unit for cold storage for Parham
5) Cooling unit and spare parts for air conditioning system for Point Wharf
6) Insulated truck (500kg x 1 unit) for Market Wharf

② Replacement of water supply equipment

1) Rainwater reservoir tank (36m^3, with pump and piping) for Market Wharf
2) Water reservoir tank (10m^3) and water supply piping on the wharf for Point Wharf

[Equipment which is assumed to be newly introduced]

③ Surveillance radar system (3 sets)

④ VHF repeater (1 set)

⑤ Submerged type fish aggregating device (2 sets)

⑥ Multipurpose boat for deployment and monitoring of FADs (1 unit)

⑦ Materials for local FADs (sinker, rope, float, fittings, etc.)

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Annex 4

Japan's grant aid scheme

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc. The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

・Preparatory Survey

- The Survey conducted by JICA

・Appraisal &Approval

-Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet

・Authority for Determining Implementation

-The Notes exchanged between the GOJ and a recipient country

・Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and a recipient country

・Implementation

-Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country, which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s), which conducted the Survey, will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

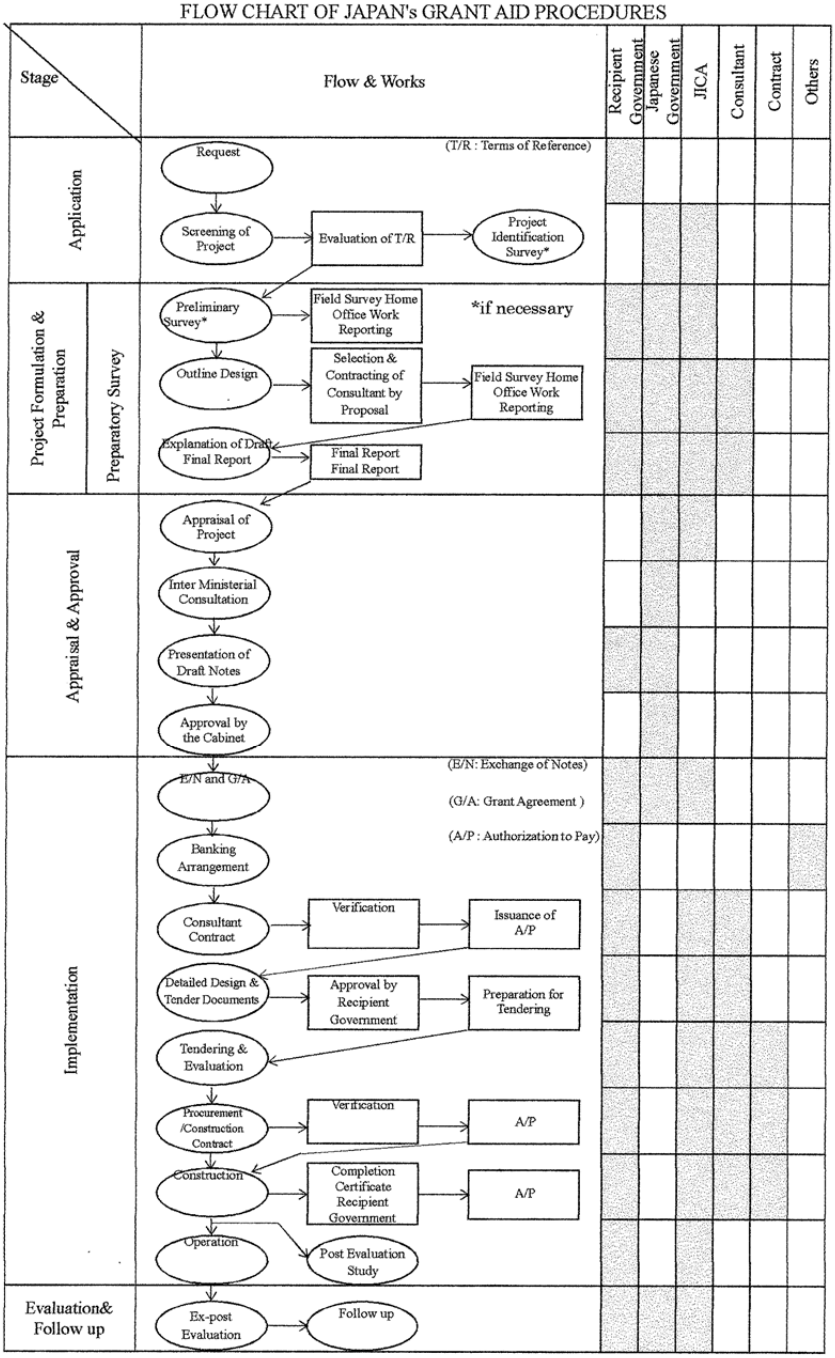
(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex 5

Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the sites;		●
2	To construct the following facilities		
	1) The gates and fences in and around the site		●
	2) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites.		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products.		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Internal transportation from the port of disembarkation to the project site	(●)	(●)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted.		●
6	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

(B/A : Banking Arrangement, A/P : Authorization to pay)

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(2) At the Second Field Survey (Explanation of Draft Report)

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR IMPROVEMENT OF FISHERY EQUIPMENT/ MACHINERY
IN
ANTIGUA AND BARBUDA
(EXPLANATION OF DRAFT REPORT)

In July and August 2014, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on "the Project for Improvement of Fishery Equipment/ Machinery in Antigua and Barbuda" (hereinafter referred to as "the Project"). Through discussions, field surveys and technical examination of the results of the survey in Japan, JICA prepared the draft report of the Project.

In order to explain and to discuss with the authorities concerned to the Government of Antigua and Barbuda (hereinafter referred to as "GOAB") about the components of the draft report, JICA sent a Preparatory Survey Team (hereinafter referred to as "the Team") to Antigua and Barbuda from December 3 to 6, 2014 headed by Mr. ISAO KOYA, Senior Advisor to Director General, Rural Development Department, JICA.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

St. John's, December 5, 2014

Mr. Isao KOYA	Ms. Milinette AMBROSE
Leader,	Permanent Secretary
Preparatory Survey Team,	Ministry of Agriculture, Lands, Fisheries
Japan International Cooperation Agency	and Barbuda Affairs
	Antigua and Barbuda

ATTACHMENT

1. Components of the draft report

The GOAB agreed and accepted the components of the draft report explained by the Team including obligations of the recipient country which are mentioned in the Chapter three (3) of the draft report. It is understood that further request of change in the Project components shall not be considered; however, the components of the Project are still subject to change depending upon the result of the tender for contractor.

2. Japan's Grant Aid Scheme

The GOAB reconfirmed its understanding of the Japan's grant aid scheme and major undertakings of each Government as described in the Annex 4 and 5 of the Minutes of Discussions signed on July 25, 2014.

3. Further schedule of the Preparatory Survey

JICA will complete the final report in accordance with the confirmed items and send it to the GOAB by the middle of March, 2015.

4. Estimated cost of the Project

The Team provided the estimated cost of the Project as described in the Annex 1. The GOAB understood that the estimated cost was not final and was subject to change in the course of appraisal by the Government of Japan.

5. Confidentiality of the Project

The GOAB affirmed that the estimated cost of the Project, together with other information related to the Project such as facility design drawings and specifications of equipment, shall not be duplicated and released to any outside parties before conclusion of all the contract(s) for the Project since they are confidential information that is concerned with the tender.

6. Environment and Social Considerations

In order to ensure that appropriate environmental and social considerations are to be made for the Project, the GOAB agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in addition to the national environmental laws and regulations of Antigua and Barbuda.

7. Other Relevant Issues

7-1. Timely fulfillment of obligations of the GOAB

It was assured that the GOAB shall take necessary measures to fulfill obligations listed in the Annex 2 with due observation of respective time limit, in addition to the obligations described in the Annex 5 of the Minutes of Discussions signed on July 25, 2014.

7-2. Proper operation and maintenance of installed equipment by the Project

It was reconfirmed that the GOAB assume overall responsibilities for the proper operation and maintenance of the Project facilities and duly undertake the following measures.

(1) The GOAB assured that the same operation and maintenance system for refrigeration facilities is to be applied before and after the Project.

(2) The GOAB assured that appropriate collaboration system with the Coast Guard is to be established for effective operation of surveillance radar system by the time of completion of the Project.

(3) The GOAB assured that each fishing vessel will be equipped with AIS transponders as a condition for issuance of fishing license by the time of completion of the Project.

(4) Antigua Fisheries Limited plans to employ a full-time adequate maintenance technician for refrigeration facilities. The GOAB assured that the Ministry of Agriculture, Land, Fisheries and Barbuda Affairs, the responsible agency for the Project, is to monitor its process and provide necessary support for Antigua Fisheries Limited.

(5) The GOAB assured that the Fisheries Division is to assign the most experienced operator and technician attached to the multipurpose boat among existing staff members before delivery.

ANNEX 1 Estimated cost of the Project

This Page is closed due to the confidenciality.

(2) Estimated Cost to be borne by Antigua and Barbuda

a) Electrification to radar installation sites (4 sites): EC$20,000

b) Purchase of PCs (3 PCs) needed for sharing of radar images (for the Coast Guard): EC$15,000

c) Commission charge for issuance of the Authorization to Pay (A/P): EC$62,000

Note:

(1) The cost estimates in the above table are provisional and will be further examined by the government of Japan for approval of the Grant.

(2) Condition for estimation

a) Time of estimation : August, 2014

b) Exchange rates : 1US$=102.87 JPY
1EC$=38.26 JPY

c) Implementation schedule : Referred to " Implementation Schedule" specified in the draft report of the Preparatory Survey

ANNEX 2 Obligation of the recipient country

Recipient country responsibilities	Implementation period
a) Acquirement and provision of places for installation of project equipment and machinery ・ Places for installing refrigeration facilities (inside existing fisheries complexes) ・ Places for installing surveillance radars and ancillary equipment to existing towers ・ Preparation of a surveillance radar monitoring room (inside Fisheries Division office in Point Wharf) ・ Installation site for new tower (Point Wharf) ・ Safe storage space for the multipurpose boat	Before equipment and machinery are installed in-country
b) Procedures required for installation of project equipment and machinery; submission of applications for approvals and permits and acquirement of permits ・ Permits for shared use of existing towers (Mt. Obama, Freetown, Codrington); ・ Construction permit for the new tower (Point Wharf) ・ Permits to use radio frequencies (for radar, microwave and VHF radios)	Before public announcement of bids for equipment and machinery
c) Registration of the insulated truck and the multipurpose boat to be undertaken by Antigua and Barbuda	At the time of equipment delivery
d) Development of the environment at places for installation of project equipment and machinery ・ Supply of water and electricity to refrigeration facilities ・ Supply of electricity to surveillance radars sites	At the time of equipment and machinery installation
e) Sharing of radar images with the Coast Guard ・ Purchase and installation of equipment required to enable data sharing (Coast Guard) ・ Provision of a fiber optic network connection between the Fisheries Division and the Coast Guard	Before inspection and transfer of equipment and machinery
f) Facilitate the procurement of portable AIS transponders for fishing boats (x400) ・100 in the initial year and 100 per year for the next three years	Before inspection and transfer of equipment and machinery
g) Disposal of equipment and machinery (industrial waste) after removal (The Japanese side will handle removal and transport to the designated site in Antigua and Barbuda.)	In accordance with recipient government standards
h) Destruction of recovered refrigerant (Japan will handle recovery and transport to the designated site in Antigua and Barbuda.)	In accordance with recipient government standards
i) Explanation to and securing of agreements from facility users	Before public announcement of bids for equipment and machinery
j) Provision of permit for installation of submerged-type FADs	Before public announcement of bids for equipment and machinery