FINAL REPORT FOR A

COMMUNICATION SYSTEM FOR THE MINISTRY OF AGRICULTURE GOVERNMENT OF HAITI

USAID

Contract Number
AID/otr-C-1619

31 JANUARY, 1979

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Washington, D.C.

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January 31, 1979

Mr. Alfred Hotvedt
Office of Project Development
Bureau for Near East
Agency for International Development
Washington, D.C. 20523

Reference: Work Order No. 2 to Contract
No. AID/otr-C-1619

Dear Mr. Hotvedt:

Submitted herewith are thirty copies in English of the Final Report on the Referenced Work Order, entitled "Final Report for a Communication System for the Ministry of Agriculture, Government of Haiti," dated 31 January 1979. This document provides the system design and bid documentation as required by the Work Order. The corresponding copies in French will be delivered in a separate submittal.

We have appreciated the opportunity to contribute to this important effort, and look forward to being of further assistance. Please let me know if further information is desired.

Very truly yours,

TELECONSULT INCORPORATED

Frederic C. Leiner
Vice President

FCL/tlb

cc: Mr. Charles Stevens
Mr. L. E. Stanfield

FINAL REPORT FOR A

COMMUNICATION SYSTEM
FOR THE
MINISTRY OF AGRICULTURE
GOVERNMENT OF HAITI

Provided by

U S A I D
Contract Number
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31 January 1979

Prepared by

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EXECUTIVE SUMMARY

OBJECTIVE

This report presents the results of a task undertaken to assist in developing two radio communications networks which will enable the Government of Haiti's Department of Agriculture to control and coordinate agriculture services in a timely manner.

FINDINGS

A visit to Haiti provided necessary background to the design of the system, (see Section 2). The communication needs of the Bureau of Agricultural Credit, the Coffee Institute centers and the Integrated Agriculture Project were assessed in addition to those of the Ministry of Agriculture's 13 districts. Other system considerations, including implementation, operators and maintenance factors were studied and evaluated (see Section 3). A preliminary system was designed based on a best fit of all these findings and factors. Subsequent work has confirmed the original design, (see Section 4).

A primary consideration in system design is the assurance of system availability and long-term reliability when utilized by personnel unfamiliar with sophisticated communications equipment and technology, operating in an adverse environment. Communication availability is enhanced by designing a network composed of an inventory of identical equipment for both fixed and mobile service. Fixed sites are powered from batteries which are kept charged from the local power distribution system. Transceivers are therefore still useable for some time following a power outage. Failed equipment can be replaced by other identical units from less critical sites and the likeness of equipment assures operational confidence.

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Long-term reliability is enhanced by the use of elementary, uncomplicated design principles and by specifying equipment of proven design. System longevity may be expected to be enhanced using a contractor who has a vested in-country interest. He should be able to make an installation based on his own experience with both technical, and local social conditions. His presence should assure warranty service and long-term maintenance.

A Request for Proposal (RFP) document has been prepared which explains the network requirements, design philosophy, delineates equipment specifications, and presents general terms and conditions of the contract.

RECOMMENDATIONS

It is recommended that the RFP be reviewed by the Purchaser in order to assure currency of information and conformance to established procedures and policy. Changes may be made as applicable. If the response to the RFP is of such nature that the system goals appear to be compromised, further professional consultation is recommended.

SECTION I

INTRODUCTION

The USAID office in Washington D.C. has assigned Teleconsult Inc. the task of developing a radio communications network which will enable the Government of Haiti's (GOH) Ministry of Agriculture to control and coordinate agricultural services in a timely manner.

In accordance with the agreement signed between Teleconsult and USAID, number AID/otr-1610 dated 12 September 1978, the scope of work itemized in the contract was reviewed and discussion held with the AID officials in Port-au-Prince, Haiti, as a preliminary stage. Thereafter trips were undertaken to several districts in order to study the area of operation, to evaluate the service requirements, to assess the space availability and power requirements and to determine the system required. The result of this work revealed several points on which the preliminary report was based.

This final report retains much of the preliminary report, expanding the discussion where applicable and adding such new work as required in order to complete the task. An example of the latter is a Request for Proposal document, included herein as Appendix C, which may be used as is, or modified as circumstances require to commence procurement procedures for the subject system.

SECTION 2

METHODOLOGY AND SURVEY

The method used to design the communication system for the Ministry of Agriculture was first, to gather all relevant information concerning the project; second, to analyze the information looking for the best way to achieve goals and finally a critical review of the system capabilities and limitations.

2.1 INFORMATION SOURCES

Necessary information relevant to project design includes the social, organizational, topographical, technical and economical factors of the milieux. Social and organizational details have been provided especially during discussions with AID and GOH officials. The topographical information has been provided through a map study and further clarified by visits to several of the potential communication terminal sites. Technical information has been drawn from the experience of the consultant and from discussions with individuals who have local experience in equipment availability, maintenance and the operation of communication networks similar to those which must be considered to meet the system needs. Economic factors include cost tradeoffs in system implementation, for example the cost of HF as opposed to VHF and the cost of assured maintenance availability.

2.1.1 Meetings

The various meetings in which details were gathered are noted for relevance.

a) Monday 18 September 1978 — 0800-1100 hours
Project review with AID personnel

b) Monday 18 September 1978 — 1100-1330 hours
Meeting at Damien with

i) Director General Mr. Marcel Depestre
Director, Division of Agriculture, Mr. Dumarsais Vincent
AID Coordinator, Mr. Robert Cassagnol
and several of the district agronomes

ii) His Excellency the Minister of Agriculture
Mr. Edouard Berrouet
and key participants, except the Director General, of the previous meeting.

c) Tuesday 19 September 1978 0910-0938 hours
Director of BCA, Mr. Conte

d) Tuesday 19 September 1978 1003-1042 hours
IHPCADE Director of marketing, Mr. Wilner Pierre-Louis

e) Tuesday 19 September 1978 1107-1135 hours
Director of IHPCADE, Mr. Bertin Dadaille

2.1.2 Area Visits (See Site Survey Reports, Appendix A)

The following places where equipment may be sited were visited:

a) Thursday 21 September 1978 0900-1010 hours
Office of District Agronome
Rue General Borgella, 27
Cayes

District Agronome	Mr. Max Mondesir
Director of Operations PDAI	Mr. Fritz Boutin
Research Specialist PDAI	Mr. Claude Grand-Pierre
Conservation Specialist PDAI	Mr. Mike Stapleton

b) Thursday 21 September 1978 1150-1230 hours
Dubreuil Work Site

Director of Operations PDAI	Mr. Fritz Boutin
Engineer	Mr. Hugues Bien-Aime
Conservation Specialist PDAI	Mr. Mike Stapleton

c) Friday 22 September 1978 1030-1135 hours
Coffee Center at Fonds-des-Negres
Engineer AID Mr. Chuck Pettis

d) Thursday 28 September 1978 0840-0930 hours
Office of District Agronome
9 Rue Boirond Tonnerre
Jacmel

District Agronome Mr. Eric Noailles

e) Thursday 28 September 1978 1102-1120 hours
PDAI Operations Office
Route to Jacmel
Marigot

Agronome — Mr. Francois Severin

f) Thursday 28 September 1978 — 1230-1325 hours
Coffee Center at Macary

Agronome — Mr. Eddie Martin
Mr. Fritz Marcelin

g) Thursday 28 September 1978 — 1435-1445 hours
PDAI Research Station at Seguin
Agronome — Mr. Fritz Marcelin

h) Tuesday 03 October 1978 — 1350-1405 hours
PDAI Operations Office at
Jean Rabel

Agronome — Mr. Michel Williams

i) Friday 06 October 1978 — 1200-1220 hours
Dept. of Agriculture Headquarters
Building at Damien

j) Friday 06 October 1978 — 1400-1410 hours
PDAI Operations Office at
Thomazeau
Mr. Luckner Cullot
Secretary — Mrs. Marie Yves-Rose Theodat

2.1.3 Discussion with Other Communication Interests in Haiti (See Appendix B)

During meetings with GOH and AID personnel, several local interests, who operate, maintain, or who are knowledgeable about communication facilities, were identified as possible sources of helpful information. Not all of these could be visited, indeed, not all need be. Those who were visited confirmed the expected required system transmission parameters. Those visited are listed below:

a) Wednesday 20 September 1978 — 1418-1435 hours
Oblate Fathers Mission in Les Cayes — Fr. Brusso

b) Wednesday 20 September 1978 — 1445-1600 hours
Sangamo Barter, Construction Co.,
Les Cayes
Project Manager, Mr. G. E. Brister

c) Thursday 28 September 1978 — 1500 hours
Teleco Department of Haiti
Port-au-Prince
Director General, Mr. Edouard Gentil

d) Friday 06 October 1978 — 1645 hours
Mr. Tim Lavelle
HACHO
AID Office, Port-au-Prince

2.1.4 Interviews with Potential Equipment Suppliers in Haiti (See Appendix B)

In order to determine in-country maintenance and spares availability all potential suppliers who were identified were contacted. These are noted below:

a) Monday 25 September 1978 — 1400-1515 hours
Fritz Electronics Communications, Co.
Boulevard Harry Truman, Port-au-Prince
General Manager, Mr. Fritz Joassin

b) Tuesday 26 September 1978 — 0900-0930 hours
Caribbean Services
32, Rue du Quai, Port-au-Prince
Mr. David Sendral, Jr.

c) Wednesday 27 September 1978 — 1330 hours
Fritz Electronics Communications, Co.

d) Thursday 28 September 1978 — 1130 hours
Telephone Interview with Mr. Robert Richmond
of the Commercial Department of the US Embassy
concerning other suppliers in Haiti

e) Friday 29 September 1978 — 0858-1010 hours
At the University d'Etat d'Haiti
Port-au-Prince

Engineer Rene Michel, Rad-Tel Electronic Center

2.2 SUMMARY AND CONCLUSIONS - VISITS AND MEETINGS

The Teleconsult Contract Statement of Work coupled with the meetings clarified the communication system needs, the goals and many of the technical details. A map study and visits to some of the communication sites provided information needed in order to determine system design parameters, operational and training needs and highlighted the in-country maintenance requirements. Discussions with other communication users confirmed frequency, power levels and antenna requirements and emphasized maintenance requirements. Interviews with potential equipment suppliers show that there is only one local franchised agency whose sole business is communications systems who is capable of supplying both high frequency and very high frequency equipment and who has the capability to himself provide maintenance. Only one privately operated business was located which has long term experience in sales, installation and maintenance.

SECTION 3

ANALYSIS OF REQUIREMENTS

The basic requirement for the eventual system is to provide reliable communication between the national headquarters at Damien and the other twelve districts. A link to the Island of Gonave is also planned. In addition, other radio service is also required from each of the district offices to the various activity centers within the district. The purpose of this system is to link all levels of the agriculture production work with such organizational, administrative, operational and logistic communication as are applicable to the development, expansion and maintenance of the agricultural production, marketing and support activity. The elements of the system are thus, the provision of suitable equipment to provide the communication links, the development of operational procedures to efficiently use this equipment, training of personnel to operate the system and finally, the provision of maintenance service adequate to keep the system in operation.

3.1 THE COMMUNICATION SYSTEM REQUIREMENTS

The communication terminals which have been identified are shown in Table 3.1 and the map, Figure 3.1. The backbone of the system is the network of twelve links from Damien to the other districts offices and Gonave Island. Secondarily, each of the districts may have depending on district activity, their own local network linking the district office to each activity center within the district. Details of the system are discussed in Section 4. The interface between the backbone and local networks is the agriculture department district office and resides in the person of the district agronomist, who, with the communication system as a tool, will be able to conform to national policy while at the same time efficiently overseeing all the needs at his district. The resulting organizational strengthening and benefit of such a system is obvious.

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Dept. of Agriculture District Offices 1/	Coffee Institute Centers (IHPCADE)	Agriculture Bureau Regional Credit Offices (BCA)	Integrated Agriculture Development Project (PDAI) Operations Offices and Research Stations	Rural Work Sites 2/
Belle-Anse 1	Thiotte 23	Thiotte 23		
Belladeres 2	Baptiste 16			
Cap-Haitian 3	Dondon 19 Pilate 22	Cap-Haitian 3	Cap-Haitian RS 3	
Cayes 4	Changieux 18	(forthcoming)	Ducis OO 24 Levy RS 28	Dubreuil I 34 Avezac IIA 35 Chantal IIA 36 Desrodieres IIA 37 Les Anglais IIA 38 Melon IIA 39 Moreau-Fonfrede IIA 40 Robert IIA 41 Roche-a-Bateau IIA 42 St.Louis du Sud IIA 43 Perigny (Torbeck) IIB La Corriere IIC Port-a-Piment IIC Poteau IIC
Gonaives 5		Gonaives 5		Ennery III St. Michel de l'Atalaye III
Hinche 6		Hinche 6	Papaye RS 30	
Jacmel 7	Macary 21	Jacmel 7	Marigot OO 26 Sequin RS 31	Marigot-Peredo IIA 32 Pedernales IIA 33 Cayes-Jacmel IIIC 33
Jeremie 8	Beaumont 17	Jeremie 8		
Miragoane 9	Fond-des-Negres 20	Fond-des-Negres 20		
Petit-Goave 10				
Port-au-Prince 11 (Operations) Office is at 12 Damien in the Cul-de-Sac	Port-au-Prince 11	Port-au-Prince 11	Damien RS 12 Thomazeau OO 27	Duthil-Manneville IIA 44 Fond-Parisien Lastic IIC Momance IID Arcanaie IID Duvalier-ville IID
Port-de-Paix 13		Port-de-Paix 13	Jean Rabel OO 25 Nan Vincent RS 29	Jean Rabel I 25 Mole St. Nicolas IIA 45 Moustique IIB Baie de Henne IIC
St. Marc 14		St. Marc 14		
Agriculture Center Gonave Island 15				

1/ Each location has been assigned a site number based on alphabetical order and general category of site activity (see Table 4.1 for clarification).

2/ The alphanumeric designation following the work site identifies the category and priority of work in these areas. Only Category I and IIA projects have been considered for equipment provision in this study. These categories are taken from the Project Paper entitled

Proposal and Recommendations
For the Review of the
Development Loan Committee

HAITI - Integrated Agriculture
Development (Revised)
AID-DLC/P-2195

Cover Letter dated 22 Sept. 76

TABLE 3.1

Communication Sites and Identification Number

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BACKBONE NETWORK

SITE NO.	NAME
1.	BELLE-ANSE
2.	BELLADERES
3.	CAP-HAITIAN
4.	LES CAYES
5.	GONAIVES
6.	HINCHE
7.	JACMEL
8.	JEREMIE
9.	MIRAGOANE
10.	PETIT-GOAVE
11.	PORT-AU-PRINCE
12.	MINISTRY OF AGRICULTURE HEADQUARTERS AT DAMIEN.
13.	PORT-DE-PAIX
14.	ST. MARC.
15.	GONAVE ISLAND

JEREMIE DISTRICT

SITE NO.	NAME

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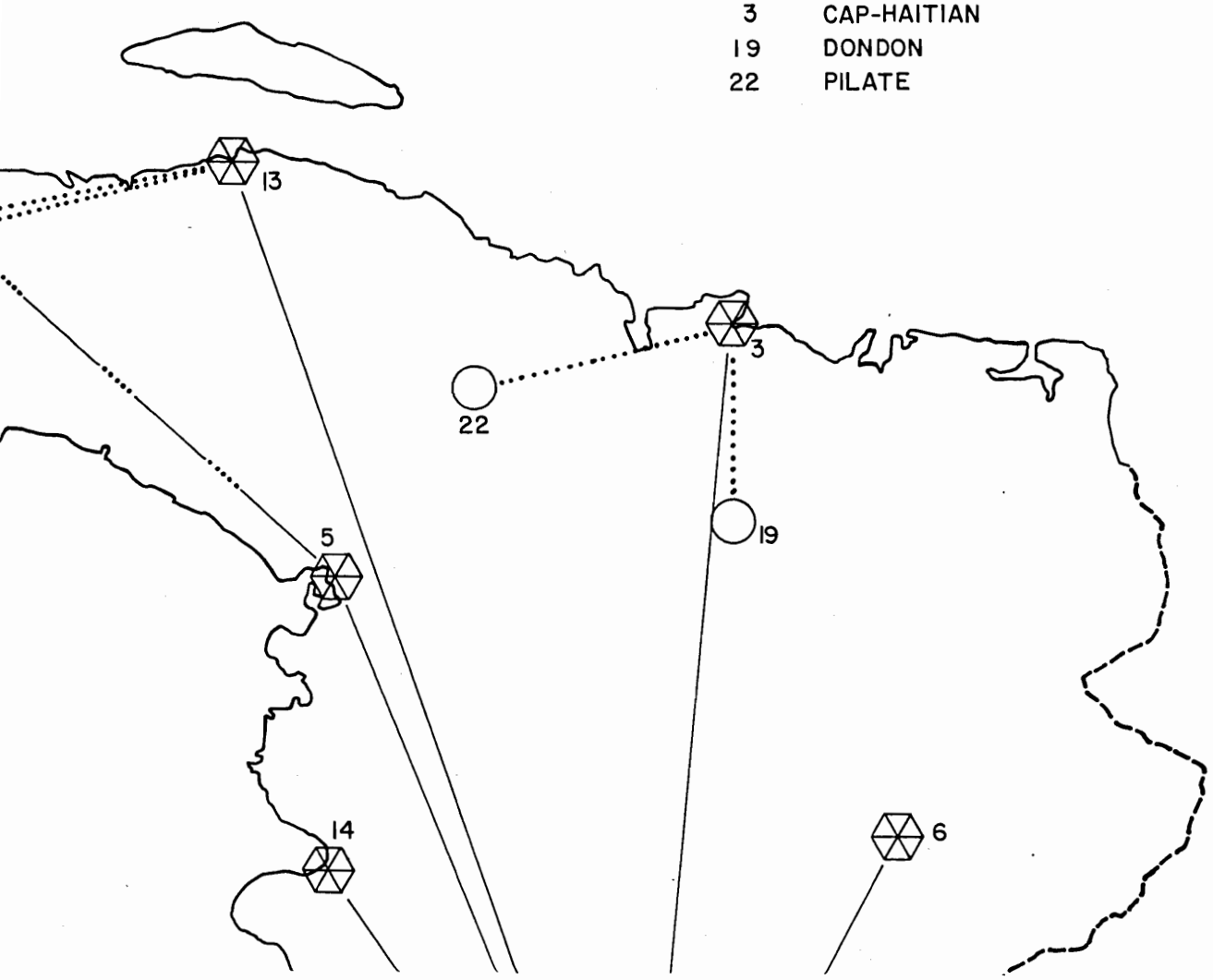
-DE-PAIX DISTRICT

NO.	NAME
	PORT-DE-PAIX
5	JEAN-RABEL
9	NAN VINCENT

CAP-HAITIAN DISTRICT

SITE NO	NAME
3	CAP-HAITIAN
19	DONDON
22	PILATE



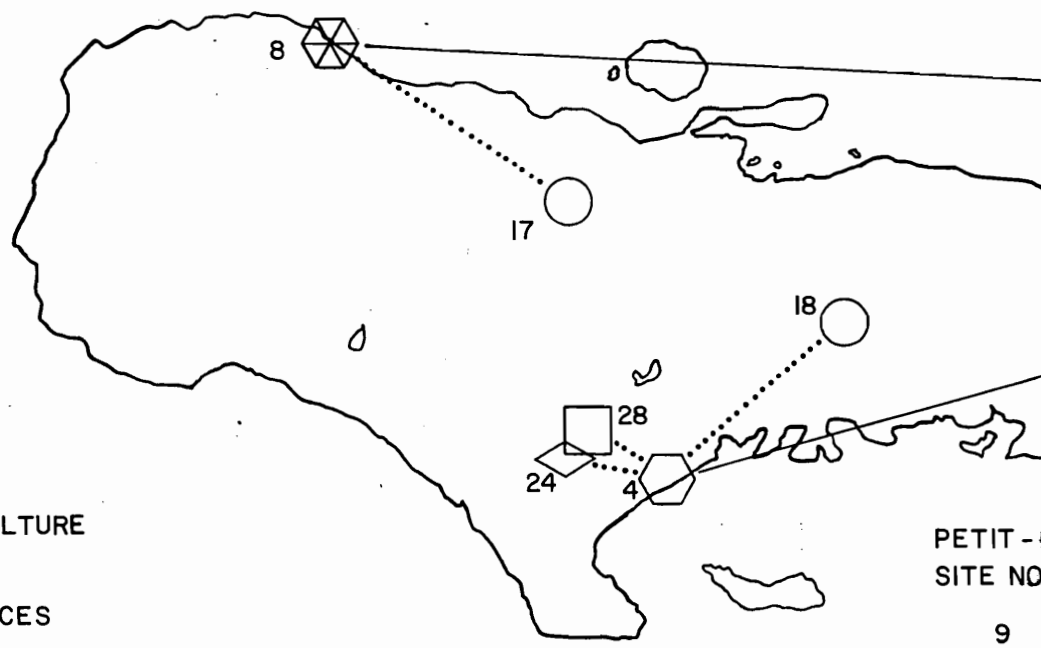
BELLADERES DIS

SITE NO NAME

BEST AVAILABLE COPY

SITE NO. NAME

8 JEREMIE
17 BEAUMONT



PETIT-
SITE NO

9
10
20

CAYES DISTRICT

SITE NO. NAME

4 CAYES
18 CHANGIEUX
24 DUCIS
28 LEVY

LEGEND

- COFFEE CENTERS
- MINISTRY OF AGRICULTURE DISTRICT OFFICES
- BCA REGIONAL OFFICES
- RESEARCH STATIONS
- PDAI OPERATIONS OFFICES
- BACKBONE NETWORK
- IN DISTRICT NETWORK
- SPECIAL INTER-DISTRICT LINK.

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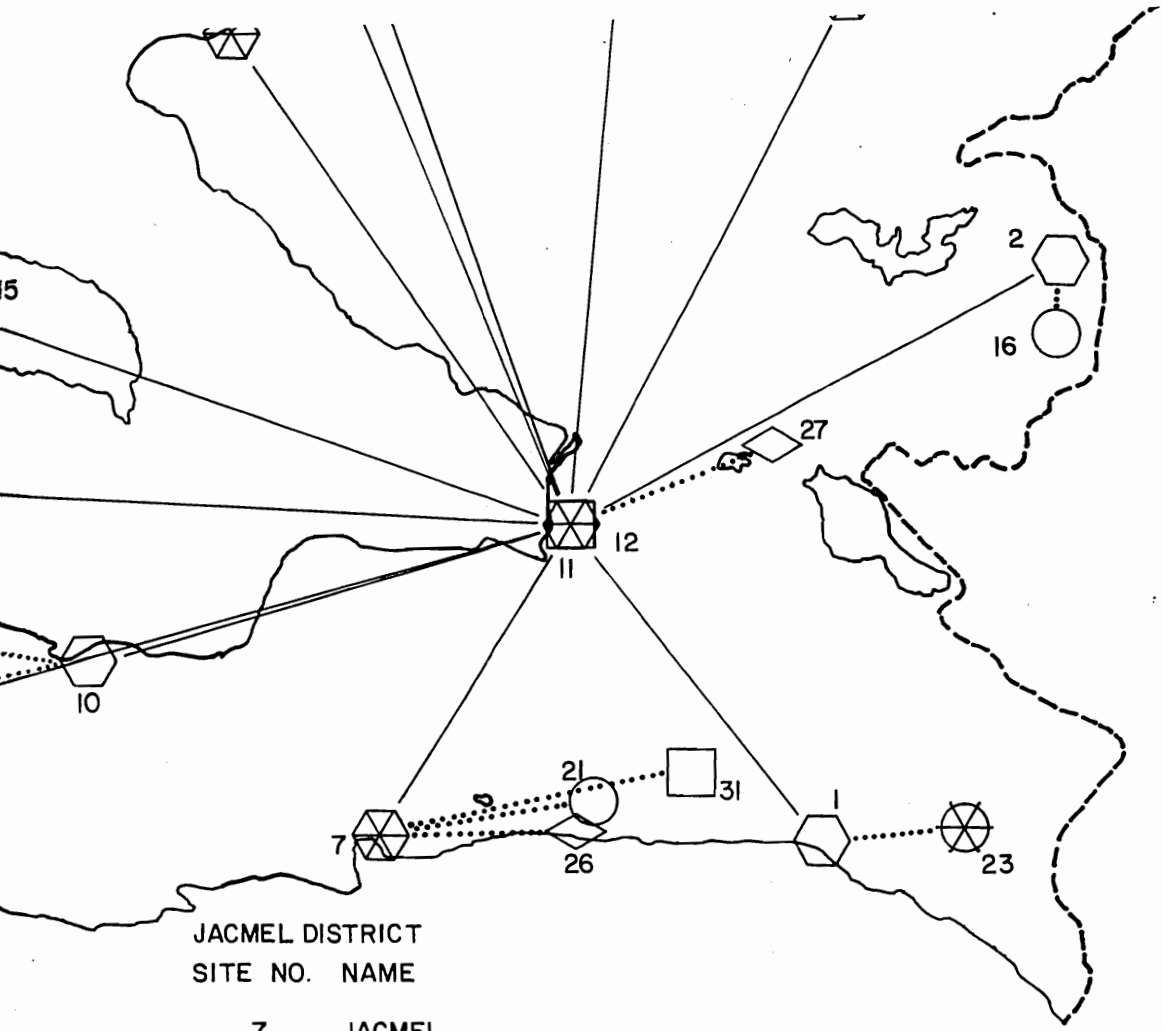

BELLADERES DISTRICT

SITE NO.	NAME
2	BELLADERES
16	BAPTISTE

PORT-AU- PRINCE DISTRICT

SITE NO.	NAME
11	PORT-AU-PRINCE
12	HEADQUARTERS (DAMIEN)
27	THOMAZEAU

JACMEL DISTRICT

SITE NO.	NAME
7	JACMEL
21	MACARY
26	MARIGOT
31	SEGUIN

BELLE - ANSE DISTRICT

SITE NO.	NAME
1	BELLE-ANSE
23	THIOTTE

RK

TELECONSULT INC.

FIGURE 3.1

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Meeting the system communication needs using the public telephone service (Teleco) has been considered and is rejected for several reasons. First, although the Teleco service network is being continually improved and expanded (using radio relay), it does not yet provide high quality reliable service to all the districts, especially to those remote locations where the agricultural work is frequently sited. Estimates of when this service maybe available range from 5 to 7 years. Further, Teleco mobil telephone service into some areas may never be developed due to the limited requirements. Second, even if service were available everywhere it is noted that during emergency periods when needed most (for example during hurricanes) it would be difficult to secure circuits due to increased loading or due to downed facilities. The planned agricultural network, with its many (including mobil) units provides redundancy of equipment and paths which could be used during emergency periods with backup provided by telephone service if and when available. Finally, using telephone service the estimated cost, say $10/day/station multiplied by 220 work days a year times 7 years (the design life of the radio equipment) equals $15,400 or approximately twice the cost for each HF fixed site assuming an overall cost including the equipment plus a monthly maintenance service fee which would effectively double the equipment cost. The facts of cost and reliability but principally of availability thus suggest the establishment of a dedicated agriculture network.

It has been noted the agricultural system will have terminals in many of the places where road building and upgrading is in progress, and it has been suggested that the proposed system for the Service d'Entretier Permanent du Reseau Routier National (SEPRRN) could be integrated with the agricultural radio network. This is not recommended for several reasons:

(a) The objective of the two networks is different, namely, long term development in fixed locations, as opposed to periodic activity in differing areas.

(b) The nature of traffic of the two networks is different, the agriculture service generally requiring a routine scheduled type of operation while the roads network needs continued channel availability in order to expedite their work.

(c) It might appear that an established network could be used for agriculture service on a scheduled basis and for the road service at other times. This possiblity emphasizes the difference in equipment required. The agriculture net can operate with simpler equipment using voice mode while the roads network requires teletype capability in order to provide hard copies of engineering, logistic, planning and other details.

(d) Combining the networks would additionally cause operational and interface difficulties. Where the equipment were located in the district agriculture office, it would put a heavy load onto this office, or if located elsewhere, impede agriculture communications. This would thus, render each network less efficient.

In view of these considerations, and the agriculture communication system requirements, this report recommends and assumes the establishment of a single dedicated network for agricultural purposes.

3.2 THE OPERATIONAL REQUIREMENTS

Operational considerations include the recommended provision of space and necessary supporting equipment; the development of operational procedures for the efficient generation, transmission, relay, delivery, determination of status, and filing of messages; recommended training of personnel in network and equipment operations; and planning for ordering, stocking and replenishment of such consumables as are required.

3.2.1 Fixed Site Accomodations

Arranging a good operations environment will tend toward an improved communications network. This environment includes adequate space to mount the apparatus and keep station records. The transceivers and their rectifier-charger units are not large. The former should be placed on a small table or desk and the latter can, depending on the actual size, be placed on or beneath the table or a short distance (up to several meters) away, as the environment and preferences allow. The battery should be located in a secure but accessible location so that replacement is not hindered and so that there will be little probability of anything accidently falling onto its terminals shorting them together, thus possibly damaging the power system.

It is recommended that the actual location of equipment at fixed sites be left to the discretion of the local authority although perhaps modified by the suggestions of the contractor. It was found during the site visits that the places chosen for emplacing the equipment were well considered and showed a respect for the proposed system.

The recommended support equipment is discussed in the tender document, Appendix C, paragraph 2.2.5. Since the furniture may be purchased locally, the Ministry may desire to provide prospective bidders with a list of acceptable equipment in order to assure the provision of installations

which will be most suitable to the users/operators.

3.2.2 Operations Procedures

Efficient utilization of the communication networks requires the development of a procedure, or discipline which will organize operations. Some operational methods are discussed in paragraph 4.4. Examples are given which may form the pattern of the network operations. In addition, some suggested procedures are provided in Appendix D.

Actual practices will develop based on real needs. The operators at Damien, and to a lesser extent, the district agronomists, may be able to sense early in the net operation, needs for changes which will improve operations efficiency. Management may be able to suggest valuable changes by analyzing such feedback and adjusting operations accordingly.

3.2.3 Maintenance Operations

Periodic maintenance is required on the equipment and installation to assure availability. Those simple procedures outlined in the manufacturers instruction manuals will, if followed, be most helpful toward early recognition and correction of problems. Training provided by the contractor should include some minor maintenance and training in those elements of the system to be periodically inspected, for example, determining the condition of the batteries, how to check and replace consumables in the power generator equipment and the integrity of the transmission line and antenna. Further, it is recommended that during the time of equipment installation at each site that the contractor be accompanied by at least one designated individual who will observe the installation and mounting of all wiring, equipment and antennas. This would provide someone who had installation knowledge and who might be able to locate and correct minor faults affecting the operation.

3.3 THE MAINTENANCE REQUIREMENTS

Adequate maintenance is required to ensure system reliability. The first level of maintenance should be through the operations procedures which will include instructions and the forms necessary for the recording of equipment operation and measurements and the performance of simple routine preventative maintenance. Diligent attention to such procedures will lend system efficiency by the early recognition and possible correction of problems.

The second level of maintenance must provide technical personnel backed by adequate repair facilities and provisioned with all necessary test equipment and spare parts.

The first level will provide an opportunity for growth of the system operations personnel while the second level will be difficult to establish, especially in the outlying areas.

If the system is to meet its requirements for many years, the maintenance requirement becomes crucial and system design tradeoffs, wherever available, have been made in the direction favoring ease of maintenance. A system composed of standard proven units and simple antennas may add to the operational burden because of the lack the sophisticated peripheral aids. Equipment designed for automatic protection against misoperation may cost more but will be valuable in ensuring equipment longevity in the operational environment discussed above.

3.3.1 The Maintenance Problem

There are a limited number of business interests in Haiti who sell and install equipment and who are additionally capable of providing the maintenance service required. The number of private maintenance shops adequate to service such a system appears to be even more limited. Those capable of providing maintenance, being few in number, have much more work potentially available than they are able to properly perform and therefore limit their work to service for their sales accounts. Further, they usually limit their service to contract work. This may be based on either a system, or unit charge, per month. In some cases these monthly rates, multiplied by the number of months in the design life of the equipment approximates the equipment cost. Full maintenance coverage thus effectively doubles the system price.

3.3.2 Steps Toward the Reduction of the Maintenance Problems

For practical purposes, it is not necessary to compile a complete inventory of hypothetical solutions to the maintenance problem. The actual policy to be adopted will be determined as more details concerning maintenance become available from prospective suppliers. The project personnel charged with bringing this work to fruition should consider all facets of the problem making a best fit of all significant parameters. These parameters essentially concern:

- the cost of the repair and maintenance service
- the time required to effect service and
- the ease with which service can be achieved.

It includes such considerations as locally available personnel to procure, repair and deliver the repaired unit, an inventory of spares and test equipment adequate to meet repair needs and an organizational structure capable of efficiently and quickly completing all aspects of the service work. The purchaser is not, however, totally at the mercy of the bidders. It is possible at this point in time, to structure the design and procurement towards reduction of the maintenance problems.

3.3.2.1 System Design Philosophy Catering for Reduced Communication Outage

The first step in reduction of maintenance problems is to make as much allowance as possible for this problem in the system design. For example, one supplier recommended the purchase of one spare unit for the system. This is a very practical idea where the system is large enough so that the cost of one unit does not represent a big percentage of total cost, and where the system is not so large that one unit provides only negligible redundancy. The problem still exists, however, of how to quickly be aware of the requirement; and supply the spare to the site where it is needed. This system has been designed so that multiple units are available in every district. The complement of equipment which is recommended is made up of mobil units at all sites. This tends to reduce outages because if a critical communication terminal fails, identical equipment can be temporarily utilized from another less critical terminal. This permits information on the subject to be despatched, and maintain traffic until repair can be made. Since the equipment is identical, no operator retraining or instruction is required. Interchanging units will require only that the two power supply wires (usually mounted in a single plug connection) and the antenna need be disconnected and reconnected. Or, if need arises, mobil HF units could be used as fixed site communication terminals. It will be seen therefore, that in each district where two or more HF units are planned (see Table 3.1) backup equipment exists. This design factor should significantly reduce the duration of communication outage throughout the country.

3.3.2.2 System Procurement Catering to Maintenance Ease

One solution to the high cost of maintenance is to accept the conditions of contract maintenance and to adjust the system size to meet fiscal resources. Another is to provide no contracted maintenance but to rely on the trouble free operation which is expected of properly installed new equipment and to write it off when it is no longer operative. These two alternatives represent opposite limits of the possibilities. The first solution compromises system goals by reducing its size, the second compromises system usefulness and longevity. Between these, and depending upon bidder response, other courses of action may be found. These are discussed below.

If no reasonable cost and reliable maintenance service is available locally, it may be possible to locate a vendor who has depot maintenance facilities in the nearby region, for example, in Puerto Rico, and who will provide repair service on a unit basis, as required, and not on the costly monthly contract maintenance service policy. This alternative has not been fully examined but may be worth a trip by project officials depending upon bidder response.

Another solution might be to locate a manufacturer who, if given this contract, would set up a maintenance depot in-country adequate for the system service. The cost to the manufacturer would be an investment in opening a new market for his product line. It is emphasized, however, that the contract be sufficiently clear that if such circumstance arises, that he fails to complete the arrangement, including the provision of space, satisfaction of all national formalities relating to the establishment of such business by an expatriate organization, such as the attaining of import/export permits of all equipments, work permits, etc. and the staffing of such depot by personnel, that he shall be in violation of the contract and shall forfeit a penalty and release and hold harmless the purchaser.

If no supplier is found who is willing to open a maintenance facility in-country other alternatives will have to be considered. Two of these have been suggested.

a) Locate a local engineer, who has the academic and repair experience suitable for maintenance and who would be willing to provide such maintenance in return for the provision of all required test equipment and spares. This could help establish a greater local maintenance service capability.

b) Locate a local candidate for training who would take responsibility, as a Department of Agriculture Employee, for maintenance of the network. Such a candidate must already have electronic academic training and have maintenance experience. Training would be factory service training for the type of equipment contracted. It would further necessitate the establishment of a suitable electronic repair facility and the purchase of test equipment.

SECTION 4

SYSTEM DESIGN

The system has been designed taking into consideration the results of the contacts and site visits (see section 2 above and Appendices A and B), the analysis of requirements (section 3) and such technical factors as are applicable.

4.1 PROPAGATION CHARACTERISTICS

The propagation characteristics for various sectors of the electro-magnetic communication spectrum have been widely studied for many years. The results of these studies have been applied to various requirements throughout the world, with varying degrees of success.

The consequent information, has led to a wide recognition of the spectrum sectors that may be most effectively utilized in a variety of situations and circumstances.[1/]

4.1.1 High Frequency (HF) Propagation

Theoretical models, and practical examples show that for the service required over the distances specified, the HF spectrum 3.0-30.0[2/] megahertz can be used with power levels of the order of 100 watts peak envelope power (P.E.P.) in the single side band (SSB) mode. Because of the limited distances, the lower section of the spectrum is recommended, frequencies in the range 2 to 7 megahertz being preferred, dependent on time of day and month of year being considered.

1/ The interested reader will find a thorough treatment of the subject in the U.S. Department of Commerce/Environmental Sciences Services Administration Technical Report ERL 110-ITS 78 entitled Predicting Long-Term Operational Parameters at High Frequency Sky-Wave Telecommunication Systems, by Barghausen, Finney, Proctor and Schultz, dated May 1969, Boulder, Colorado.

2/ The HF band, by agreement, is the frequency range of 3.0 - 30.0 Megahertz, and whose wave length is 100 to 10 meters. Wavelength (λ) is related to frequency as follows:

$$\lambda = 299.76/f$$

where: λ (lamda) = wavelength in meters

f (frequency) = radiated frequency in megahertz

299.76×10^6 = velocity of light in meters per second

This application requires communication across mountainous terrain for a variety of paths varying from a few kilometers to an ultimate limit which will not exceed 225 kilometers. To meet this requirement, with the equipment and operational methods proposed, omni-directional antennas with high angle radiation characteristics are necessary. This condition may be achieved utilizing simple and relatively inexpensive frequency-conscious devices.

Due to mechanical limitations, mobil stations are usually equipped with vertical whip antennas, which should, as far as is practical, be mounted such that the metal vehicle provides the best possible ground plane.

Fixed stations may be equipped with either horizontal dipoles, vertical vee dipoles, or quarter wave verticals. Dipoles should not be mounted more than a quarter wave length above the ground plane reflector, which in some localities may be several feet below ground level (approximately at water table level). Should this vary considerably, a false ground plane may be established using a metallic mesh on, or just below, the surface of the soil. Several electrical connections are then made from this mesh to buried earth plates positioned in localized zones of high soil conductivity.

Communication is achieved by reception of signals refracted by ionized layers of atmosphere, hence the nearer the radiation is to the vertical the shorter the horizontal, or surface distance, before the signal returns to earth and the receiving antennas. A limitation is imposed by the fact that as the incident angle to the ionized region approaches the perpendicular, refraction fails to return the rays, which then pass through the region and are lost in space. In practice, this effect is countered by the use of radiation angles not exceeding 85° and the use of lower frequencies in the available spectrum. Depending on frequencies chosen, returned "sky wave" signals may be intercepted as close as 10 to 15 kilometers from the transmitter. At the other limit of the phenoma, radiation angles of 3° to 5° will permit communication over distances of one to two thousand miles in one hop. For the present application therefore, radiation patterns which concentrate the available power between 60° and 85° to the horizontal together with suitable choice of frequency, will provide communication over random surface distances varying between 15 and 250 kilometers. Maintenance of similar polarization of transmitting and receiving antennas is usually not significant in this circumstance .

This is due to distortion of the polarization of the wave front, which occurs during refraction. Antennas of the three types proposed, in general conform to these radiation characteristics.

A ground wave is also radiated which suffers rapid attenuation due to obstruction absorption, particularly in mountainous terrain. This can, however, under most circumstances, be relied on to fill the gap between the radiator and the nearest returning sky wave, provided the recommended radiation angles are utilized.

The above type of equipment configuration is currently utilized by other organizations in Haiti. Their communication requirements vary over a similar random selection of distances to those required by the Department of Agriculture.

The established performance, equipment availability, and lenient antenna demands, reinforce the system recommendation, for all applications where a cheaper VHF system cannot be utilized.

4.1.2 Very High Frequency (VHF) Propagation

This frequency spectrum, 30 - 300 MHz (10 - 1 Mtrs) has been partitioned by international agreement into several bands some of which are allocated for land fixed/mobil applications, The bands widely used in this application are:

30 - 50 MHz (10 - 6 Mtrs) commonly called Low Band, and

150 - 174 MHz (2 - 1.7 Mtrs) commonly called High Band

Practical propagation conditions vary between the two bands, but may be determined by established mathematical procedures. The available practical limit approximates to line of sight. This, however, is extended by the use of towers, and selected topographic features. The limitation imposed by the true earth curvature is further modified, sometimes adversely, by the refractive effects induced by variation with altitude of the atmospheric parameters of temperature, humidity and density.

Several of the localities under consideration lend themselves to the use of this sector of the spectrum, without employing costly hill-top repeaters. These include, Les Cayes Plain, the Cul-de-Sac Plain, L'Artibonite River Valley, and the Cap-Haitian area. Where topographic features permit, advantage is taken of the extension of range described.

Base and mobil units with 25 - 50 watts radiated power are recommended, with fixed station antennas mounted on 30 meter high support structures.

4.1.3 Ultra-High Frequency (UHF) Propagation

This frequency spectrum, 300-0 - 3000.0 MHz (1 Mtr - 100 cm), is also partitioned by international agreement with at least one band, 450-460 MHz, available for fixed/mobil land operation. The propagation characteristics are similar to those of VHF but propagation losses are higher. In areas of dense cultivation such as forests and plantations, absorption is high. Consequently this band is normally utilized over shorter distances and is not recommended in this application.

4.2 EQUIPMENT REQUIREMENTS

The equipment requirements are dependent on the area topography (whether VHF may be used or all HF equipment is required), the system procurement philosophy, and the existing facilities, especially relating to power availability and cost.

4.2.1 Topographical Limitations

The Cayes and Cul-de-Sac Plaines are naturally suited to utilization of a VHF network, with the attendant advantages noted in paragraph 4.1 above. Since these areas are key work areas, the establishment of VHF bases is recommended. Mobil VHF units powered by battery and rectifier-charger units may also be utilized advantageously at fixed sites for short hops, for example between Damien and the Port-au-Prince IHPCADE office and between the Hinche district office and Papaye, or wherever no telephone service exists. For the remaining paths, HF systems are indicated.

4.2.2 Procurement Philosophy

Agriculture priorities are not the same in each area, it is, therefore desirable to develop a system design which will allow initial implementation in some regions, followed by progressive implementation in other regions as circumstances require and permit. Design must assure that there will be no interface or interference problems between districts or between sequentially provisioned portions of the system. A complete system configuration is thus first required. This has been made based on the

communications terminals identified and shown in Table 3.1 and the propagation characteristics discussed in paragraph 4.1 above.

4.2.3 Cost Factors

The complete system configuration was developed with the following cost factors in mind:

a) VHF has been used where practical to reduce transceiver equipment expenditure.

b) Mobil units for both HF and VHF are used at fixed sites (instead of base station equipment) in order to

(I) Improve economies of scale in procurement

(II) Reduce unit costs (the mobil units generally being less costly than the base station units)

(III) Allow a failed unit (fixed or mobil) to be replaced by another (mobil or fixed) unit of less priority and thus improve ease of maintenance, and operational efficiency.

c) Telephone service (land line) is recommended between the district office and any other district authority wherever possible.

4.2.4 Existing Facilities

Those facilities required to support a communication network are shelter, electrical power and a place for the antenna. Mobil installations provide a good power source and a shelter, which although adequate for modern equipment, is not totally secure. In addition the vehicle provides a place to mount the antenna. VHF antennas are better suited to mobil mounting than HF antennas (which require loading coils or special impedance matching equipment).

Fixed sites provide good shelter, usually a closed building. Urban sites usually have electrical power but may lack suitable space for a dipole antenna, while rural sites frequently lack power but usually have adequate space for antennas.

4.2.5. Power

A source of electrical power must be available for each radio terminal. Table 4.1 shows power availability for those fixed sites identified in Table 3.1 which will be provisioned with equipment. Those sites not served now, or expected to be served with electrical power by the time of system procurement, must be provisioned with a generator capable of site needs. In addition, each fixed site requires a rectifier-charger which will operate from the alternating current power source and supply current to automobile type batteries. These must have an ampere hour capacity adequate to operate site radio equipment for a period of three days with 10% transmitter-on time. The site should thus be able to maintain communications during an emergency, when no mains power is available for three days. Using emergency procedures, equipment could be turned on for only scheduled periods. This should allow adequate time, during long term power disruption which frequently attends emergency situations such as the occurrence of hurricanes, for personnel to locate a vehicle whose battery is still charged.

4.3 OVERALL SYSTEM CONFIGURATION

The system design is based on the topography of the region, the social and organizational characteristics of the user needs, and technical and economic factors relating to the optimum procurement of those equipments. Materials and services required to establish, operate and maintain the system are also considered.

4.3.1 The Networks

The system is composed of a high-frequency radio network connecting the Department of Agriculture Headquarters at Damien to the other twelve agriculture district offices and to Gonave Island. Each district office also needs to communicate with such other activity centers as may be located within the district. Especially important is communication with BCA Regional Offices and the IHPCADE coffee centers. Four districts have PDAI activity in them to which communication is also required. The rural work sites are not shown on the map since activity may shift from time to time. The system configuration is also summarized in Table 4.2.

Site Designation: Number	Site Designation: Name	Authority Located at Site: Agriculture Dist. Office	IHPCADE	BCA	PDAI: Operations Office	PDAI: Research Station	PDAI: Rural Work Site	Power Source Description
1	Belle-Anse	x						Commercial Power
2	Belladeres	x						None
3	Cap-Haitian	x		x		x		Commercial Power
4	Les Cayes	x						" "
5	Gonaives	x		x				" "
6	Hinche	x		x				" "
7	Jacmel	x		x				" "
8	Jeremie	x		x				" "
9	Miragoane	x						" "
10	Petit-Goave	x						" "
11	Port-au-Prince		x	x				" "
12	Hq. at Damien	x				x		" " at Hq. only
13	Port-de-Paix	x		x				" "
14	St. Marc	x		x				" "
15	Gonave Island	*						Unknown
16	Baptiste		x					12KW Generator (Planned 78)
17	Beaumont		x					" " "
18	Changieux		x					" " "
19	Dondon		x					45KW " "
20	Fond-des-Negres		x	x				" " Opr. 110V/60Hz
21	Macary		x					12KW " (Planned 78)
22	Pilate		x					" " "
23	Thiotte		x	x				" " "
24	Ducis				x			Unknown
25	Jean-Rabel				x		x	None
26	Marigot				x			None
27	Thomazeau				x			Requires Connection

* Agricultural Center

Table 4.1 Power Availability

Site Designation: Number	Site Designation: Name	Authority Located at Site: Agriculture Dist. Office	IHPCADE	BCA	PDAI: Operations Office	PDAI: Research Station	PDAI: Rural Work Site	Power Source Description
28	Levy					x		Diesel Generator
29	Nan Vincent					x		None
30	Papaye					x		Unknown
31	Seguin					x		None
32	Marigot-Peredo						x	None
33	Pedernales						x	"
34	Dubreuil						x	5KW Generator on site
35	Avezac						x	None
36	Chantal						x	"
37	Desrodieres						x	"
38	Les Anglais						x	"
39	Melon						x	"
40	Moreau Fonfrede						x	"
41	Robert						x	"
42	Roche a Bateau						x	"
43	St. Louis du Sud						x	"
44	Duthill-Manneville						x	"
45	Mole St. Nicolas						x	"
	Total Sites	14	9	10	4	5	15	

Table 4.1 Power Availability
(continued)

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BACKBONE NETWORK			DISTRICT NETWORKS								
				Authority					Transmission Equipment		
						PDAI					
Ministry of Agriculture District Offices	HF/VHF - Transmission Equipment	Potential Funding Source for Equipment	District Activity Center	IHPCADE Coffee Centers	BCA Regional Offices	Operations Offices	Research Station	Work Sites	Land Line	HF/VHF	Potential Funding Source for Equipmnet
Belle-Anse	HF		Thiotte Thiotte	x	x				x	HF	073 -
Belladeres	HF		Baptist	x						HF	073
Cap-Haitian	HF	IBRD	Dondon Pilate Cap-Haitian	x x	x				x	HF HF	073 073
Cayes	HF VHF	PDAI PDAI	Changieux Ducis Levy Movable Units, 2 Mobil Network, 4 Mobil Network, 4	x		x	x	x		HF VHF VHF HF HF VHF	073 PDAI PDAI PDAI PDAI PDAI
Gonaives	HF		Gonaives		x				x		-
Hinche	HF VHF		Hinche Papaye		x		x			VHF VHF	
Jacmel	HF	PDAI	Macary Jacmel Marigot Sequin Movable Units, 2 Mobil Network, 8	x	x	x	x	x	x	HF HF HF HF HF	073 - PDAI PDAI PDAI PDAI
Jeremie	HF		Beaumont Jeremie	x	x				x	HF	073 -
Mirgoane Petite-Goave	HF HF	CIDA	Fond-des-Negres Fond-des-Negres	x	x				x	HF	073
Port-au-Prince (Damien)	HF VHF	PDAI PDAI	Port-au-Prince Damien Thomazeau Damien Movable Units, 2 Mobil Network, 4 Mobil Network, 7	x	x	x	x	x	x	VHF VHF VHF HF HF VHF	073 - PDAI PDAI PDAI PDAI PDAI
Port-de-Paix	HF	PDAI	Port-de-Paix Jean Rabel Nan Vincent Movable Units, 2 Mobil Network, 8		x	x	x	x	x	HF HF HF HF	- PDAI PDAI PDAI PDAI
St. Marc	HF		St. Marc		x				x		-
Gonave Island	HF		-								

Table 4.2

Complete System Configuration

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4.3.2 Bell-Anse District

Local communication in this district is proposed only between Belle-Anse and the coffee center at Thiotte. The disposition of various agencies within the Thiotte area permits the passage of internal traffic either by telephone or hand, without undue loss of time or efficiency.

4.3.3 Belladeres District

Only a link to Baptist is required from this district office.

4.3.4 Cap-Haitian District

Two HF links; one each to Dondon and Pilate are required. The BCA office will exchange traffic with Cap-Haitian District office by telephone.

4.3.5 Les Cayes District

Les Cayes region with its wide plain provides an opportunity to exploit the advanatages of very high frequency (VHF) communication Sites on the plain, (for example Levy and Ducis) and some mobile units will use this network. The remaining mobile units and those district sites located on the other side of the mountains (for example Les Anglais), or those in the mountains (Changieu), where line-of-sight to the district office does not exist, will communicate using HF Service.

4.3.6 Gonaives

Gonaives has no planned in-district radio links, the BCA traffic being passed by local telephone. Gonaives is located at the important road junction from Port-au-Prince, to Cap-Haitian and Mole St. Nicolas. Provision is therefore made for an interdistrict link to Jean Rabel, in order to coordinate surface traffic passing over the difficult mountain road between these centers.

4.3.7 Hinche District

Hinche, in addition to its HF link to Port-au-Prince, will utilize VHF to two outposts, namely the BCA office, and the research station at Papaye.

4.3.8 Jacmel District

The Jacmel region is very mountainous, therefore High Frequency communciation is necessary to provide a service. Macary, Marigot, Seguin and the district mobil units will all communicate with the district office or each other using this medium. The proximity of the BCA regional office to the Agriculture District office, however, allows for the easy handling of messages within Jacmel, by established methods.

4.3.9 Jeremie District

Jeremie will utilize an HF link to its coffee center, and use the local telephone for BCA office traffic.

4.3.10 Miragone/Petite-Goave

Although comprising two separate agricultural districts, Petite-Goave will be the area terminal for the backbone network. Traffic facilities to both Miragone and to the coffee center at Fond-des-Negres, will be effected on a local basis also utilizing HF communication.

4.3.11 Port-au-Prince District (Damien)

The requirements and topography of this district are such that VHF can be effectively utilized in some localities. Two district networks will therefore be operated, one HF and one VHF.

The links between the Damien District Office, two movable centers and four mobil units, will utilize HF.

The links between the IHPCADE office in Port-au-Prince, the Damien Research Center, Thomazeau, and four mobil units will utilize VHF. In addition, three mobil units utilizing this VHF channel will be available and at the disposal of the Minister, the Director General, and the Under Secretary, of the Department of Agriculture.

The Damien BCA office will communicate with the network operations room via telephone.

The HF equipment located at the Damien District Office will also be used for communication on the backbone link and will thus form the Control Center for communication purposes.

An additional VHF unit will be located at Damien. This unit will normally be used for the network serving their personnel.

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4.3.12 Port-de-Paix District

The Port-de-Paix district is similar to Jacmel in that the mountains make it necessary to use HF for communication. The BCA regional office, like Jacmel, is also located in town. All stations, Jean Rabel, Nan Vincent and the mobils will communicate with Port-de-Paix, and depending on propagation will be able to contact each other.

4.3.13 St. Marc

St. Marc, like Gonaives, presently has no planned district network.

4.3.14 Gonave Island

This link in the backbone network provides service to the island via the coffee center at Nan Cafe.

4.4 OPERATIONAL METHOD

4.4.1 Channel/Frequency Allocation Requirements

The Department of Agriculture in operating the system have two major requirements.

a) The facility for information exchange between the Department Headquarters and each of the regional District Offices - The Backbone System.

b) The facility for information exchange between designated District Offices and a number of fixed and mobil units within the jurisdiction of that office - The District Networks.

For maximum economy, this system design has maintained equipment requirements at the minimum commensurate with an effective service. To achieve this, the equipment utilized for the Backbone System is utilized as the control center for each District Network. This applies also in the case of the Headquarters equipment, which is used as the control center for the Port-au-Prince District Network.

Dual application of the equipment requires that the two facilities be operated on a time sharing basis. Discussions with the Department of Agriculture indicate, that on the Backbone System, traffic for all districts can be exchanged on a scheduled basis, while the local traffic in each District Network will be of a random nature. All District Networks can communicate with Headquarters, and in many cases with each other. It follows therefore, that for random usage in each area, without mutual interference, each district that

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operates its own network requires its own unique channel. This is achieved by the allocation of a separate frequency for each District Network.

Some District Networks are provided with two additional Operational Centers, and mobil units. These facilities may be required to operate in two more random combinations, necessitating two more unique channels. A potential total of 21 district and local networks therefore exists, which creates a requirement for that number of individual frequency allocations plus one additional frequency for the Backbone System.

To obtain maximum flexibility of equipment, and operational advantage each unit requires the facility to operate on a number of channels. Since the maximum number of local networks required in any District Network is three, the maximum number of channels required on any equipment is three for the District Network and one for the Backbone System; a total of four channels. This facility, when considered in conjunction with the utilization methods subsequently outlined, will be seen to have further intrinsic operational advantages. The general nature of agricultural activities is such that nocturnal activity is negligible. Consequently no provision has been made for an additional night frequency allocation. Nocturnal communication may be required, and should the normal day frequency prove unsatisfactory, the situation will probably affect only the extreme links used in the Backbone System. Thus only one further frequency allocation would be required, at the low end of the frequency range. Equipment with a minimum of four channels therefore meets the anticipated requirement, though equipment with facility for five or six channels could prove advantageous.

A number of Districts are to be equipped with VHF units. This frequency band is better suited to the specific terrain and intended for local use. This equipment is not capable of operating on the Backbone System channels, neither is its range sufficient to cause mutual interference between the districts for which it is recommended. Facility for four channels is called for in the equipment specification. Four frequency allocations should therefore be obtained and all equipments activated on these allocations. A fifth frequency allocation, however, will permit selected units to be activated on a channel to which there is limited access, for the loss of one of the channels generally available. This provides a discreet channel that may be utilized as required. It should be noted, however, that the facility is not secure, since other organizations within communicating distance may well possess

equipment with access capability to that channel. Methods of utilizing these facilities are outlined in 4.4.2.

4.4.2 Utilization Methods

The methods of utilizing the two systems and the limitations imposed by the provision of common equipment is best understood by first describing the VHF system. This system is totally independent within one District Network, and therefore does not suffer the limitation of channel allocations to the Backbone System, nor of communicating time lost, for the same reason.

4.4.2.1 VHF District Networks

To describe the use of this system a hypothetical district equipped only with VHF is utilized . Four channels are available and are designated for example, as follows:

Channel A = Area
Channel B = BCA Office
Channel C = Coffee Center
Channel D = District Office

The equipments located at the BCA Office, Coffee Center, and District Office, are switched to, and are therefore, monitoring channels B,C, and D, respectively. Mobil Units, and fixed units not designated are switched to channel A. Area communication between mobils, etc., takes place on this channel, each unit being identified by its own unique name or call-sign.

Should any one of these units require to communicate with the B.C.A. Office, Coffee Center, or the District Office, he switches to the appropriate channel and listens. If no conversation is in progress, he calls that office and communicates. On completion he returns his equipment to Channel A to make himself available on the Area Network.

Should one of the designated offices B,C, or D wish to communicate with one of the mobil or undesignated fixed units, he selects channel A, waits for a quiet period, identifies the unit required and instructs him to call. On receipt of the instruction the required unit selects the appropriate channel B,C, or D, thus removing himself from the area network. He then proceeds to establish communication as instructed, as if he were initiating the call.

When any designated office requires to communicate with another designated office, he selects the appropriate channel and listens. If no traffic is being passed, he calls, establishes contact and communicates. Should no answer be received, the situation is analogous to receiving no reply when attempting to establish a telephone call. Either the party being called is

busy or not available to reply. The caller should therefore, switch back to his designated channel, and attempt the call at a later time. On completion of a conversation, the equipment is switched back to the designated channel.

It will be seen from the above example, that by utilizing this method and rigidly disciplining users to select the allocated channel when not actively communicating, the maximum communication advantage will be available at all times. The example demonstrates only the principle to be used, the activities of the designated offices will therefore vary in practical networks, depending on equipment deployment proposed for the specific Network.

Variations of the principle may be devised and utilized to satisfy the particular needs of each District Network. This is best demonstrated with a second hypothetical example.

Suppose two separate areas of activity are required within a specific District Network, the following channel allocations might be adopted.

Channel A = North Area
Channel B = South Area
Channel C = Research Center
Channel D = District Office

Two vehicles and the BCA office are allocated to Channel A, and always revert to "A" channel. Two vehicles and the Operations Office are allocated to channel B and they always revert to "B" channel. By using exactly the same procedures as those outlined in the previous example, two general activity networks are now available to operate independently, while still retaining mutual access between each other and the designated offices.

4.4.2.2 HF District Networks

The District Networks that operated on HF equipment also have four channels which should be utilized in a similar manner. However, as one channel (The District Office channel) is also the Backbone System channel a marginally different procedure must be adopted for in-district communication on this channel. Again assume the hypothetical network with the following channel designations

Channel A = North Area
Channel B = South Area
Channel C = Operations Office
Channel D = District Office/Backbone System

Allocations are made as required in the hypothetical district and all units revert to their specifically allocated channel when not actively communicating.

Should District Office require to communicate within his district, he selects the appropriate channel A,B, or C, and establishes his call. On completion he reverts to channel D.

Should a unit allocated to channel A, B, or C wish to communicate with the District Office, he selects channel D and listens. If no traffic is in progress he requests District Office to call him on his, (the callers) own channel. The caller then reverts to his own channel and awaits the return call. This minimizes random traffic time on the channel allocated to the Backbone System.

It will now be apparent that by using the above procedures the following advantages are realized.

a) No major limitation of in-district communication occurs while Backbone System traffic is being handled.

b) All districts are in continuous contact with Headquarters, except when specifically communicating in-district.

c) All units operating with this type of equipment have immediate access to the Backbone network, should the need arise.

It will also be apparent that as the equipment is potentially capable of communicating with any other point in the country and surrounding area, a unique frequency allocation is required for channel A,B and C of each district. Channel D, however, will be tuned to the same frequency on equipments of this type, regardless of District or location.

It also follows that should a piece of equipment be transferred from one district to another, channel A,B and C will require to be reset to the frequencies utilized in the new district. This may require the services of a qualified technician, depending on the equipment chosen. Some common usage of frequencies in two districts may be possible by use of the USB/LSB facility called for in the equipment specification, although this facility may be limited by conditions which in practice permit, Upper Side Band only, or Lower Side Band only. However, should both be permissable it is possible, that Les Cayes District, and the Port-de-Paix District could operate with identical frequency allocations for channels A,B, and C. One district would use USB on all channels, while the other would use LSB on all channels. On channel D, however, an arbritrary choice of USB or LSB must be made by the Department, and used in all districts.

4.4.2.3 Special Facility

The Port-au-Prince District has a proposed additional complement of three mobil units and one fixed unit in the VHF District network. Bearing in mind that this has potentially only district communciation facility and no access to the Backbone System, considerable advantages may be obtained with the allocation of a fifth frequency.

The three mobil units are each activated on three of the four generally used frequencies, with the additional allocation on the fourth channel. The second of the two fixed units at Headquarters is equipped in a similar manner. The fixed station now has access to three channels on two units to provide increased reliability, and access to each of the other two channels on one or other of the two units. Thus a discreet channel is available between the three selected mobils and Headquarters, without the loss by Headquarters, of access to any of the normal channels.

The appropriate Headquarters unit will always revert to the special channel, as will the three mobils, when not specifically communicating on another of the available channels. Figures 4.1, 4.2, 4.3, 4.4, illustrate the disposition of equipment in four of the more complex District Networks.

4.4.2.4 Backbone System

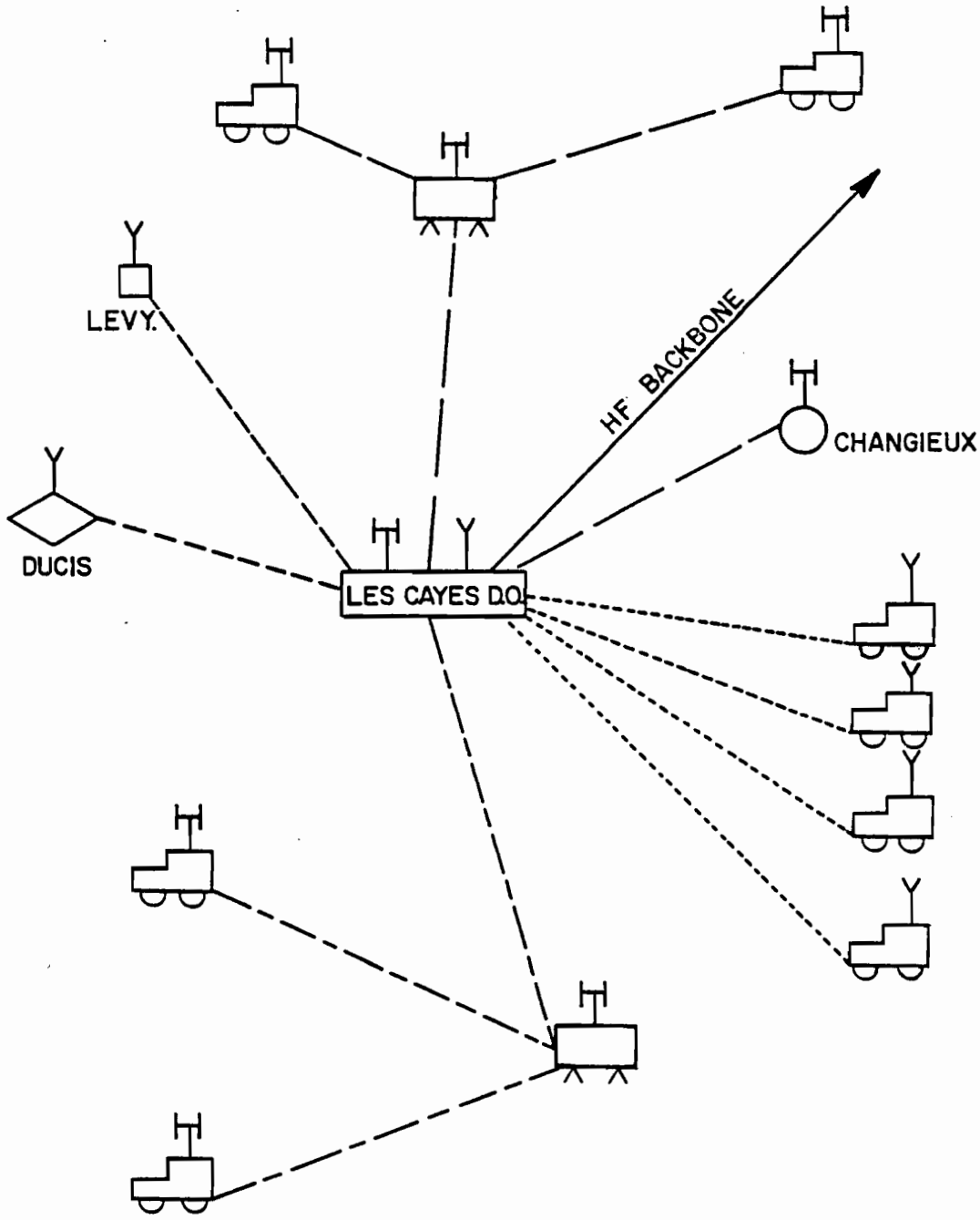
The availability of this system and its random utilization will be apparent from the discussion of HF District Networks in 4.4.2.2 above. Specific routines and procedures are now outlined to assist in establishing an efficient communication pattern.

All district offices revert to this channel and are therefore potentially in contact with Headquarters at all times. "At all times", may be defined as twenty-four hours per day, 7 a.m. to 8 p.m., or such other periods that may be required, as defined by the Department of Agriculture, limited only by adverse propagation conditions.

The amount of traffic to be exchanged, and time required to pass it, is determined by department activity, and information content. A flexible system of scheduling and traffic assessment has therefore been devised, to meet what may be a wide variation in traffic time requirement.

The schedule or Communication Program comprises a broadcast by Headquarters of general information and instruction, followed by a Traffic Check. A traffic check requires that each district office, in sequence indicates

LES CAYES DISTRICT NETWORK



LEGEND

- IHP CADE
- RESEARCH
- P.D.A.I.
- MOVABLE OFFICE
- MOBIL UNIT.
- HF "D" CHAN
- HF "B" CHAN
- HF "A" CHAN
- VHF "A" CHAN
- VHF "B" CHAN
- HF EQUIP.
- VHF EQUIP.

FIGURE 4.1
EQUIPMENT DISPOSITION
CAYES

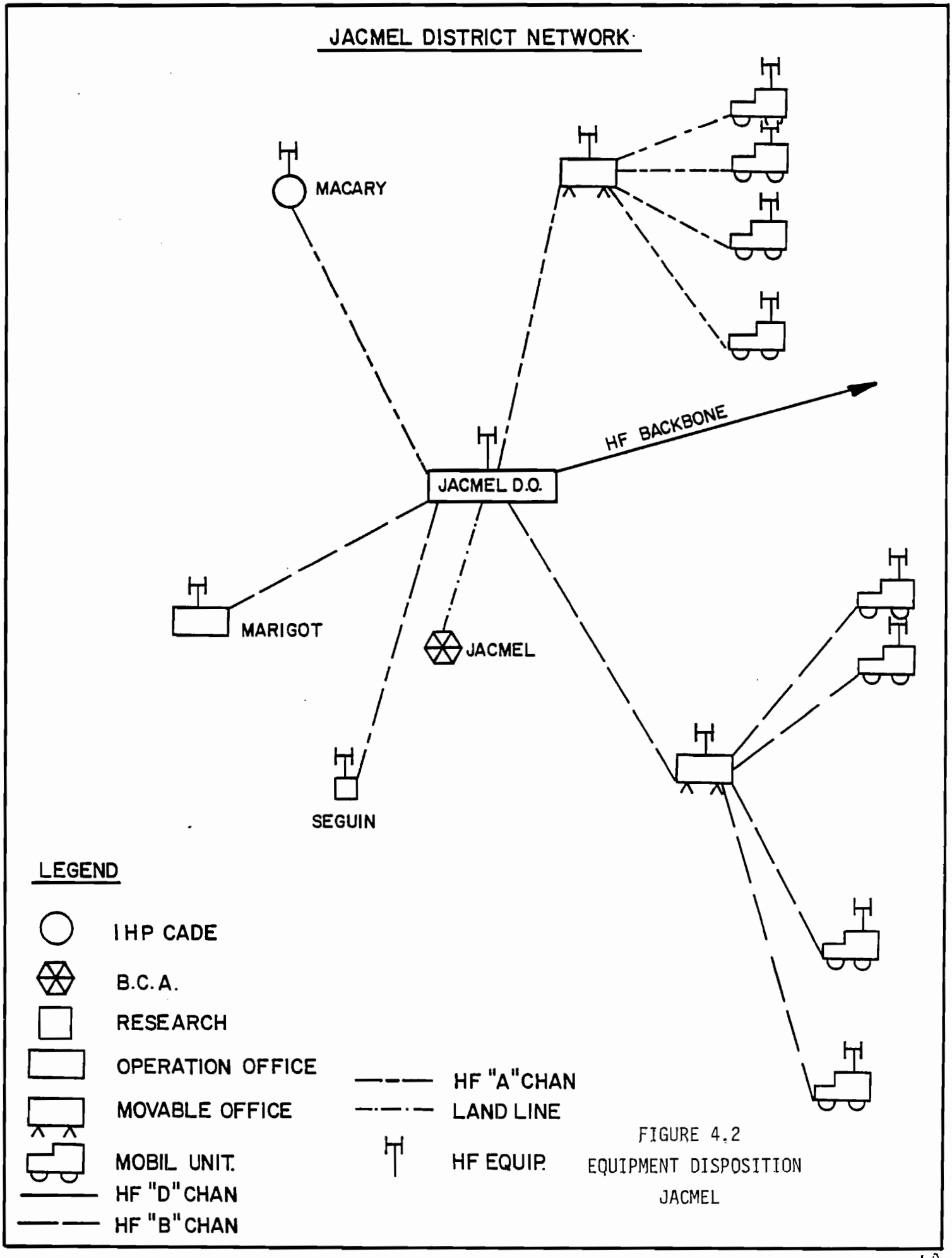


FIGURE 4.2
EQUIPMENT DISPOSITION
JACMEL

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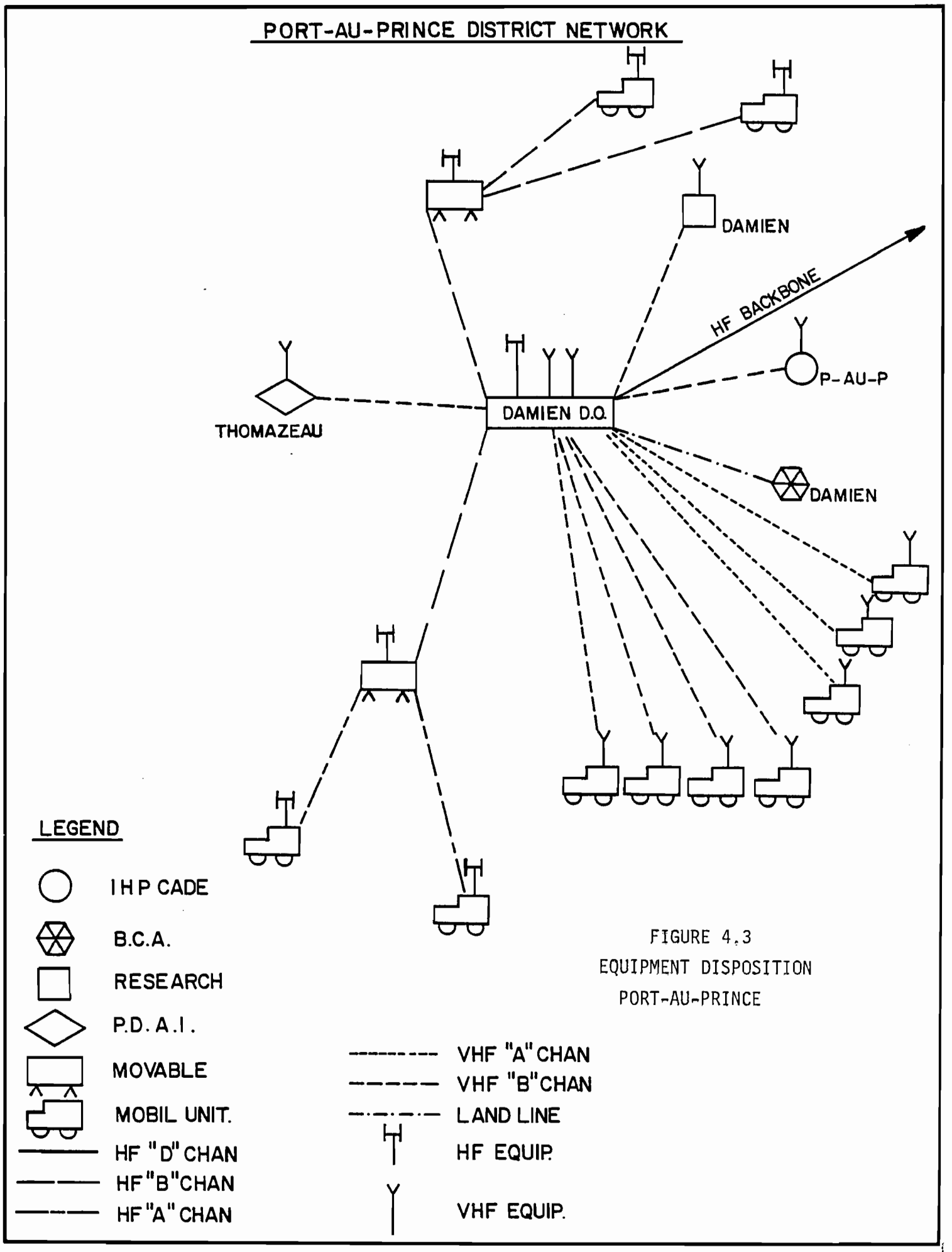

FIGURE 4.3
EQUIPMENT DISPOSITION
PORT-AU-PRINCE

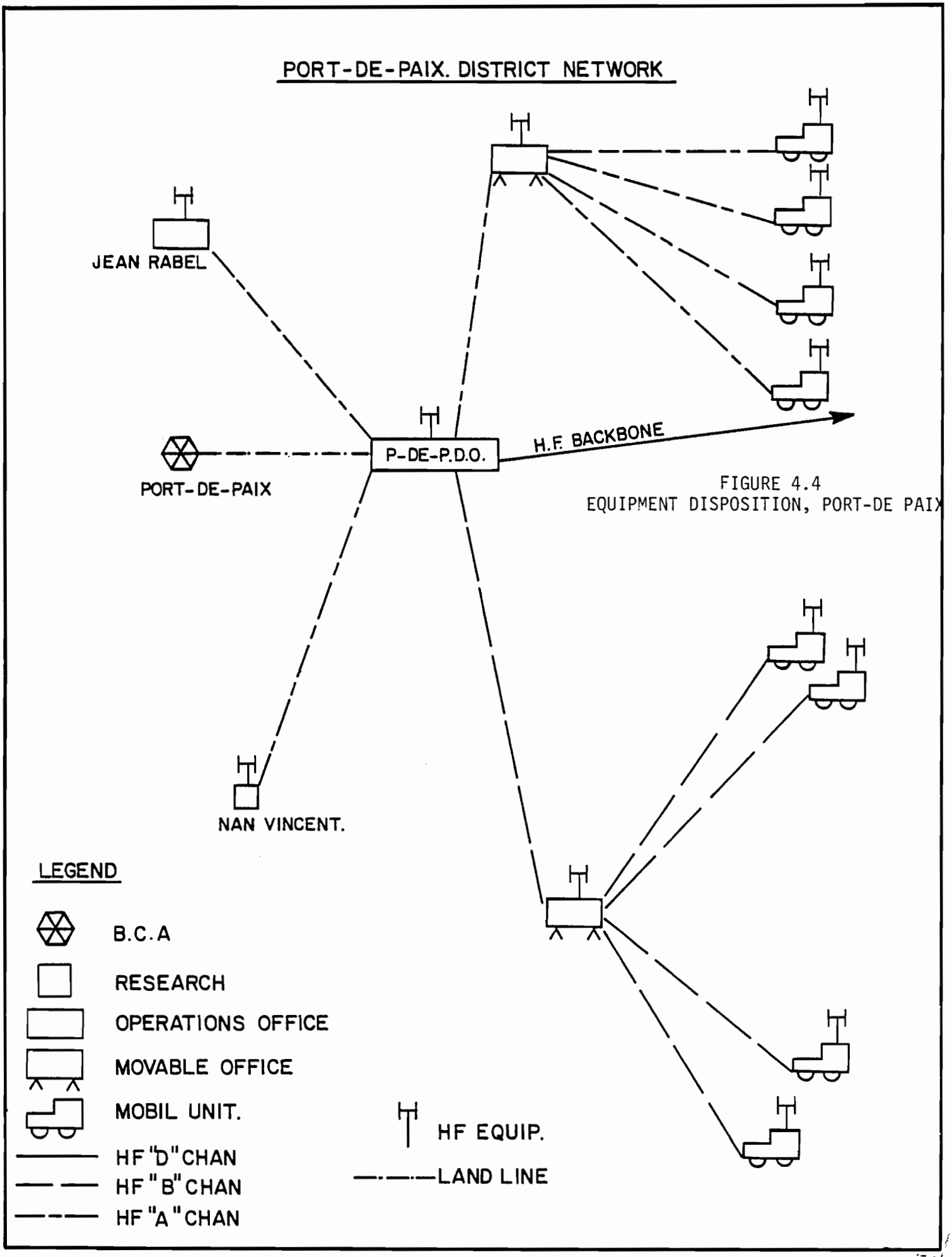

FIGURE 4.4
EQUIPMENT DISPOSITION, PORT-DE PAIX

the number of messages that it has in hand for transmission. The Headquarters station similarly indicates the number of messages in hand for that particular station. No traffic is exchanged at this time, the procedure being basically a method of establishing which stations are operational, confirming two-way communication and assessing the days traffic.

With twelve stations to call in, this phase of the procedure, subsequent to the broadcast, should require no more than five to six minutes. This brevity, will only be achieved, however, when confidence in the system has been established, and the individual offices have learned their position in the "call-in" pattern. The use of maximum economy of words in the transfer of intelligence further contributes to efficiency. Headquarters station controls this "call-in" while recording its statistical content. He does not wait for a station that does not respond at the appropriate point in the "call-in" but notes the fact, and then calls the next station in sequence. By passing over a station in this manner, time is not lost by the remainder of the offices, in consequence of failure, for whatever reason, of one or two stations. The reason for failure to call-in will be ascertained by the next phase of the communication program, or by alternative methods.

The final phase, of the communication program is the Traffic Schedule. This requires that each office is allocated a specific time of the day at which he will "call-in" with his traffic. Assume for example that the exchange of messages with any selected office requires an average of ten to twenty minutes of communicating time. The twelve stations are scheduled to call, each at a specified time, at half hour intervals throughout the day. The total schedule will require six and a half hours per day, and absorb the major part of the working day. This, however, is not of major significance to the individual district offices, since each District Administrator knows his scheduled call time and his day may be planned accordingly.

It will be noted that thirty minutes of communication time has been allocated for an anticipated average of fifteen minutes traffic handling time, in respect of each district office. This is desirable within this specific system as it possesses several advantages, some of which are now given. These are all described assuming stations are scheduled to call on the hour, and at thirty minutes past the hour, and that the traffic between each station and Headquarters is completed within fifteen minutes.

a) A period of fifteen minutes is available for Headquarters to distribute the last traffic input, and prepare the next traffic output.

b) Headquarters and the scheduled station have time to request clarifications, and exchange any unrecorded intelligence.

c) All local stations are aware that traffic density will be low for fifteen minutes before the hour and half hour, thus giving them access to their own District office for a number of minutes every half an hour throughout the day. It should be remembered that if the correct District network procedure is adopted, only fifteen seconds of traffic time is required by any local unit. Thus a typical daily schedule might be as shown below.

0700 - Listening watch
0800 - H.Q Broadcast, followed by call-in by districts
0830 - Bell-Anse Traffic
0900 - Belladeres Traffic
0930 - Hinche Traffic
1000 - Cap-Haitian Traffic
1030 - Port-de-Paix Traffic
1100 - Gonaives Traffic
1130 - St. Marc Traffic
1200 - Gonave Island Traffic
1230 - Jeremie Traffic
1300 - Les Cayes Traffic
1330 - Petit-Goave Traffic
1400 - Jacmel Traffic

It will be seen that all scheduled traffic is cleared by 1415 hours. For the remainder of the day a listening watch is maintained by the Headquarters station, and by such other District offices as staff availability will permit. The responsible officer at each district office is withdrawn from his other duties for an average of fifteen minutes at 0800 and a further fifteen minutes at his scheduled traffic time.

4.4.2.5 Modification of Utilization

The methods of use and program of schedules outlined above demonstrate a practical way in which the two systems may be utilized. They do not represent a rigid procedure which must be strictly adhered to, and they will require modification as the user gains experience, and the demands on the system change with seasonal activity. A typical modification is the provision of the special link between Gonaive and Jean Rabel. This is quite simply achieved by arranging for a channel on one or two units of the equipment in the Gonaives district to operate on the same frequency as one of the channels allocated to Jean Rabel.

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SECTION 5

RECOMMENDATIONS AND CONCLUSIONS

5.1 GENERAL

This study is based on the Work Order requirement that a dedicated radio telecommunications system be designed for the Ministry of Agriculture. This study has established that such a system should fulfill many of the requirements of the Ministry and can be integrated with the radio requirements of the Bureau of Agricultural Credit and the Coffee Institute. The system has been designed accordingly, taking into consideration the unique features relating to system purpose, coverage area, and local conditions.

5.2 METHOD OF PROCUREMENT

Based on an analysis of the requirement and on discussions with AID and GOH personnel, it has been determined that a competitive procurement should be used. It is recommended that the facilities be purchased as a total turnkey system. Accordingly, a Request for Proposal (RFP) document has been prepared (Appendix C) which can be used for implementation of this project. Prior to issuing the RFP, it is recommended that the procuring agency check the equipment requirement list to assure currency of information; this list is provided in Figure 2.3, which lists the quantity of equipment to be provided by the contractor. The power system generator requirements are based on Table 4.1 in this report; it is noted that the actual generator implementation in some areas may differ from that stated in the table; in addition, the equipment at some sites (no. 15, 24 and 30) was unknown at the time the data was gathered. Changes in this Figure should be made as applicable.

5.3 SECURING A CONTRACTOR

The RFP may also require modification to insure that certain potential Bidders are not discouraged by either the scope of required work or

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the general terms and conditions of contract. It may be necessary to make provision for modifications in the general terms and conditions to encourage such bidders to respond. In the event that the response by qualified local bidders is considered to be insufficient, or that basic system goals may be compromised, it is recommended that professional help be secured, as applicable, to aid in the process of modifying the proposal request, evaluation of proposals, and negotiation of the contract.

APPENDIX A

SITE SURVEY REPORTS

These reports briefly describe the conditions at fixed sites where equipment may be emplaced. They are included in this report for reference. They may be valuable to prospective bidders to whom this appendix could be given with the request for proposal documentation.

Site Survey Report

I. Site Identification

Name Les Cayes District Agriculture Office

Address Rue General Borgella 27
Les Cayes

Operating Authority Department of Agriculture
Government of Haiti

II. Site Description

Equipment Location Ground Floor

Building Description

Orientation Building is on the north side of a street which runs approximately E-W ($\approx 285^{\circ}$ - 95°)

Length approximately 40 meters

Width approximately 15 meters

Height 3 storey

Roof Pitch $\approx 30^{\circ}$

Roof Construction corrugated metal

Note: the availability of this building is not sure. It is presently rented but may be purchased by the Dept. of Agriculture. If not available, the new office area must be resurveyed.

Radio Room Description

Size adequate space in any of several ground floor office areas.

Adjacent place or space to mount antenna dipole could be mounted above roof on N-S line of building.

Power Available 110VAC Commercial power. 220 will be available. No present emergency power supply.

III. Other

Date 21 September 1978 Time 0900-1010 hours

Survey Team (Names) RE Hartman, A W Jemere

Individuals Showing Site

District Agronome		Mr. Max Mondēsir
Director of Operations	PDAI	Mr. Fritz Boutin
Research Specialist	PDAI	Mr. Claude Grand - Pierre
Soils Conservation Specialist	PDAI	Mr. Mike Stapleton

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Site Survey Report

I. Site Identification

Name Dubreuil Cayes Operations Office

Address Cayes Plain

Operating Authority Department of Agriculture, PDAI

II. Site Description

Equipment Location Upper floor office

Building Description

Orientation Building is on the south side of a road which runs approximately E-W (= 290° - 110°)

Height two storey

Roof Pitch small

Radio Room Description

Size adequate for equipment

Adjacent place or space to mount antenna Above the roof or on a mast supported by the side of the building is space to mount a vertically polarized antenna. Adjacent fields provide adequate space to mount dipole antennas.

Power Available No commercial power. A 5kw 120V Airco generator (5 gal tank) is on site but not yet connected into building wiring. It is planned that a 54 gallon fuel drum will provide on site fuel storage.

III. Other

Date 21 September 1978 Time 1150-1230 hours

Survey Team (Names) R. E. Hartman A. W. Jemere

Individuals Showing Site Agronome Mr. Fritz Boutin
Engineer Hugues Bien - Aime
Engineer Mike Stapleton

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Site Survey Report

I. Site Identification

Name Fond-des-Negres

Address National Route 200 between Miragoane and Aquin

Operating Authority BCA and IHPCADE

II. Site Description

Equipment Location Any of several offices good places

Building Description

Orientation Building is on the west side of entrance road running essentially N-S from the main E-W National route.

Radio Room Description

Size adequate

Adjacent place or space to mount antenna Hill rises to west (behind) the office building. Exact placement should be decided by installation contractor who will optomize location.

Power Available None

III. Other

Date 22 September 1978 Time 1030-1135 hours

Survey Team (Names) R.E. Hartman A. W. Jemere

Individuals Showing Site Engineer Chuck Pettis

Site Survey Report

I. Site Identification

Name Jacmel District Agriculture Office

Address 9 - Rue Boirond Tonnerre
Jacmel

Operating Authority Department of Agriculture

II. Site Description

Equipment Location ground floor, area at foot of staircase

Building Description

Orientation N side of E-W street

Length 18 meters

Width 12 meters

Height 2 storey

Roof Pitch small

Roof Construction corrugated metal

Radio Room Description

Size 3M x 3-1/2 Meters

Adjacent place or space to mount antenna A dipole may have to also occupy space over the adjacent building to the east. Some space exists behind the building. If used, tall masts will be required.

Power Available Commercial, 220 VAC

III. Other

Date 28 September 1978 Time 0840-0930 hours

Survey Team (Names) R. E. Hartman

Individuals Showing Site Agronome of Jacmel Mr. Erick Noailles

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Site Survey Report

I. Site Identification

Name Marigot Operations Office

Address Route to Jacmel (Main Street)

Operating Authority Department of Agriculture, PDAI

II. Site Description

Equipment Location upper floor, front room

Building Description

Orientation Building on N side of street which runs essentially E-W (295° - 115° approx.)

Length 34 feet (measured)

Width 17 feet (measured)

Height two storey

Roof Pitch small

Roof Construction corrugated metal

Radio Room Description

Size 10 feet x 17 feet (measured)

Adjacent place or space to mount antenna There is a large space behind the building which might be used to mount a dipole antenna.

Power Available None

III. Other

Date 28 September 1978 Time 1102-1120 hours

Survey Team (Names) R. E. Hartman

Individuals Showing Site Agronome Mr. Francois Severin

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Site Survey Report

I. Site Identification

Name Macary Coffee Center

Address Main road Seguin to Marigot

Operating Authority IHPCADE & BCA

II. Site Description

Equipment Location room off main entry adjacent to both BCA & IHPCADE planned offices.

Building Description

Orientation long axis of building approx. 310° - 130°

Roof Pitch low

Radio Room Description

Size 6 feet x 6 feet. Vents at top will allow easy access for transmission line to antenna.

Adjacent place or space to mount antenna More than adequate space for a dipole with any orientation.

Power Available 110VAC test generator or site. Will later be removed and 12 kw unit installed.

III. Other

Date 28 September 1978 Time 1230-1325

Survey Team (Names) R. E. Hartman

Individuals Showing Site Agronome Mr. Eddie Martin
and Mr. Fritz Marcelin

Site Survey Report

I. Site Identification

Name Seguin Research Station

Address Seguin

Operating Authority Department of Agriculture, PDAI

II. Site Description

Equipment Location small office at foot of stairway located in the SE corner of the building

Building Description

Orientation Essentially E-W

Height two storey

Roof Construction corrugated metal

Radio Room Description

Size 9 foot by 9 foot

Adjacent place or space to mount antenna adequate space to emplace antenna.

Power Available None

III. Other

Date 28 September 1978 Time 1435-1445

Survey Team (Names) R. E. Hartman

Individuals Showing Site Agronome Mr. Fritz Marcelin

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Site Survey Report

I. Site Identification

Name Jean Rabel PDAI Operations Office

Address Rue Bois Change, Jean Rabel

Operating Authority Department of Agriculture, PDAI

II. Site Description

Equipment Location along east wall, 2nd room

Building Description

Orientation on south side essentially E-W street (100-280°)

Length approx. 10 Meters

Width approximately 25 meters

Height single storey

Roof Pitch small

Roof Construction corrugated metal

Radio Room Description

Size 13.8 feet x 12.5 feet

Adjacent place or space to mount antenna dipole car be strung from poles, one placed at front of property, other along driveway on east side of house. Care must be taken to assure that the transmission line is kept away from the edge of the metal roof as it pases toward the window area behind which the radio equipment will be placed.

Power Available 110VAC generator (not operative at the time of visit).

III. Other

Date 03 October 1978 Time 1350-1405

Survey Team (Names) R. E. Hartman

Individuals Showing Site Agronome Michael Williams

Site Survey Report

I. Site Identification

Name Ministry of Agriculture Headquarters Building

Address Damien

Operating Authority Department of Agriculture

II. Site Description

Equipment Location any of the rooms, first or second floor

Building Description

Orientation facade 50° - 230°

Length approximately 100 meters.

Width approximately 20 meters

Height 2 storey, approximately 12 meters

Roof Pitch approximately 30°

Roof Construction corrugated metal

Radio Room Description

Size any of the rooms will be adequate

Adjacent place or space to mount antenna there is space behind the building to place poles.

Power Available Commercial, 110VAC

III. Other

Date 06 October 1978 Time 1200-1220 hours

Survey Team (Names) R. E. Hartman

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Site Survey Report

I. Site Identification

Name Thomazeau PDAI Operations Office

Address Rue Terrasse
Thomazeau

Operating Authority Department of Agriculture, PDAI

II. Site Description

Equipment Location upper floor, enclosed room, along NW wall

Building Description

Orientation NE-SW street approximately 50° - 230°

Length 37.5 feet

Width 20.6 feet

Height two storey

Roof Pitch not visible, said to be flat

Roof Construction concrete

Radio Room Description

Size 11 x 11 feet

Adjacent place or space to mount antenna On roof. Antenna should be elevated to adequately clear the roof of the building to the south (it is about 3 meters higher).

Power Available None connected into building at the moment. A power line crosses the street almost in front of the house. Adjacent buildings are connected. The voltage is not known.

III. Other

Date 06 October 1978 Time 1400-1410 hours

Survey Team (Names) R. E. Hartman

Individuals Showing Site Luckner Collot, Mamie Yves - Rose Theodat

APPENDIX B

CONTACT REPORTS

These reports are included in this report so that the interested reader may gain a better understanding of telecommunications operations, procurement and maintenance conditions in Haiti. They individually discuss significant factors and taken collectively they provide added perspective.

CONTACT REPORT

1. DATE & TIME OF CONTACT: 20 September 1978 1418-1435 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Oblate Fathers Mission
   Les Cayes Father Brusso

3. PURPOSE OF CONTACT: To gather information about ratio communication operations in Haiti from a network operator.

4. RESULT OF CONTACT IN BRIEF: The Oblate Fathers have a high frequency communication network to coordinate their mission service. The net operates on 3700 kHz. Other stations are located in Camp Perrin, Cap-Haitian, Capotille, Carise, Chardonnieres, Coteaux, Damassin, Ferrier, Les Anglais, Mt. Organise, Port-au-Piment, Port-au-Prince, Port Salut, Quanaminth, Rendel, Roche-a-Bateau and Tiburon. They use 8 to 10 Yaesu FT101 SSB units (260 W PEP) and the remaining sites use old AM equipment. Antennas are dipoles.

   Year round daily service is good, occasionally varying with sunspot cycle.

   The Port-au-Prince contact is Father Omar Duplesis at 40 N. Avenue.

CONTACT REPORT

1. DATE & TIME OF CONTACT: 20 September 1978 1445-1600 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Sangamo Barter Construction Company, Les Cayes, Project Manager Mr. G. E. Brister

3. PURPOSE OF CONTACT: To gather information about radio communication operations from a network operator.

4. RESULT OF CONTACT IN BRIEF: Sangamo Barter is contracted to upgrade the national route going to Les Cayes. They operate both a VHF repeater for communication with the mobil units along the work path, and a HF station for communication with the office in Port-au-Prince.

   1) The HF Net. This net operates on 4010 or 7340 kHz using a 125 PEP SSB unit made by Radio Systems Inc. of Rochester, N.Y. (Model SR 204). Two dipole antennas, one for each frequency, are used. These are both strung from the same poles with the lower frequency antenna mounted beneath the higher frequency unit. Beneath both is a trailer with a metal covering. Operational experience has resulted in a reported 75 to 90% reliability. During a visit to the site on 21 September between 1550 at 1700 hours, the net was in operation to Port-au- Prince on 4010 kHz. It was noted that the equipment signal strength rated on the recognized 1-5 scale as being readability 3, Signal strength 4. The readability was lower than expected due to the static which is presumed to have been originated by local storms which later brought rain to the area. It is believed that service would be better if the antennas were remounted placing the shorter dipole below the longer one and getting more clearance below and adjacent to them.

   2) The VHF Net. This net operates with the base/repeater unit and 18 mobil units. The base uses a 100 Watt Motorola Micom unit. The mobil units are 100 Watts, two channel Motorola equipment. The systme operates in the 43 MHz frequency range. The base station is located in a shack atop a nearby hill, approximately 80 feet above the surrounding land. A 70 foot tower mounts a ground plane antenna fed by heliax. Remote operation is by a two-wire tie-line from the shack to the manager's office trailer.

Operations are reported to be possible out to 25-50 miles in the base-to-mobile mode and up to 15-20 miles mobil-to-mobil. On 21 September after servicing of the base station unit, VHF service was monitered coming from the Aquin area, about 35 miles distant. The signal strength was not high enough for full FM received quieting, but it was readable without any difficulty. (R-5)

3) TPTC (Travaux Publique por Transport et Communication) VHF Net
In addition to the Sangamo Barter VHF Network, the same antenna tower and radio shack are used to emplace identical antenna and base station equipment for TPTC. This net has 6 to 8 100 watt mobil units operating at 44.3 MHz. They are also reported to have access to the Miragoane repeater for relaying into Port-au-Prince, a service Sangamo Barter would also like but which is not available due to reported lack of channels. The TPTC base repeater is not operative. During an inspection of the facility, the control line was found to be severed and left open circuited in a field and the line cord for the repeater was found to have its plug pulled from the mains outlet boxes. The reason for this is not known.

4) Maintenance and Service Experience. This $50K system was purchased from Motorola in the U.S.A. and not through the Port-au-Prince franchised dealer. Problems were encountered getting the system operative, evidently, due to an error at the factory which required reordering crystals. It reportedly took two orders to get the right crystals for the Sangamo Barter equipment and four orders before the right crystals arrived for the TPTC system. All details of the problem are not clear, but when asked about this problem, the franchised dealer indicated that if he had not been bypassed, his service could have been immediately available to help, and in fact the problem was solved only after he did become involved.

At the time of this interview, Sangamo Barter was having trouble with their equipment, the received signal level having been dropping continually over a period of several weeks to an almost unusable low level. The project manager reportedly tried to obtain service on several occasions, "at any price" but was unable to get someone from the franchised dealer to come to Cayes.

Hoping to be able to reciprocate Sangamo Barter for their time and information of this interview, it was suggested that perhaps some simple adjustment could be made to temporarily make the equipment usable. On 21 September the facility was again visited. Mr. Brister authorized the replacement of three modules removed from the Sangamo Barter equipment. This cured the problem: The three modules were then packed and brought to Port-au-Prince for delivery to the franchised dealer. While in his office a phone call was received (believed to be from Cayes) from an agent who reportedly went to investigate the equipment problem. The dealer indicated he had planned to send someone there the next day.

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5) Conclusion. The lack of in-country service availability caused Sangamo Barter to have both initial operations problems and later maintenance problems. This availability is usually reserved for sales customers who have made their purchase through the franchised dealer.

CONTACT REPORT

1. DATE AND TIME OF CONTACT: Monday 25 September 1978 1410-1515 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Fritz Electronics Communications Co. Mr. Fritz Joassin, General Manager; Boulevard Harry Truman, Port-au-Prince

3. PURPOSE OF CONTACT: To gather information about maintenance service availablity.

4. RESULT OF CONTACT IN BRIEF: Mr. Joassin kindly gave us over an hour from his busy schedule, discussing operations and maintenance problems in Haiti, including showing his service shop. His company is staffed with three technicians, installers and office help, eight total.

   The service area is a room approximately 5x5 meters with work benches along about half the wall area. A good complement of test equipment, including several specialized Motorola test units were noted. Both a good parts cataloging and a filing system were noted. The shop was impressively organized and neat.

   During a general discussion, Mr. Joassin observed that his experience shows that 100 watts PEP SSB operation from 3 to 7 MHz will cover the country, both day and night. He is also involved with the VHF repeater stations in the country. He further explained some service problems, for example, to service one customer located in the Anse d' Hainault region, access is available only by helicopter or boat (the roadways being not always possible, or too rough for the safe transport of the needed test equipment). As well organized as the service appears, the small staff and shop gave Mr. Joassin ample opportunity to be selective with interests who would compromise his reputation, as for example one customer who had to havehis equipment rewired twice because rats had damaged the installation, when the customer should have secured the equipment shelter against the entry of vermin. Selectivity of service is further realized by generally limiting business to those sales customers who contract for maintenance.

5. CONCLUSION: Mr. Joassin appears to be a capable, serious and well organized businessman who is jealously guarding his company's reputation and position.

Also See Contact Report of 27 September 1978

CONTACT REPORT

1. DATE & TIME OF CONTACT: Tuesday 26 September 1978 0900-0930 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Mr. David Sendral, Jr. Carribbean Services, 32 Rue Americaine, Port-au-Prince

3. PURPOSE OF CONTACT: To gather information about maintenance and service availability.

4. RESULT OF CONTACT IN BRIEF: This import organization is the agent for several companies and they have their own agent in Miami. They advised that they submitted a proposal to Damien about three months ago for a system using ITT equipment out of Puerto Rico. It could not be determined if the proposed equipment were manufactured in Puerto Rico or elsewhere. Their proposal also provided for installation. When asked about service, Mr. Sendral advised that if such a need arose, Damien could call and they would do their best to provide service.

5. CONCLUSION: This is a general (as distinguished from an electronic equipment) business organization. They have no service capability. The contracting for any radio network equipment with them therefore cannot be recommended at this time.

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CONTACT REPORT

1. DATE AND TIME OF CONTACT: 27 September 1978 1330 hours

2. NAME OF SUPPLIER, AGENCY OF DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Motorola, Mr. Fritz Joassin, Port-au-Prince.

3. PURPOSE OF CONTACT: To obtain budgetary prices for the supply and installation of HF and VHF radio systems, power supplies and antennas.

4. RESULT OF CONTACT IN BRIEF: The agency has given the following list of prices.

1) MICOM HF SSB mobil 12 channel (equipped for 3 channels): 125 Watt

a) Trunk unit	$2,948
b) Under dash unit	$2,593

2) Base station HF SSB 125W 2-9 MHz	$3,030

3) Dipole Antenna (dual) Installed

Base antenna	$153.25
Accessories	$ 82.00
Mounting (labor)	$250.00
Transport (minimum)	$ 80.00
Total	$565.25

4) Mobile Antennas

a) 1-2 Channels	
i) antenna	$246.00
ii) mounting	$ 60.00
Total	$306.00
b) 6 Channels	
i) antenna	$502.00
ii) mounting	$ 40.00
Total	$542.00

5) a) 100 ft. tower (30 meters) installed:

Tower only	$1,124.00
Mounting	
Without basement (foundation) work	$ 350.00
Including basement (foundation) work	$ 600.00
Totals	
Without basement work	$1,474.00
With basement work	$1,724.00

b) Base station ground plane VHF (Average 3 dB gain) $ 233.00

6) Battery power supply for mobile units in building:

a) Heavy duty sealed 12V battery	$ 500.00
b) Battery charger unit	$ 700.00

7) Cost of maintenance:

Mobile Station

a) Within Port-au-Prince

Fixed rate monthly	$ 35.00
After two years	$ +15%

b) In the provinces

Fixed rate monthly	$ 35.00
Transport charge	$ +15%
After two years	$ +15%

Fixed Station

Fixed monthly rate (all other charges same as mobil)	$ 45.00

8) Design Life of Radio Equipment is 7 years with 20% operation daily.

9) Equipment lightning protection — part of normal installation

10) Antenna changeover Box — $ 140.00

-10

CONTACT REPORT

1. DATE AND TIME OF CONTACT: 28 September 1978 1130 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: American Embassy, Commercial Department, Mr. Bob Richmond.

3. PURPOSE OF CONTACT: To know whether there are any dealers or representatives for RCA, GE, Hallicrafters etc. for HFSSB or VHF FM Radio Equipment in Haiti.

4. RESULT OF CONTACT IN BRIEF: According to information obtained from Mr. Richmond none of the above are represented in Haiti.

CONTACT REPORT

1. DATE & TIME OF CONTACT: 28 September 1978, 1500 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT AND PLACE OF CONTACT:

Teleco Department, Mr. Edouard Gentil, Director General

3. PURPOSE OF CONTACT: To acquire information on existing and projected telecommunication facilities in Haiti. The information would be used to determine the suitability of these facilities to meet the requirements of the Department of Agriculture, presently being investigated.

4. RESULT OF CONTACT: Discussions revealed the following information in respect of present and future systems.

4.1 Inter-Urban Network

The inter-urban system is comprised principally of single pair open wire overhead systems from Port-au-Prince to a number of important cities in other regions. These are routed for the most part along the interconnecting highways. Power lines follow almost identical routes.

Expansion of this system is provided by newly constructed twenty-four channel microwave systems and twelve channel VHF systems to some parts of the country.

Planning is being undertaken for the improvement of the microwave system between Port-au-Prince, Gonaive, and Cap-Haitien. This will include expansion to one hundred and twenty channels and possible extension to other parts of the country.

Communication between Port-au-Prince, Jeremie, Les Cayes, Miragoane, Jacmel, and Gonaives is provided by VHF systems. Extension to include the island of La Gonave is under consideration.

Details of the expansion plan and proposed time-scale are not currently available.

To meet immediate requirements private communication systems are permitted by the Communications Department, whenever the need arises. The Department, however, retains the right to provide the services, and will do so as and when available facilities permit.

4.2 Suburban Network

The immediate program in the sphere is the expansion of Central Office facilities in Port-au-Prince and its suburban localities. Six central

72

offices are currently involved. The available capacity of these offices is at present fully utilized and is, therefore, not able to meet additional demands. To meet immediate demands, therefore, private VHF systems are permitted, and are being operated within the city and its suburbs.

Expansion rates are limited by available resources and allocation priorities. Facilities are not, therefore, expected to meet or exceed demands in the near foreseeable future.

5. CONCLUSION: Existing and projected public systems do not offer facilities that will meet the demands of this requirement, accordingly a private dedicated system should be investigated.

CONTACT REPORT

1. DATE & TIME OF CONTACT: Friday 29 September 1978 0858-1010 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACT AND THE PLACE OF CONTACT: Engineer Rene Michel, c/o Faculte des Sciences, University d' Etat d' Haiti, Rue Mgr Guilloux, Port-au-Prince.
Rad-Tel Electronic Center, 91, Rue Pavee, Port-au-Prince.

3. PURPOSE OF CONTACT: To survey a potential supplier of equipment and maintenance service.

4. RESULT OF CONTACT IN BRIEF:

Engineer Michel provided information valuable for the analysis of the proposed communications system. He has, since 1960, installed communication systems for several clients in Haiti.

These are:

1) National Bank of the Republic of Haiti (BNRH), 11 HF Stations
2) Agriculture Development (IDAI), 9-10 HF Stations
3) United Nations, 3 HF Stations
4) Haitian American Community Health Organization (HACHO), about 80% of the units.
5) Canadian agency for assistance, unknown
6) Petroleum company, 4 VHF units.

Previously, Collins equipment was used for such systems, but due to its limited frequency range (catering to the Amateur Service), other general coverage equipment is recommended, namely, that of the RF Communications Equipment Company of Rochester, N.Y.* The HF equipment operates from 2 to 8 MHz with up to 10 crystal controlled channels, USB and LSB. VHF equipment Model RF-1500 is also available.

Operational experience within Haiti indicates that the 4-5MHz frequency range provides good service both day and night. Antennas for HF systems are typically ground planes (with loading) for 100 to 130 km ranges (maximum), otherwise dipoles are used.

Concerning maintenance, Engineer Michel described his own personal inventory of test equipment, several of which are from the B & K Instruments, Inc. product line and for which he is also the local representative. Engineer Michel has not in the past retained a staff for help but has performed installation and maintenance himself. Because of his teaching and administrative responsibility at the university, he prefers that faulty units be brought to Port-au-Prince for service, recommending that one

* This company is now a part of the Harris Company RF Communications Division, and Information Handling group.

spare unit be initially purchased for each equipment type, thus providing an immediate in-country replacement until the faulty unit can be repaired. He indicated that BNRH uses this philosophy. Usual parts replacement is available from local sources and or Engineer Michel's inventory. Special orders and or spares requires about 15 days. Service is effected via the mechanism of the service contract. Rates are usually on a monthly basis, depending upon the type of equipment, its location, distance, ease of reaching the area etc. Some representative examples of past contracts are are as follows:

BNRH	$300/month for 11 stations
Petroleum Co.	$75/month for 4 stations
IDAI	$200/month for 7 stations

Other relevant operations and maintenance observations by Engineer Michel are the frequent problems due to low mains voltage (a measured 85V at one time at Miragoane); and that during one hurricane, only the BRNH system remained operational in-country. This was because of the availability of 1.5 KW diesel generators. This emphasizes the need for on-site service availability to recognize problems, such as low voltage, which may be only local.

5. CONCLUSION. Engineer Michel is a mature individual who has not only the academic preparation, but who also has the demonstrated ability and the equipment inventory necessary for installation and maintenance service. If he could not himself provide in-country installation of a network the size anticipated within the desired time frame, he certainly is an established and proven alternative for maintenance. Further, because he is a Haitian national, he would not experience the problems in setting up a maintenance operation which might otherwise accrue to an expatriate organization.

Note: Subsequent to the visit to Haiti, Eng. Michel wrote a letter to Teleconsult offering communication equipment sales and installation. His proposal and design, although incomplete, is attached hereto for interest. The Rad-Tel organization, although not so large, may represent a viable alternative to the generally recognized "sole" source for communication equipment and service in Haiti.

Rad - Tel Electronic Center

91, Rue Pavee

Instrumentation
Composants Electroniques

Telecommunication
Systemes d'Alarme

January 6,1979.

Teleconsult

Att.: Mr Richard E. Hartman

Dear sir Hartman,

Since your last visit to Haiti, we did heard from you. Regarding our propositions for a Radio link connecting different points of Haiti using SSB equipment manufactured by RF Communications, Inc. and financed by the AID in a joint programm whith the Department of Agriculture,we have the advantage to inform you that some modifications must be considered in our original study as the model RF Controller had been deleted, following informations received from the Firm.
Its closest model is the RF-220 with about the same characteristics but with an heavy duty power supply and designed for continuous service.
We have one of this model in operation here since three years and we did, up to now, experienced any trouble with it.
It is priced at $. 3 900.00.
As an alternate, a lighter model, the RF-2200 could be offered at $. 1 935.00. It is a 125 watts PEP and intended for intermitent service.
In our opinion, the RF-220 would be the most suitable to be recommanded for the kind of service in Haiti.
Regarding the working frequencies,all the stations will be provided with the general calling frequency while for communication, a special frequency will be assigned to each zone.
The central station in P-au-Pce will get all thes frequencies.
A distribution table is annexed to the present.
As the frequencies used are closed and spread from 4580 to 4625 Mhz, dipole antenna will give good results and so installation will be easier and simpler.
A list of material to be ordered is given in the inclosed sheet.

With our best regards,

Rene Michel
Ing. Electronique.

Rene Michel
c/o Faculté des Sciences
Rue Mgr Guilloux
Port-au-Prince, Haiti

Best Available Document

System of radiotelephone to link Port-au-Prince to eight other locations, using SSB transceivers of 150 watts PEP.

Material that should be ordered :

10	RF-220 SSB transceiver at $.3 900.00	$.	39 000.00
10	100 ft coaxial cable, RG58A/U @ .18 ¢ /ft		180.00
20	Connector, PL-259 @ $.2.00		40.00
20	Adapter for PL-259, UG-175 @ .60 ¢		12.00
20	Tube 6146 @ $. 16.00		320.00
		$,-	39 552.00
	Export packing & Air freight		600.00
	CIF Port-au-Prince	$.-	40 152.00
	To be bought in Port-au-Prince for antenna construction and installation : pipes 1 1/2" and 2" x 20' for antenna poles, copper wire #. 12 for antenna, isolators and guy wire, steel wire and turnbuckles ... accessories		1 800.00
		$.-	41 752.00
	Installation & Labor		5 000.00
	TOTAL	$.-	46 752.00

René Michel
Ing. Electronique

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11

P - au - Pre
office Central

4595 Khz
4590 "
4585 "
4580 "

4600 Khz
appel general

4605 Khz
4610 "
4615 "
4620 "
4625 "

Cayes
4600 Khz
4595 "

Ducos
4600 Khz
4595 "

P - de - Paix
4600 Khz
4605 "

Jn Rabel
4600 Khz
4605 "

Jacmel
4600 Khz
4610 "

Marigot
4600 Khz
4610 "

Seguin
4600 Khz
4610 "

Thomazeau
4600 Khz
4590 "

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CONTACT REPORT

1. DATE & TIME OF CONTACT: Friday 06 October 1978 1645 hours

2. NAME OF SUPPLIER, AGENCY OR DEPARTMENT CONTACTED AND THE PLACE OF CONTACT: Mr. Tim Lavelle of HACHO: AID Office Port-au-Prince

3. PURPOSE OF CONTACT: Determination of problems associated with the new HACHO communication system.

4. RESULT OF CONTACT IN BRIEF: This contact with Mr. Lavelle was very brief, but confirmed previous information and highlighted basic in-country installation and maintenance problems. Through a sequence of events, not known by the author, a large inventory of equipment was purchased for the HACHO system. This equipment has been delivered and now needs to be put into service. Personnel to do this are lacking and the local Motorola representative (who has such capability) will not become involved because, reportedly, the equipment is not Motorola.

5. CONCLUSION: The need to effect the system purchase to include installation and maintenance is imperative.

APPENDIX C

REQUEST FOR PROPOSAL

This document has been prepared for the GOH to use, as prepared, or to modify as desired. On one hand, its content has been made broad enough so that a complete system can be procured which will satisfy the stated intent of the needs and the system design. On the other hand, it has been limited in some degree so that it would not be so burdensome that the small bidder would not respond. It is recommended, however that as potential bidders are identified this document be reviewed and changed as applicable in order to assure that a competitive choice is available from sources capable of providing maintenance.

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1.0 INTRODUCTION

The Ministry of Agriculture of the Government of Haiti (GOH) in cooperation with the United States Agency for International Development (USAID) proposes to establish a voice communications network for use in the improvement of agricultural services. The network will comprise two basic systems determined by the intended application.

The principal system is a country wide network, using the HF spectrum to provide one simplex voice channel permitting a final ultimate total of thirteen district offices to communicate with the head office.

The secondary system progressively provides single channel simplex voice communication between various activity centers within each district. These local networks will utilize the HF or VHF spectrum as dictated by the topographical features of each district.

This document describes the network as a complete entity in its ultimate form. It specifies the equipment requirements, defines the scope of the work, and outlines the general terms and conditions of contract that are required as the basis of an agreement with the successful bidder.

Tenders are invited to define, engineer, furnish and install a completely working system, comprised of commercial quality equipment. A statement of the life expectancy of the equipment in this specific environment is required. The tender shall include provision of maintenance services, operator training and equipment familiarization. Firm fixed price tenders are requested for this task in accordance with the following specifications and documents.

2.0 STATEMENT OF WORK

This Statement of Work (S.O.W.) sets out (as listed in the Table of Contents) the work to be accomplished and the commitments to be met in order to satisfy the requirements of the Ministry of Agriculture of the Government of Haiti.

2.1 THE SYSTEM DESCRIPTION

The extent of the overall network is shown in the map, Figure 2.1. The several districts of the Department of Agriculture and other sites are linked to the Agriculture Headquarters located at Damien, a suburb of Port-au-Prince. Details of the overall network are shown in Figure 2.2. the complete system configuration.

2.2 GENERAL DESIGN CONSIDERATIONS

General Design Considerations are discussed in order that the Bidder will have the benefit of knowing those factors which have been considered in the system design and will therefore be able to respond with his inventory of equipment and implemention plan in a manner which meets the intent of the design. The radio equipment, antenna, power and support equipment to be provided are discussed below.

2.2.1 Spectrum Allocation

The network coverage area is generally mountainous and is extensive enough to require utilization of the HF portion of the spectrum. Because of the limited distances, the lower section of the spectrum will be used, frequencies in the range 2 to 7 megahertz being preferred. Theoretical models, and practical examples show that for the service required over the distances specified, power levels of the order of 100 watts peak envelope power (P.E.P.) in the single side band (SSB) mode will be adequate.

In addition to the HF backbone network centered on Port-au-Prince, communication to activity centers within several of the regions is required, including the use of mobil units. Some regions are topographically suited to the local use of VHF. Where possible, VHF is desirable. Its proposed utilization is shown in Figure 2.2.

2.2.2 Radio Equipment

The mountainous terrain and the remote sitings of some communication terminals places them in regions where electrical power may not be available, where it may be unreliable or where access is difficult. These factors have affected the radio system design by suggesting the use of mobil type equipment at all sites. This provides a commonality of units so that relatively unskilled personnel can replace faulty equipment, either fixed or mobil, with an identical unit, which has only to be removed from another mobil or fixed site of less priority until such time as

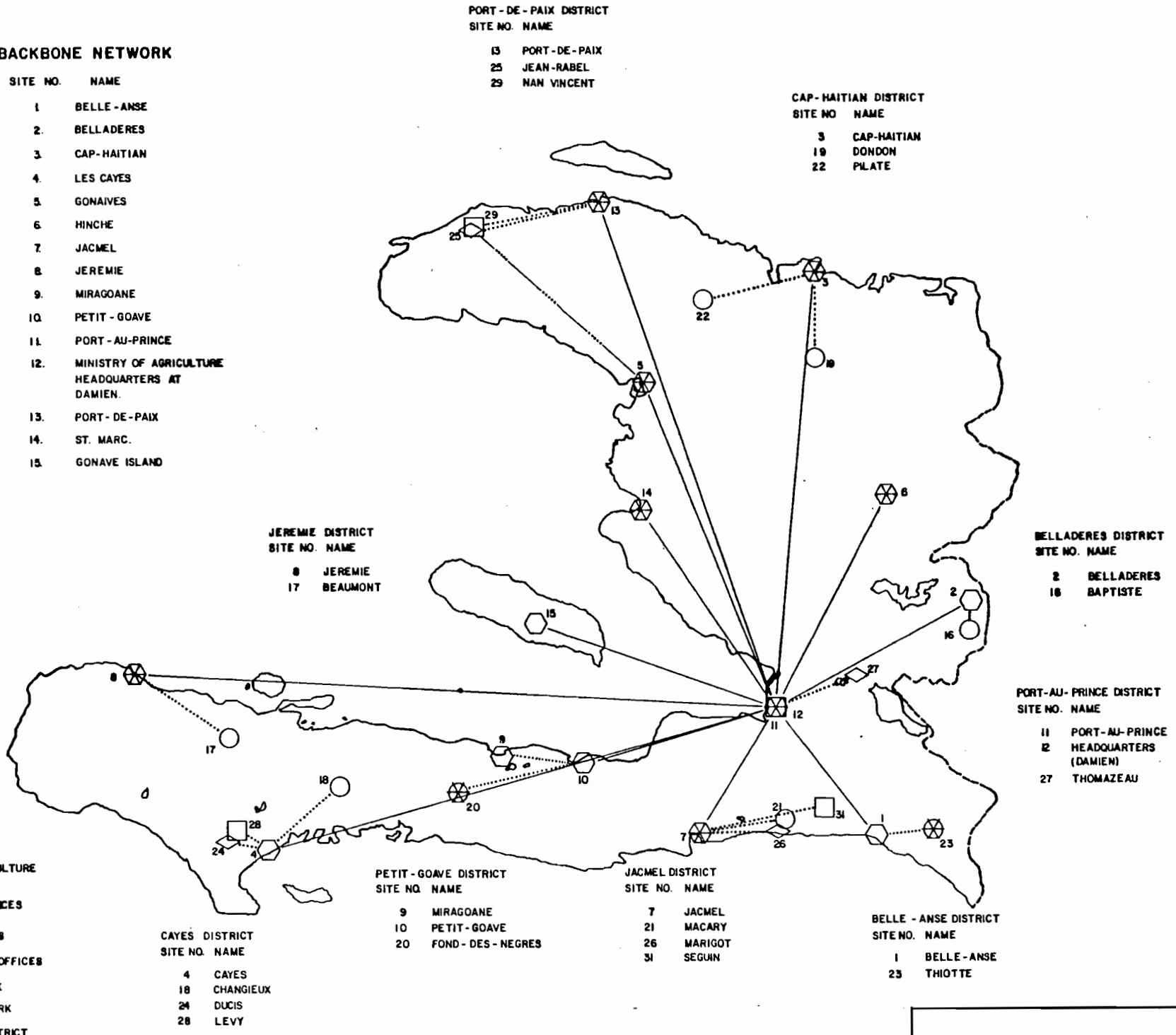

Figure 2.1
Overall Network

TELECONSULT INC.

BACKBONE NETWORK		DISTRICT NETWORKS							
			Authority					Transmission Equipment	
					PDAI				
Ministry of Agriculture District Offices	HF/VHF Transmission Equipment	District Activity Center	HHPCADE Coffee Centers	BCA Regional Offices	Operations Offices	Research Station	Work Sites	Land Line	HF/VHF
Belle-Anse	HF	Thiotte	x						HF
		Thiotte		x				x	
Belladeres	HF	Baptist	x						HF
Cap-Haitian	HF	Dondon	x						HF
		Pilate	x						HF
		Cap-Haitian		x				x	
Cayes	HF	Changieux	x						HF
	VHF	Ducis			x				VHF
		Levy				x			VHF
		Movable Units, 2					x		HF
		Mobil Network, 4							HF
		Mobil Network, 4							VHF
Gonaives	HF	Gonaives		x				x	
Hinche	HF	Hinche		x					VHF
	VHF	Papaye				x			VHF
Jacmel	HF	Macary	x						HF
		Jacmel		x				x	
		Marigot			x				HF
		Sequin				x			HF
		Movable Units, 2					x		HF
		Mobil Network, 8							HF
Jeremie	HF	Beaumont	x						HF
		Jeremie		x				x	
Mirgoane	HF	Fond-des-Negres	x						HF
Petite-Goave	HF	Fond-des-Negres		x				x	
Port-au-Prince (Damien)	HF	Port-au-Prince	x						VHF
	VHF	Damien		x				x	
		Thomazeau			x				VHF
		Damien				x			VHF
		Movable Units, 2					x		HF
		Mobil Network, 4							HF
		Mobil Network, 7							VHF
Port-de-Paix	HF	Port-de-Paix		x				x	
		Jean Rabel			x				HF
		Nan Vincent				x			HF
		Movable Units, 2					x		HF
		Mobil Network, 8							HF
St. Marc	HF	St. Marc		x				x	
Gonave Island	HF	-							

Figure 2.2

Complete Figure Configuration

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maintenance personnel can arrive, or until the unit can be transported to, and received back from, a maintenance depot. The power supply for the fixed station units are thus also fed from a nominal 12 volt source. This allows some continuity of operation in the event of short internal power disruptions, while the general availability of automotive batteries improves the probability of site operation during long term power disruption which frequently attends emergency situations, such as the occurrence of hurricanes. The concept of providing maximum system flexibility and ease of maintenance is an important design concept.

2.2.3 Antennas

To meet the backbone network requirement, with the equipment and operational methods proposed, omni-directional antennas with high angle radiation characteristics are necessary. This condition shall be achieved utilizing simple and relatively inexpensive frequency-conscious devices.

Fixed stations shall be equipped with either horizontal dipoles, vertical vee dipoles, or quarter wave verticals. Dipoles should not be mounted more than a quarter wave length above the ground plane reflector which in some localities may be several feet below ground level (approximately at water table level). Should this vary considerably a false ground plane may be established using a metallic mesh on, or just below, the surface of the soil. Several electrical connections are then made from this mesh to buried earth plates, positioned in localized zones of high soil conductivity.

Due to mechanical limitations mobil stations shall be equipped with vertical whip antennas, which should, as far as is practical, be mounted such that the metal vehicle provides the best possible ground plane.

The Bidder shall state in his proposal what measures he proposes to assure that the corrugated metal roofs which characterize local construction will not adversely affect the antennas or transmission lines in any way. In those regions where VHF is used, an additional support structure to obtain adequate height will be required.

2.2.4 Power

Since all units are to be of the mobil type, as noted in paragraph 2.2.2 above, all fixed sites require the provision of a high quality 12V automotive (lead - acid) type storage batteries, whose capacity is adequate to power the transceiver for three days with a 10% transmitter on-time,

an automatic rectifier - charger unit with a 220/110 VAC switchable input and a generator where applicable (See Figure 2.3). In addition, each site which requires a battery shall be supplied with a minimum 20 liter container of distilled water, two hydrometers, two pairs of rubber gloves and such other power - system maintenance items as are applicable to the proposed system.

2.2.5 Support Equipment

The Bidder shall also propose for each fixed site those other furnishings applicable to such an installation; namely, a table or desk suitable for emplacement of the transceiver, with adequate drawers or separate file unit, a 12 volt desk lamp, chair, battery protection, a positive action antenna grounding lightning protection system, and any other item necessary to the proper operation of each installation.

2.3 INVENTORY OF EQUIPMENT TO BE PROVIDED

The procurement for this system is listed in Figure 2.3. Some detail relating to the procurement will be found as follows:

Item	Paragraph
HF Radio Transceivers	3.1.1
VHF Radio Transceivers	3.1.2
HF Mobil Antenna	3.2.1
HF Fixed Antenna	3.2.2
Fixed VHF Antenna	3.2.3, 3.2.4, 3.2.5
Mobil VHF Antenna	3.2.6
Support Structures	3.2.7, 3.2.8
Batteries	3.3.1
Rectifier-Chargers	3.3.2
Generators	3.3.3
Support Equipment	2.2.5

GOH reserves the right to limit the initial procurement to a selected number of districts. Bidders shall however propose for the complete system. Requirements of the several districts are listed below:

2.3.1 Bell-Anse District

Local communication in this district is proposed only between Belle-Anse and the coffee center at Thiotte. The disposition of various agencies within the Thiotte area permits the passage of internal traffic either by telephone or hand, without undue loss of time or efficiency.

2.3.2 Belladeres District

Only a link to Baptist is required from this district office.

2.3.3 Cap-Haitian District

Two HF links; one each to Dondon and Pilate are required. The BCA office will exchange traffic with Cap-Haitian District office by telephone.

2.3.4 Les Cayes District

Les Cayes region with its wide plain provides an opportunity to exploit the advanatages of very high frequency (VHF) communication. Sites on the plain, (for example Levy and Ducis) and some mobil units will use this network. The remaining mobil units and those district sites located on the other side of the mountains (for example Les Anglais), or those in the mountains (Changieu), where line-of-sight to the district office does not exist, will communicate using HF Service.

2.3.5 Gonaives

Gonaives has no planned in-district radio links, the BCA traffic being passed by local telephone. Gonaives is located at the important road junction from Port-au-Prince, to Cap-Haitian and Mole St. Nicolas. Provision is therefore made for an interdistrict link to Jean Rabel, in order to coordinate surface traffic passing over the difficult mountain road between these centers.

2.3.6 Hinche District

Hinche, in addition to its HF link to Port-au-Prince, will utilize VHF to two outposts, namely the BCA office, and the research station at Papaye.

2.3.7 Jacmel District

The Jacmel region is very mountainous, therefore High Frequency communciation is necessary to provide a service. Macary, Marigot, Seguin and the district mobil units will all communicate with the district office or each other using this medium. The proximity of the BCA regional office to the Agriculture District office, however, allows for the easy handling of messages within Jacmel, by established methods.

2.3.8 Jeremie District

Jeremie will utilize an HF link to its coffee center, and use the local telephone for BCA office traffic.

2.3.9 Miragone/Petite-Goave

Although comprising two separate agricultural districts, Petite-Goave will be the area terminal for the backbone network. Traffic facilities to both Miragone and to the coffee center at Fond-des-Negres, will be effected on a local basis also utilizing HF communication.

2.3.10 Port-au-Prince District (Damien)

The requirements and topography of this district are such that VHF can be effectively utilized in some localities. Two district networks will therefore be operated, one HF and one VHF.

The links between the Damien District Office, two movable centers and four mobil units, will utilize HF.

The links between the IHPCADE office in Port-au-Prince, the Damien Research Center, Thomazeau, and four mobil units will utilize VHF. In addition three mobil units utilizing a VHF channel will be available and at the disposal of the Minister, the Director General, and the Under Secretary, of the Department of Agriculture.

The Damien BCA office will communicate with the network operations room via telephone.

The HF equipment located at the Damien District Office will also be used for communication on the backbone link and will thus form the Control Center for communication purposes.

An additional VHF unit is shown in Figure 2.3 located at Damien. This unit is normally used for he mobil network serving key personnel.

SITE Name	Number	Radio Transceivers HF	Radio Transceivers VHF	Antenna System Fixed HF	Antenna System Fixed VHF	Antenna System Mobil HF	Antenna System Mobil VHF	Power System Battery, etc.	Power System Rectifier Charger	Power System Generator	Support Equipment
Belle-Anse	1	1		1				1	1		1
Thiotte	23	1		1				1	1		1
Belladeres	2	1		1				1	1	1	1
Baptiste	16	1		1				1	1		1
Cap-Haitian	3	1		1				1	1		1
Dondon	19	1		1				1	1		1
Pilate	22	1		1				1	1		1
Cayes	4	1	1	1	1			2	1		2
Changieux	18	1		1				1	1		1
Ducis	24		1		1			1	1	1	1
Levy	28		1		1			1	1		1
Moveable Units		2		2				2	2	2	2
Mobil Units		4	4			4	4				
Gonaives	5	1		1				1	1		1
Hinche	6	1	1	1	1			2	1		2
Hinche BCA Office	6		1		1			1	1		1
Papaye	30		1		1			1	1	1	1
Jacmel	7	1		1				1	1		1
Macary	21	1		1				1	1		1
Marigot	26	1		1				1	1	1	1
Seguin	31	1		1				1	1	1	1
Moveable Units		2		2				2	2	2	2
Mobil Units		8				8					
Jeremie	8	1		1				1	1		1
Beaumont	17	1		1				1	1		1
Miragoane	9	1		1				1	1		1
Fond-des-Negres	20	1		1				1	1		1
Petite-Goave	10	1		1				1	1		1
Port-au-Prince (City)	11		1		1			1	1		1
(Damien)	12	1	2	1	2			3	2		3
Damien Research Str	12		1		1			1	1	1	1
Thomazeau	27		1		1			1	1		1
Moveable Units		2		2				2	2	2	2
Mobil Units		4	7			4	7				
Port-de-Paix	13	1		1				1	1		1
Jean Rabel	25	1		1				1	1	1	1
Man Vincent	29	1		1				1	1	1	1
Moveable Units		2		2				2	2	2	2
Mobil Units		8				8					
St. Marc	14	1		1				1	1		1
Gonave Island	15	1		1				1	1	1	1
TOTALS: Transceivers		58	22								
Antennas				34	11	24	11				
Power System Equipment								45	42	17	
Support Equipment											45

Figure 2.3

Inventory of Required Equipment

Complete System

BEST AVAILABLE COPY

2.3.11 Port-de-Paix District

The Port-de-Paix district is similar to Jacmel in that the mountains make it necessary to use HF for communication. The BCA regional office, like Jacmel, is also located in town. All stations, Jean Rabel, Nan Vincent and the mobils will communicate with Port-de-Paix, and depending on propagation will be able to contact each other.

2.3.12 St. Marc

St. Marc, like Gonaives presently has no planned district network.

2.3.13 Gonave Island

This link in the backbone network provides service to the island via the coffee center at Nan Cafe.

2.4. PRODUCT ASSURANCE

2.4.1 Equipment Manufacturer Capability

The manufacturer(s) of the equipment(s) proposed by the Bidder shall have in operation a factory adequate for and devoted to the manufacture of the equipment proposed. This facility shall have been operative in such work for a minimum of five years. Installations utilizing equipment being offered in response to these specfications and of similar size and scope, shall have been installed and in continuous satisfactory operation for a minimum of one year in at least three installations. A list of said installations containing sufficient information to permit contact with equipment users shall be submitted with the bid.

2.4.2. Inspection and Test Privileges

The purchaser shall have the right to visit the operational facilities of the manufacturer (including major subcontractors) during normal working hours for the purpose of inspecting the design, work in progress, the materials on hand, packaging procedures and to witness tests, including factory acceptance tests.

2.5 INSTALLATION

The Contractor shall be responsible for the installation of all equipments, both fixed and mobil radio equipments, antennas, power equipment, peripheral equipment, and such other wiring, equipment and any other interconnection cabling as is required to complete each installation. The mounting and type of all fixed site antennas shall be a topic specifically detailed in his proposal. Because of the diversity of sitings, and in consideration of the fixed and mobil installation, the Bidder shall state in his proposal both his past experience and his plan to effect the work for this project.

When installing fixed sites, the Contractor shall be responsible for and pay particular attention to the location of batteries, to ensure maximum safety in respect of corrosion, fire, explosion and damage. Additionally where power generating equipment is to be installed, attention must be given to its location, and to designating a safe area for storage of fuel supplies and lubricants.

Concerning the two VHF terminals sited at Damien, the Bidder shall consult with the equipment manufacturer and report his recommendation to assure that mutual interferance between the units is in no way detrimental to any equipment. Any additional equipment required in this contract shall be included in the Bidder's proposal.

2.6 TESTING

All equipment delivered shall be tested for conformance to manufacturers specifications. Those tests which are usually performed only at the factory need not be repeated on site provided that a copy of the factory test results are provided. All equipment as installed at each site, fixed and mobile, shall operate as a system. The contractor shall provide a copy of the test results for each installation which shall as a minimum include:

1) Voltage level of the nonimal 12-volt power buss, both transmit and receive conditions
2) Current drain from the 12 volt buss, both transmit and receive
3) Voltage standing wave ratio, (VSWR) which shall be 1.5:1 or less at each frequency
4) Transmit power output at each frequency
5) Demonstrated high quality service to all sites with which communication is planned.

2.7 TRAINING

The Contractor shall provide in the French language training in the operation and maintenance of the system. Operators training shall consist of instruction, including hands-on-training, in use of the:

a) Transceiver equipment
b) Rectifier-charger units
c) Removal and replacement of the transceiver and rectifier charger units and
d) How to keep records of equipment operation.

Maintenance training shall include:

a) Utilization of the equipment manuals especially as relating to the manufacturer's trouble location documentation.
b) Battery maintenance procedure, including the use of the hydrometer.
c) Significant operational indications and the logging and recording of all measurements.
d) How to interpret records of operation and measurements in order to locate problems.

The Contractor shall provide instruction in the French language to key personnel in each location where equipment is installed. This instruction shall be adequate and complete enough so that those who receive this training would themselves be capable of giving the same training to others. Additionally, the Contractor shall, if Purchaser personnel are designated, provide special instruction during the time of installation of all wiring, equipment and antennas. Such instruction should include training in making and checking wiring connections, how to recognize connection faults and the installation and connection of the antennas. Such training is intended to provide local competence in removing and installing units, and the location and correction of minor faults.

2.8 DOCUMENTATION

The Contractor's system shall be fully documented in order that proper understanding, operation, maintenance and expansion planning may be effected by the Purchaser's personnel. To this end, the following documentation is required in addition to other documentation described elsewhere in this specification.

a) Detailed Equipment List

A detailed, itemized equipment list shall be included with the contract proposal. This list shall include the quantity, model number and description of each major component of the proposed systems. Examples of typical items to be included in this list are: transceivers, rectifier-chargers, generators and antennas and such supporting equipment as may be applicable to the proposed inventory.

b) Performance Specification Sheets

Performance specification sheets shall be provided for all items shown on the equipment list.

c) Proposed Drawings and Diagrams

The Bidder's proposed network design and recommendations, especially where deviation from this SOW is made.

d) Test Reports

In all categories of tests, the Contractor shall submit complete reports of test data gathered, supplementary information related to the tests necessary to interpret test results, an analysis of data where required to extract results, and intended corrective action to be taken in cases where requirements were not met during tests. One copy of the test report shall be left on site, and one copy submitted to the Ministry not more than one month after completion of all the tests.

e) Manuals

The Bidder shall supply with his proposal manuals for the basic equipment proposed. The Contractor shall supply a quantity sufficient for one copy of applicable documentation to be kept at each installation plus two additional copies. These manuals shall provide all technical information for each installation and a complete set of "as-built" drawings which will include:

i) a complete bill of material
ii) equipment specification
iii) installation wiring and cabling diagrams
iv) detailed schematics
v) circuit descriptions including all information describing major malfunction identification and subsequent trouble-shooting procedures
vi) test and alignment procedures, and
vii) further information sufficiently detailed to permit a duly qualified service technician to operate and maintain the equipment.

2.9 Maintenance Service

The Bidder shall be capable of providing maintenance service in-country. He shall describe his facility and provide a list of present and past customers. Any Bidder who does not now have an in-country service capability shall provide full details about the facility he proposes to establish, including the general location, physical size, the complement of test equipment and spare parts with which the facility will be provisioned, the level of staffing and his maintenance plan. He shall additionally provide proof with his proposal that he has applied for and received approval from the Government of Haiti for the establishment and operation of such a facility.

3.0 EQUIPMENT SPECIFICATION

3.1 RADIO EQUIPMENT

3.1.1 HF Equipment Specification

Frequency Range:	2 to 7 MHz minimum.
Frequency Stability:	$\pm$ 1 part in 10^5 or better over 24 hours period at ambient temperatures between 0^oC and + 50^oC.
Number of Channels:	4 simplex minimum.
RF Input/Output Impedance	50 ohms - Nominal unbalanced.
Operational Mode:	SSB (Switch selected LSB or USB).
Modulation:	Voice.
Power Source:	12 VDC nominal(16 VDC max., 10.8 VDC min.).
Equipment Ground:	Equipment grounding must be compatible with vehicle supply source.
Environment:	0^oC to + 50^oC @ 10% to 95% humidity.

Mechanical Description:

Single unit transmitter/receiver, utilizing modular construction. The unit must be ruggedly constructed and supplied complete with detachable mounting frame. The frame should be capable of permanent fixture at its chosen location with easily released fastenings which permit removal of the electronic unit. A mechanical security system to deter unauthorized removal is advantageous. Physical dimensions should be such that the unit may be conveniently mounted beneath the dash, on the transmission hump, or beneath the seat of an average four seater car. Additionally, wall mounting in the cab of average small pick-up trucks is a possible location. Unit should be self-contained in that all controls and

operator facilities, including loudspeaker, are contained in the one unit housing the transmitter/receiver. Weight should be such that the unit may be safely lifted and manipulated for service and maintenance purposes, by one man.

Shock and vibration encountered during shipment and mobile utilization shall not damage the equipment or affect the operational performance.

3.1.1.(a) Transmitter

Output Power	100 watts P.E.P. min., 150 watts max. P.E.P.
Intermodulation:	-26db reference P.E.P.
Carrier Suppression:	At least - 40dB.
Unwanted Sideband Suppression:	1 KHz tone at least -40dB.
Spurious and Harmonic Emission Suppression:	At least -40dB.
Tuning and Output Power Control:	No facility must be available to the operator.
Channel Selection:	Single switch selecting, transmitter receiver and antenna matching.

3.1.1.(b) Receiver

Sensitivity:	0.5 microvolts for 10dB S+N/N at 1 watt minimum audio output.
Selectivity:	At least -6dB at 300Hz and 2·7kHz.

Image Rejection:	At least -60dB, reference 10dB S+N/N.
Other Spurious:	At least 55dB - reference 10dB S+N/N.
Audio Output:	Minimum 2.5 watts with less than 10% total distortion.
AGC Type:	Fast attack, slow release.
AGC Threshold:	7.5 microvolts or less.
Tuning	No facility must be available to the operator.
Channel Selection:	Single switch selecting transmitter receiver and antenna matching.

Ancillary Equipment

The supplier shall include any necessary ancillaries, such as microphones, that are a normal or an essential part of the installation. The supplier will make himself aware of the allocated frequencies, through the purchaser. The supplier shall ensure that the frequency allocations are compatible with the equipment supplied, both individually and as a group, and shall supply all necessary crystals and/or other components to activate the equipment on those frequencies.

3.1.2 VHF Equipment Specification

Frequency Range:	150-174 Megahertz.
Number of Channels:	Four minimum.
Operational Mode:	Frequency modulation.
Modulation:	Voice.
Power Source:	12 VDC nominal.
Environment:	0°c to 50°c @ 10% to 95% humidity.

General Description:

A single unit totally integrated unit preferred. This implies that the transmitter, receiver, loudspeaker power supply and control facility, are assembled in a single, removal entity. This should be supplied complete with a detachable mounting frame. The frame should be capable of being permanently fitted at its chosen location, and should be equipped with easily released fastenings which permit removal of the electronic unit. A mechanical security system to deter unauthorized removal is advantageous. Physical dimensions should be such that the unit may be conveniently mounted, beneath the dash, on the transmission hump, or beneath the seat of an average four-seated car or pick-up Truck. Wall mounting in the cab of small pick-up trucks is an alternative possibility. The unit should be ruggedly constructed on a modular basis, with the object of providing high reliability and rapid maintenance/repair access in an adverse environment.

3.1.2.(a) Transmitter

Output Power:	25 to 50 watts nominal.
Output Impedance:	50 ohms nominal.
Spurious and Harmonics:	80dB below carrier.
FM Noise	80dB below $\pm$ 30KHz deviation @ 1.0KHz.

Audio Distortion:	Less than 5% @ 1.0KHz, ± 3.0KHz deviation.
Frequency Stability (Oscillator):	± 0.0005% from 0°c to 60°c.

3.1.2.(b) Receiver

Sensitivity:	0.5μV for 20dB quieting.
Intermodulation:	More than 70dB down at ± 30KHz.
Spurious and Image Rejection:	More than 70dB down.
Squelch Sensitivity (at threshhold setting):	0.3μV or less.
Selectivity:	More than 70dB down @ ± 30KHz.
Frequency Stability:	± 0.001% from 0°c to 60°c.
Audio Output:	3 watts minimum with less than 5% distortion.
RF Input Impedance:	50 ohms nominal.

Ancillary Equipment:

The supplier shall include any necessary ancillaries such as microphones, that are normal, or an essential part of the installation. The supplier will make himself aware of the allocated frequencies, through the purchaser. The supplier shall ensure that the frequencies allocated are compatible with the equipment to be supplied, both individually and as a group, and shall supply all necessary crystals and/or other components necessary to activate the equipment on those frequencies.

3.2 ANTENNAS

3.2.1 HF Mobil Antenna (Verticle Whip)

Length	Not more than 3.25 Meters overall.
Power Capacity:	To match transmit power capability.
Input Impedance:	50 ohms nominal.
VSWR:	Less than 2:1.
Mounting:	Compatible with existing vehicle fleet.
Tuning:	Preset - no facility available to operator.
Channel Selection:	Single switch selecting transmitter, receiver and antenna matching.

3.2.2 HF Fixed Antenna

Requirements: Each fixed site may be required to operate on any of up to four frequencies. This may be achieved with:

(a) A single antenna together with switched matching and coupling facility.

(b) Four frequency conscious antennas, adjusted to the allocated frequencies, matched, and switch selected.

(c) Dependent on authorized frequency allocated, frequency selection may be achieved by the use of one or two wide frequency band antennas.

For any of these alternatives, selection must be affected with the main equipment channel selector switch. Individual site requirements may be determined by site limitations and proposals for all three alternatives should be indicated.

Radiation Characteristics:	Omni directional high angle radiation is required. Maximum power in the vertical plane should be developed and be substantially constant between 50° and 85° to the horizontal.
Input Impedance:	50 ohms nominal.
Power Capacity:	150 watts P.E.P.
VSWR	1.5:1 or less.

Proposal should include all necessary R.F. and control connectors, insulators, hardware, running gear, support structures, ground plane reflectors and ancillary items to provide complete radiators which are connected to and excited by the associated R.F. equipment. The complete assembly must be capable of survival during extremes of weather conditions as recorded at or near the individual localities, by the local weather bureaus, for the previous seven years.

Typical radiation diagrams, in the horizontal and vertical planes, for the proposed antennas should be supplied.

3.2.3 Fixed VHF Antenna (360° Horizontal Pattern)

Locations:	Damien D.O., Damien Research Center, Port-au-Prince Coffee Center, Thomazeau, Les Cayes.

Electrical

Frequency Range Nominal:	150-176 Megahertz.
Impedance Nominal:	50 ohms.
VSWR:	Less than 1.5:1.
Power Capability:	100 watts.
Bandwidth	Compatible with selected radio equipment and five allocated frequencies.

Horizontal Radiation Pattern:	360°.
Gain:	3dB Min. 6dB preferred. (ref. 1/2 wave Dipole).
Lightning Protection:	To meet generally accepted standards.

Mechanical

Survival Conditions:	Capable of survival under wind conditions recorded or estimated by nearest meteorological unit during the previous seven years.

3.2.4 Fixed VHF Antenna (180° Horizontal Pattern)

Location:	Ducis, Levy.

Electrical

Frequency Range Nominal:	150-174 Megahertz.
Impedance Nominal:	50 ohms.
VSWR:	Less than 1.5:1.
Power Capability:	100 watts.
Bandwidth:	Compatible with selected radio equipment and five allocated frequencies.
Horizontal Pattern:	180°.
Gain:	3dB min. 6dB preferred. (ref. 1/2 wave dipole).
Lightning Protection:	To meet generally accepted standards.

Mechanical

Survival Conditions:	Capable of survival under wind conditions recorded or estimated by nearest meteorological unit during the previous seven years.

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3.2.5 Fixed VHF Antenna (360° Horizontal Pattern)

Location:	Hinche D.O., Hinche BCA, Papaye.
Electrical	
Frequency Range Nominal:	150-174 Megahertz.
Impedance Nominal:	50 ohm
VSWR:	Less than 1.5:1.
Power Capability:	100 watts.
Bandwidth:	Compatible with selected radio equipment and five allocated frequencies.
Horizontal Pattern:	360°.
Gain:	Unity (ref. half wave dipole).
Lightning Protection:	To meet generally accepted standards.
Survival Conditions: (Mechanical)	Capable of survival under wind conditions recorded or estimated by nearest meterorological unit during the previous seven years.

3.2.6 Mobil VHF Antenna

Locations:	11 mobile units.

Electrical

Frequency Range Nominal:	150-174 Megahertz.
Impedance Nominal:	50 ohms.
VSWR:	Less than 1.5:1.
Power Capability:	50 watts.
Bandwidth:	Compatible with selected radio equipment and five allocated frequencies.
Horizontal Radiation Pattern:	Nominally 360° radiation.
Gain	3dB min.
Lightning Protection:	To meet generally accepted mobile standards.

Mechanical

Operational Conditions:	Off road, tropical agricultural areas.
Mounting:	To suit existing vehicle fleet.

3.2.7 30m Support Structure (Fixed VHF Antenna)

Locations:	Damien D.O., Les Cayes D.O.
Antenna Height Above Mean Terrain Level (30 km radius):	30 Meters.
Minimum Antenna Height Above Mean Obstruction Level (1km radius):	5 Meters.

Survival Conditions:	Capable of survival under wind conditions recorded or estimated by the meterological unit nearest to each specified site during previous seven years.

3.2.8 Support Structure (Fixed VHF Antenna)

Locations:	Damien Research Center, Port-au-Prince Coffee Center, Thomazeau, Ducis, Levy Hinche D.O., Hinche B.C.A., Papaye.
Antenna Height:	Adequate to provide a line of sight conditions to each of the associated communicating antennas (in no case will this approach 30 meters). Minimum height - 5 meters.
Supported Load:	Chosen antenna requirements for each specific site.
Survival Conditions:	Capable of survival under wind conditions recorded or estimated by the meteorological unit nearest to each specified site during previous seven years.

3.3 POWER SYSTEM

3.3.1 Batteries

Batteries are required in the inventory of equipment for all fixed and moveable sites. They will be floated across the output at a rectifier-charger unit and connected to the radio transceiver equipment.

The batteries shall be of the automobile type, lead-acid, 6 cell, having a nominal fully charged terminal voltage of 12.6VDC., The ampere hour capacity shall be such that they will supply the transceiver equipment, with a 10% transmitter on time, for a period of three days (approximately 150 Ampere hour).

It is preferred that the batteries be of a type generally available on the local market so that replacement, when required, can be easily effected.

The Bidder shall fully describe the batteries he proposes including the adequacy of the ampere hour capacity.

3.3.2 Rectifier-Chargers

Rectifier-charger units are required for all fixed and moveable sites. These units will be used to convert the local mains power (110/220V, 60/50 Hz) to a regulated and filtered DC output capable of charging the nominal 12 VDC nominal local battery which in turn is used to power transceiver equipment.

The Bidder shall propose such equipment as will be compatible with the remaining inventory of equipment he proposes and is in harmony with stated system design philosophy. Some specifics are given below:

Input:	105-125VAC and 210-250VAC, reconfigurable by a jumper change· protected with a resettable breaker.
Output:	Filtered and automatically regulated to proper charge rate dependent on battery condition. The unit shall be capable of recharging fully discharged batteries in a period of

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24 hours. Internal protection shall be provided against overloading and overcharging.

Temperature Range: The unit shall be operative within specifications, without the use of fans or blowers over the range of $-10^{o}C$ to $+ 50^{o}C$.

Electro Magnetic Interference: Operation of the unit shall have no adverse effect on the radio equipment.

The Bidder shall state the full specifications of the unit he proposes. A metered unit is preferred but not required.

3.3.3 Generator

Generators are required for fixed sites which presently have no electrical power and for moveable units (see Figure 2.3). The generator output voltage shall be compatible with the rectifier-chargers input (see above) and capable of maintaining a supply to meet their demand when the batteries are fully loaded under discharge conditions. They shall be capable of continuous operation.

The Contractor shall be responsible for installation as discussed in paragraph 2.5.

3.4 SUPPORT EQUIPMENT

This equipment refers to those items which are needed in order to equip the fixed and moveable unit installations. They are itemized in paragraph 2.2.5 above. The Bidder may propose any other support material which he feels is desired on an optional, and separately priced basis. Any such additional material shall be fully explained and documented.

4.0 GENERAL TERMS AND CONDITIONS OF CONTRACT

4.1 BID FORM

The bid form shall be fully completed by the Bidder who shall offer to engineer, furnish and install the equipment, CIF in Haiti, as described in this Request for Proposal for the unit prices and the lump sum so indicated.

The completed form shall, upon receipt by the Purchaser constitute a firm offer by the Bidder to undertake all required duties relevant to those sections bid at these prices listed on the bid form.

This offer shall remain firm for 120 days following the date set for opening of bids. The Purchaser shall send to the successful Bidder a "Notification of Award" which shall constitute an acceptance on the part of the Purchaser of the Bidder's offer. The Purchaser's acceptance shall be effective upon its receipt by the Bidder. Upon receipt of the "Notification Award" by the Bidder, a contract shall be deemed to have been formed between the Bidder and the Purchaser which contains those prices listed on the bid form and all the terms and conditions set forth herein.

The Bidder shall submit the following unit and lump sum prices for the assembly of the network as defined in this document (see Bid Form).

4.2 CONTRACTOR QUALIFICATION

The Contractor (the successful bidder) shall comply with the following listed requirements:

4.2.1 Compliance with National Law

The radio communications system and all components thereof shall be in complete compliance with all requirements of all applicable laws and regulations of the country in which the work is to be performed, and the country of equipment manufacture.

4.2.2 Permits and Licenses

It shall be the sole responsiblity of the Contractor to obtain any necessary construction, and installation and operational permits and licenses and he shall comply with all applicable regulations, rules, codes and ordinances without additional cost to the Purchaser.

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BID FORM

Full Name of Bidder _____

_____

Business Address _____

_____

_____

The undersigned fully acknowledges that he has received and examined the Request for Proposal document relating to the procurement for a telecommunications network for the Ministry of Agriculture, Government of Haiti against which this bid is submitted.

	Item 1/	Unit Cost 2/	Quantity	Extended Price
1.0				
	Radio Transceivers			
	HF			
	VHF			
	___			
2.0				
	Antennas			
	Fixed HF			
	VHF			
	Mobil HF			
	VHF			
	____			
3.0				
	Power System			
	Batteries			
	Rectifier - Charger			
	Generator			
	_____			

1/ Manufacture and Model number shall be indicated

2/ Conversion rate five Gourdes equals one US dollar

4.0

Support Equipment (Lot)

_____

5.0 Executed by

5.1 _____

Signature of Individual Bidder

_____

Witness to Signature

(OR)

5.2 _____

Individual Contractor

_____

Partnership Contractor

By _____

Member of the Partnership

_____

Corporate Contractor

By _____

(AFFIX CORPORATE SEAL)

_____

Title

5.3 Date _____

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4.3 DELIVERABLES

4.3.1 Material and Workmanship

All equipment and component parts furnished shall be guaranteed to be new, meet all requirements of this specification, and be in an operable condition at the time of delivery.

All parts shall be of high quality workmanship, shall be in production at the time of bid, and no part or attachment shall be substituted or applied contrary to the manufacturer recommendations and standard practices.

4.3.2 Inspection of the System Equipment

The manufacture and installation of the system or any component thereof, shall be subject to inspection by the Purchaser either at plants of the manufacturer or upon installation at the in-country site.

Any work or material found to be in any way defective or unsatisfactory shall be corrected or replaced by the Contractor at his own expense at the order of the Purchaser, notwithstanding that it may have been previously overlooked or passed by any inspector. Inspection shall not relieve the Contractor of his obligation to furnish materials and workmanship in accordance with this contract and its specifications.

Any work found unsatisfactory by the Purchaser which caused the Contractor to incur additional costs to eliminate the deficiency shall not be paid for by the Purchaser as an extra.

4.3.3 Bid Price Time Extension (Additional Quantities and Installation)

It is and shall be understood and agreed that additional quantities and the installation thereof (if required) of equipment shall be furnished by the Contractor for a period of one (1) year from date of system acceptance at price(s) for same from the Purchaser during said contract period.

4.3.4 Delivery and Installation

The Contractor shall deliver, install, test, and operationally activate all the equipment within one hundred eighty calendar days after receipt of purchase order; or within delivery date as qualified by the Contractor in his Bid Proposal and the same accepted by the Purchaser. A

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detailed schedule is required.

Following installation, the Contractor shall verify and demonstrate successful operation of the equipment and/or system to the satisfaction of the Purchaser.

4.3.5 Delivery Penalty

a) Liquidated Damages

The Contractor understands, has ascertained and agrees that the Purchaser will actually sustain damages in the amount hereinafter fixed for each and every day during which he fails to deliver and install the equipment or perform the services within the time specified or as agreed upon in this specification per paragraph 4.3.8 below. There shall therefore be deducted from any money due or to become due to the Contractor, subsequent to such time fixed for delivery, a sum representing the then accrued liquidated damages.

Such deduction shall not be considered a penalty, but as the agreed monetary damages sustained by the Purchaser, because the Contractor failed to deliver the system within the time fixed for delivery.

In the event of delay in completion of delivery of the system, it is understood and the Contractor hereby agrees that the amount of $50.00 per day to a maximum of $5,000.00 shall be deducted from the monies due the Contractor for each intervening calendar day any work remains incomplete.

b) Delay

The Contractor shall not be liable for any delay in manufacture or delivery resulting from causes beyond his control. Such causes shall include, but are not limited to, compliance with any regulations, orders, or acts of any domestic government, or any department or agency thereof, acts of civil or military authorities, acts of God, acts or omissions of the Purchaser, fires, floods, strikes, lockouts, embargos, wars, riots, insurrections, shortages of fuel, natural disaster, delays in transportation and loss or damage of goods in transit, or defaults of the Contractor's suppliers or subcontractors due to said causes. The delivery and/or installation schedules shall be extended by the amount of any delay resulting from said causes.

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4.3.6 Title

Title to each component of the system shall pass to the Purchaser when such component is delivered, installed, tested and accepted by the Purchaser. The Contractor shall bear all risk of loss until passage of title and adequate documents for securing title shall be provided to the Purchaser by the Contractor.

4.3.7 Warranty-Guaranty and Continuing Service

a) Guaranty Period

All equipment including installation material shall be guaranteed by the Contractor against mechanical and electrical workmanship defects. In the event defects become evident within the warranty period, the Contractor shall furnish all replacement parts and materials at no cost to the Purchaser for a period of not less than one (1) year after the date of system acceptance.

b) Maintenance and Service

The Contractor shall have a customer service department. (See paragraph 2.8)

c) Additions and/or Changes in Service

During the warranty and maintenance period the successful Bidder will be required to respond to Purchaser requests for additions and/or changes in telecommunication services on a cost reimbursable basis. Specific costs will be documented prior to contract award.

4.3.8 Equipment Acceptance and Performance Period

Unless the Purchaser otherwise agrees, acceptance of any portion of the system prior to the time that the Contractor meets all acceptance criteria shall not release the Contractor from liability for faulty workmanship or materials or for failure to fully comply with all of the terms of this contract. The Purchaser reserves the right and shall be at liberty to inspect all materials and workmanship at any time during the manufacturing or installation process and shall have the right to reject all materials and workmanship which do not conform with the instructions, contract requirements and specifications; provided, however , that the Purchaser is under no duty to make such inspection and no inspection so made shall relieve the Contractor

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from any obligation to furnish materials and workmanship in accordance with the instructions, contract requirements and specifications and industry accepted standards and procedures.

4.3.9 Revision Requirements

All revision information pertaining to the equipment purchased shall be supplied to the Purchaser at no cost as it becomes available. (This includes corrections to the instructional manual, etc.) This information is to be furnished for as long as this equipment is being produced by the manufacturer.

4.4 PAYMENT

4.4.1 Payment Does Not Imply Acceptance of the Work

The granting of any progress payment or payments by the Purchaser or the receipt thereof by the Contractor, shall not constitute in any sense acceptance of the work or of any portion thereof, and shall in no way lessen the liability of the Contractor to replace work or material which does not conform to the contract documents, though the character of such work or material may not have been apparent or detected at the time such payment was made. Materials, components or workmanship which do not conform to the instructions or these contract requirements and specifications, or are not equal to any samples submitted to and approved by the Purchaser, will be rejected and shall be replaced by the Contractor without delay.

4.4.2 Retention of Sums Charged Against the Contractor

When under any provision of this contract, the Purchaser shall charge any sum of money against the Contractor, the amount of such charge shall be deducted and retained by the Purchaser from the amount of the next succeeding payment, or from any other monies due or that may become due the Vendor or account of the contract.

4.4.3 Payment Terms

Payment for the Telecommunications System shall be made in accordance with the following schedule:

50% upon delivery of each item of equipment. Invoices to the Purchaser will be submitted monthly.

25% upon completion of the installation.

25% upon acceptance of the total installed and operational system. Acceptance shall be by a written letter of agreement between the contractor and the Purchaser.

4.5 GENERAL TERMS AND CONDITION COMPLIANCE

The Contractor shall be fully bound by these general terms and conditions as if the same are a part of the Warranty made to equipment(s).

APPENDIX D

OPERATIONS PROCEDURES

A well organized communications network will have at its disposal and will use certain standardized procedures and forms. These will be basic to communication needs and network design. They will cover such areas as:

- scheduling routine network operations
- procedures for emergency calling and operations
- message generation, handling and delivery formats
- maintenance of station transmission logs and message files
- scheduling of outages and maintenance
- ordering of materials needed to maintain the equipment and operation.

This appendix suggests some procedures which may prove helpful to network operations. It is emphasized that these are examples. If they are incorporated into operations they should be periodically reviewed and ammended or replaced based on past experience.

1.1 INTRODUCTION

A communications network, by the requirement for its existence, implies the distribution of personnel over an area, without the means of immediate exchange of information.

Since individuals cannot spontaneously create their own lines of communications, the manufactured channels that exist require to be "organized". Once organized they require to be "operated" in order to achieve a flow of information. The system then requires to be maintained to ensure an acceptable standard of efficiency in the flow of information. Hence a successful communciation system relies on its Organization, Operation, and Maintenance.

2.1 ORGANIZATION

This is dependent on the individual requirements of any system, and this particular system has been organized to meet two distinct requirements simultaneously.

One is organized for spontaneous activity the other for scheduled activity. An outline of the organization of the latter is given in Section 4.4. This outlines one method of organizing activities so that the two requirements may be interleaved.

3.1 OPERATION

This requires, a specific format and procedure to be learned and adopted, by all personnel operating the system, and by personnel utilizing the facilities offered by the system.

In the case of a spontaneous system such as base to mobil no log or record is kept, a strict operating procedure should however be adopted. This basically requires that each station identifies himself and the station he is calling, whenever he operates the system. For example:

Mobil Three to Mobil Two - Where are you? - over

Mobil Two to Mobil Three - I am located at plantation well - over

Mobil Three to Mobil Two - O.K., I will meet you at base in ten minutes - over

Mobil Two to Mobil Three - Roger - out.

Each station identifies himself and the person he is speaking to. He keeps his message as short as possible, and he indicates when he has finished

each transmission. Completion of the conversation is indicated by the use of an alternative to that used to indicate transfer at a point during the conversation. This is used as an indicator to other users of the channel. All radio operators are extremely polite, and are trained to be so, thus no one speaks while another conversation is in progress. The terminating word therefore indicates that the conversation has been completed and the channel is available to other users. Brevity of words is a further deference to other users, and also improves efficiency.

Many systems are required to handle third party traffic, and in the present system, third party traffic may be passed over as many as four radio links in sequence. Due to scheduled transmission several hours may elapse between origination of the message and its receipt by the addressee. The message must therefore be written on a form similar to a telegram form, and be fed into the system by a specified route.

A suitable form is shown in Figure 3.1 and its progress outlined below. Figure 3.2 shows the same form at its first stage, that is, as completed by the user of the communication system, who wishes to send a message. It will be noticed that he completes only the center part of the form, the upper and lower sections are for the system operators.

Step 1 - Completed form is sent to Communications Office.

Step 2 - Operator completes the RCVD. BY box with his initials, and then fills in the top part of the form as follows:
SIG. NO. is the serial number for this message, from his message file (to be described)
FROM - he enters his station call sign
TO - he enters the call sign of the final radio station in this case that of CC DONDON
VIA - he enters the call signs of the station in route in this case, those of Petit-Goave, Port-au-Prince and Cap-Haitan.
He then transfers the Date/Time of origin from the text to the top part of the form and fills in the Date/Time and Method of Receipt.

Step 3 - Operator calls District Office and says, "I have a message",

MESSAGE FORM SIG. NO.

FROM	VIA
TO	DATE/TIME OF ORIGIN
DATE/TIME OF RECEIPT	DATE/TIME OF DESPATCH
METHOD OF RECEIPT	METHOD OF DESPATCH

FROM TO DATE

TEXT TIME

RCVD. BY	DESP. BY

Figure 3.1

MESSAGE FORM SIG. NO.

FROM	VIA
TO	DATE/TIME OF ORIGIN
DATE/TIME OF RECEIPT	DATE/TIME OF DESPATCH
METHOD OF RECEIPT	METHOD OF DESPATCH

FROM C.C. FOND-DES-NEGRES TO C.C. DONDON DATE Juin 6/79.

TEXT TIME 1430

OUTILS DE RECHANGE DEMANDES DE NOTRE MAGASIN, ETANT CHARGES AUJOURD'HUI. ATTENDONS ARRIVEE A VOTRE LIEU EN QUATRE JOURS — GEORGES LEFARGE

RCVD. BY	DESP. BY

Figure 3.2

Step 4 - District Office accepts message, copying the whole content of center part, as transmitted, onto a similar message form. He also accepts the serial number, the time of origin and routing call signs from the top part of the form and copies them onto his.

Step 5 - District Office operator enters time/date and method of receipt on the copy he has made and signs the RCVD. BY box. Meanwhile, the sending operator fills in the time and date of despatch on his copy and signs the DESP. BY box with his initials. He now records the details in the station Message Records and files the actual message appropriately.

Step 6 - District Office operator enters details of the message in his Message Record, and places the actual copy in the Despatch Box to await the next scheduled communication with HQ.

Step 7 - At the next scheduled communication with HQ the message is passed together with any other that may be waiting,

Step 8 - Operator completes the remainder of his copy of the message. He then completes the details for the particular message in the Message Record, and files the actual message in the file, while the Receiving Operator processes his copy. It will be seen that copies of the message exist at each radio station on the route with details of its processing in Message Record at each station. A high standard of cross-check capability therefore exists with a consequent high standard of operating discipline and little loss of transmitted information.

3.2 OPERATION RECORDS

In order to record the activities of each radio station a diary of activity is maintained. A typical example is shown in Figure 3.3. This indicates every incident that occurs, that has a bearing on the actual radio equipment.

It is maintained in continuous form so that no insertions can be made at a later date. The diary has the signature of each person that operates the equipment beside the time and date at which he commenced, and the time

STATION Cattewille. CALL SIGN H3AB

DATE	TIME	STATION	MESSAGES SENT	MESSAGES RECVD	SIGNAL CH.	SIGNAL STR.	END TIME	REMARKS
3/79	1050	de H3AA	4	3	D	4/9	1045	Msgs. handed to District Manager.
"	1100	H3AC de H3AA	-	—	D	4/9	1110	
"	1115							Off Watch J. Smith.
4/79	0730							On Watch J. Smith.
"	0800	de H3AA	—	-	D	5/9	0820	Daily Broadcast.
"	0821	H3AA de H3AB			D	5/9	0821	Call in traffic state-3 waiting.
"	0830							Off Watch J. Smith.
"	1025							On Watch J. Smith.
"	1030	de H3AA	3	7	D	4/9	1050	Traffic cleared.
"	1055							Off Watch J. Smith.

Figure 3.3

BEST AVAILABLE COPY

and date at which he completed his activities.

A separate Message Record is also maintained, this record in column form, has details of each message handled by the station in chronological order. Message details are extracted from the top part of each message form, as it is handled, the message being filed after processing, for reference purposes.

It follows that each message not originating or terminating at the radio office, must appear twice in the Message Record. Once when it is received and once when it is despatched.

4.1 MAINTENANCE

In order to maintain equipment at a high standard of serviceability, a routine schedule of maintenance must be organized and adopted.

The activities to be performed, such as checking battery electrolyte, and generator lubricant and fuel, should be defined to occur at routine intervals.

A diary for these activities must be maintained and the details entered against a time and date by the person who performed them.

Responsibility for the activities is organized on a roster basis, thus allocating responsibility at specific times and or days.

5.1 EMERGENCY PROCEDURES

These can only be defined when the organizer is aware of the type of emergencies likely to occur. The procedures to be adopted in particular circumstances are then defined and made known to all those who might be affected.

For example all HF equipments have access to the Backbone System. In the event of a road accident, the vehicle operator with a radio, would select the appropriate channel and originate a M'Aidez call. Any station who could hear the call would answer, accept the information, and pass it on by whatever means were available, to render assistance as rapidly as possible.