HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1
GENERAL MANAGEMENT REPORTS

Department of Planning and Economic Development

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1

GENERAL MANAGEMENT REPORTS

Prepared by

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for the

State of Hawaii

Department of Planning and Economic Development

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The successful conduct of Phase I work efforts described herein would not have been possible without the dedication, perserverance and hard work of many individuals and organizations. Although it would be almost impossible to identify all of those who have been involved with Task 1 work efforts, the following identifies those who have had the most visible influence.

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HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1

PROGRAM MANAGEMENT PLAN

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SECTION 1

INTRODUCTION

1.1 GENERAL

This Program Management Plan (PMP) has been prepared to identify and specify the administrative, technical and fiscal functions and controls that will be utilized during the Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program). The functions and controls have been developed and designed to assure that the overall Program work tasks are performed to the highest quality possible within the Program's organizational, time and budgetary constraints. Although this PMP has been prepared during the preliminary definitional phase of work (Phase I), it is intended for use by the Program Team as a working plan and directive during succeeding phases of work. As such, this PMP will be a dynamic document that will reflect changing Program conditions through revisions in design approach, scope and detail of Program elements as the project progresses. Upon approval by Hawaiian Electric Company (HECO) and funding agencies, this PMP will become a controlled document, and all future revisions will be subject to the change control procedures established herein and in the Quality Assurance Plan.

1.2 THE HDWC PROGRAM

The HDWC Program is fully described in HECO's June 2, 1980 Unsolicited Proposal to the U.S. Department of Energy (DOE) (Unsolicited Proposal No. P8001174). The basic stated purposes of the Program are: (1) Determine the technical and economical feasibility of interconnecting the Hawaiian Islands with a submarine high voltage direct current (HVDC) electrical transmission cable;

(2) Determine the ocean engineering problems and solutions of deploying, retrieving and repairing a deep water cable in the Hawaiian environment; and (3) Develop a commercial cable criteria document that can be used by electric utilities, DOE or other agencies for the design, installation and maintenance of deep water, HVDC cables.

The HDWC Program is presently scheduled to be conducted during the October 1981 to December 1984 time period.

1.3 PROGRAM ORGANIZATION

The overall Program organization is shown in Figure 1. As shown, HECO will be under direct contract to the funding agencies. Parsons Hawaii (Parsons), in turn, will be under direct contract to HECO and will issue subconsultant contracts to all other Program participants.

HECO, in their role as Prime Contractor, will conduct Program reviews at the initiation, mid-point and completion of each Program phase. These reviews will focus on progress versus schedule and expenditure versus budget. HECO will also review and comment on all phase reports and critically review final reports to be submitted to funding agencies, and review and approve every task report prior to submittal to funding agencies.

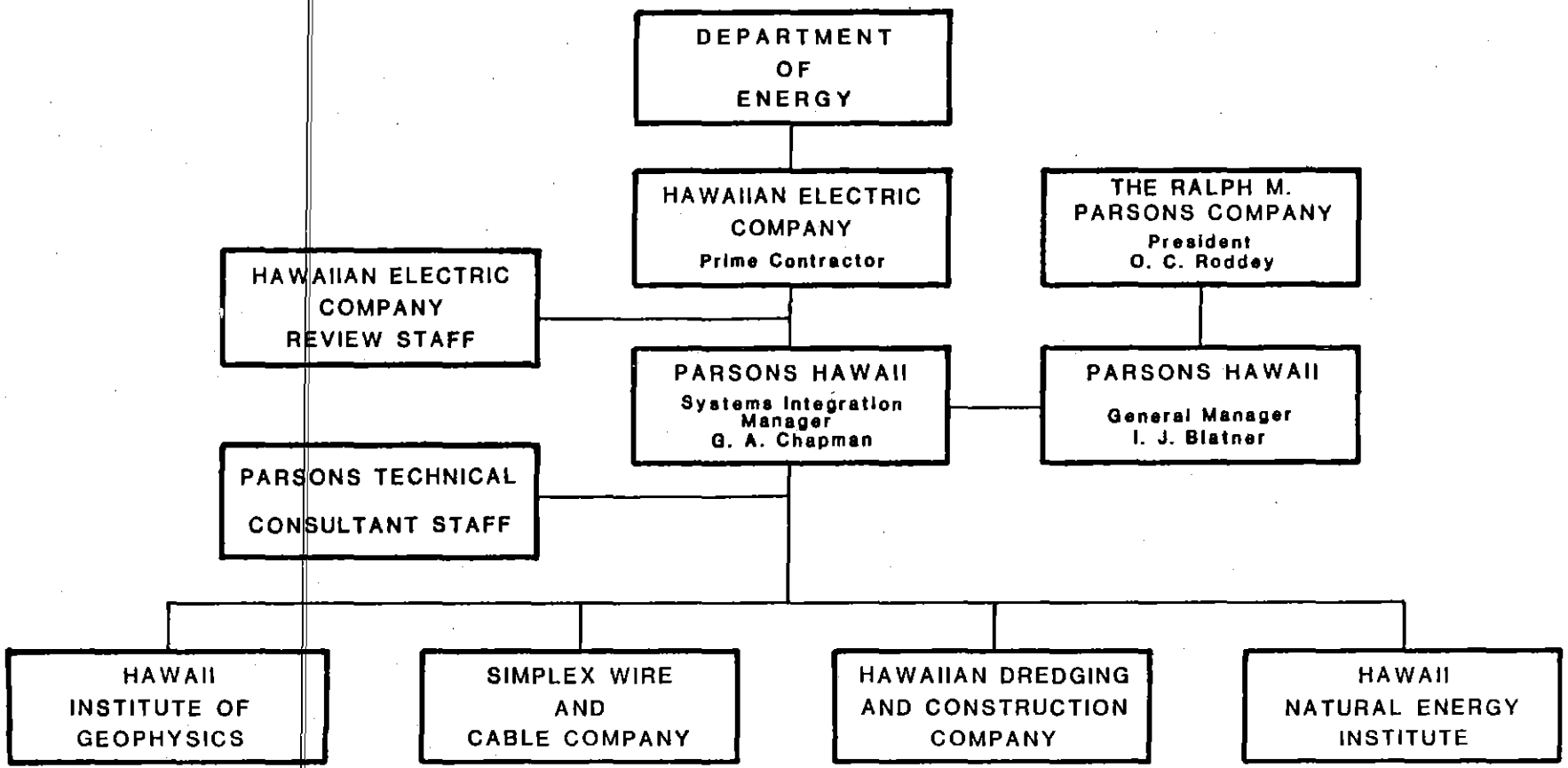
Within the framework of the Program Team, Parsons has been assigned the principal functions of Systems Integration Manager and has organized these functions as shown in Figure 2.

In order to perform the required Program Management role, HECO and Parsons will employ a system of project controls that focus on intelligent planning, close control of the resources available,

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE TECHNICAL EVALUATION PROGRAM

FIGURE 1

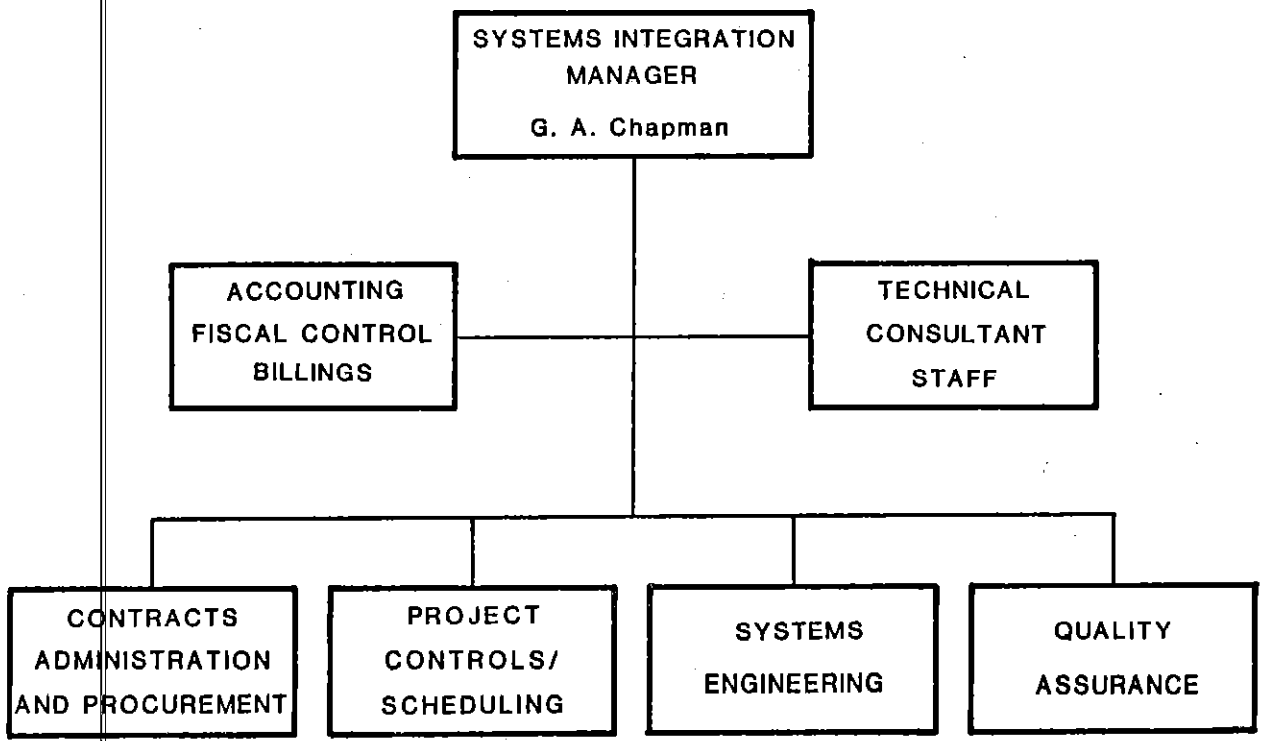
PROGRAM ORGANIZATION



HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
TECHNICAL EVALUATION PROGRAM

FIGURE 2

PARSONS HAWAII PROGRAM ORGANIZATION



direct lines of communication between all Program participants, and strict coordination and control of the work of all participants through the use of review committees and technical working groups.

The system of project controls noted above include the Project Control System (PCS) identified herein. The PCS consists of standard cost control and reporting procedures, schedule procedures, design review procedures, quality assurance/quality control procedures and data control procedures.

SECTION 2

ADMINISTRATIVE FUNCTIONS AND CONTROLS

2.1 GENERAL

The following subsections describe the Program Management organization and procedures that are applicable to all Program participants. In order to assure applicability to and awareness by all Program participants, appropriate language and phrases from this PMP and other controlling procedures (e.g. Quality Assurance Plan), will be included in contract documents. Each Program participant will be provided a copy of the latest issue of the controlling documents.

2.2 REPORTING/LIAISON PROCEDURES

As Prime Contractor, HECO will receive direction from funding agencies regarding various Program deliverables, schedules, cost control methods, technical matters and other Program items. The responsibility for carrying out the required action will be determined by HECO and communicated to Parsons via job instruction memos, letters of transmittal and telephone conversations or personal meetings as deemed appropriate by HECO. Should action be required by Parsons subconsultants, Parsons will so inform them by appropriate means. All major and, where appropriate, minor instructions will be transmitted in writing to the subconsultants. These instructions, in the form of a memo, will describe the items of required work or action, indicate any special preparation requirements, indicate milestones for delivery of review documents (if required), and final completion dates as required. For work or actions requested that are, in the mutually agreed judgment of Parsons and the subconsultant, outside contractually established

scopes of services, Parsons will request a technical and cost proposal and proceed, if possible, to negotiate an amendment to the basic contract or issue separate purchase orders, work orders or other agreed upon contract documents. Specifically excluded from extra work clauses of all contracts are the development by Parsons or its subconsultants, at Parsons written request, proposed Scopes of Services and Cost Proposals for future work tasks. Copies of all job instruction memos or requests will be provided to HECO and will be controlled documents as specified below.

In all but specifically authorized occasions, only HECO shall communicate directly with funding agency personnel. Allowable exclusions include social gatherings or meetings in which Program participants may come into direct contact with funding agency personnel. It shall be the individual Program participant's duty to inform HECO, via Parsons, that such a meeting is possible or probable, when and where such a meeting may occur and follow any HDWC Program directions provided by HECO or Parsons. This control is necessary to insure that only releasable information is provided in the above noted meetings and to insure that during the conduct of work, preliminary information, misinformation or unconfirmed results or data are not disseminated.

As indicated on the Program Organization Chart (Figure 1), Parsons will communicate and liaise directly with HECO. All Parsons subconsultants shall communicate directly with Parsons and indirectly with HECO through Parsons. Exceptions to this will be allowed only in those instances when appropriate Parsons personnel are not immediately or within a reasonable period of time, in the professional judgment of the subconsultant, available to communicate directly to HECO. Conversely, HECO will communicate to Parsons subconsultants through Parsons, except in those cases as noted above for subconsultants.

As shown on the Program Organization Chart, subconsultants are free to, and expected to, communicate directly with each other. This procedure is necessary to assure coordination of work efforts and to insure the immediate dissemination of technical information among subconsultants. In all cases, Parsons shall be kept informed of such communication and be provided copies of written correspondence, meeting minutes, telephone conversation confirming memos, or other such records. Parsons, in turn, shall notify HECO of such communications and, when required, provide copies of pertinent written communication records.

2.3 DISSEMINATION OF MANAGEMENT INFORMATION

It is anticipated that during the progress of the Program, management information and documents (such as this PMP) will be updated and distributed to all Program participants, at the direction of HECO or funding agencies. Management instructions or directives shall only flow from funding agencies to HECO to Parsons to subconsultants.

2.4 PROGRAM STAFFING

The HDWC Program is a multi-discipline program during which many directly and indirectly interrelated tasks will be conducted concurrently. As such, it is imperative that each Program participant assign only those personnel to the Program who have proven experience and capabilities to perform their assigned duties. In order to assure the proper assignment of personnel, all Parsons subconsultants shall be required to submit to Parsons detailed resumes of key personnel. Parsons, in turn, shall be required to submit resumes of its key personnel to HECO. If in the professional judgment of either Parsons, HECO or the funding agencies, personnel are not considered to be appropriate for their given

assignment, the participating organization may be required to either reassign personnel or provide additional supporting personnel. This requirement is necessary in order to maintain the high level of technical and administrative work required during the conduct of the Program.

2.5 MANAGEMENT CONTROLS

All management controls regarding Program work instructions, scheduling and costs, dissemination of technical data or other Program information, shall be as stated within this PMP and other Program control documents or contract documents. It is noted that the HDWC Program is a research, development and demonstration (RD&D) program and, as such, all Program participants are expected to retain a certain amount of internal management and technical flexibility. Situations may arise that are totally foreign or new to a given participant but may be quite common to another. In these situations, Parsons, as Systems Integration Manager, will attempt to develop an amicable solution to any problem areas that may arise. However, it is possible that mutually agreeable solutions will not be reached. In those cases, appropriate contract clauses shall prevail.

2.6 SCHEDULING AND COST CONTROL

Complete scheduling and cost control procedures are included in Section 4 of this PMP. In essence, an overall project schedule will be developed by Parsons, linking technical task work with budgeted tasks. Each Program participant will be expected to develop their own schedules and report monthly the progress of their work and costs incurred.

2.7 PROGRESS REPORTING

As established during Phase I work activities, monthly narrative reports detailing the technical work performed by each Program participant will be submitted to Parsons. Parsons, in turn, will submit an overall monthly progress report to HECO. The informational content and format of these reports will be identified in the contract documents. Along with the narrative reports, a cost report will be submitted per the format shown in Section 4, Figure 3, and as described in the contract documents.

2.8 QUALITY ASSURANCE

All Quality Assurance and Quality Control (QA/QC) procedures to be followed during the conduct of the HDWC Program are identified in a separate QA Plan that will be provided to each Program participant.

2.9 CHANGES TO WORK

All changes to work will be governed by appropriate contract document clauses.

SECTION 3

TECHNICAL FUNCTIONS AND CONTROLS

3.1 GENERAL

In this section the primary technical functions and responsibilities of each Program participant are identified, as are the technical controls and procedures. As noted throughout this PMP, the controls and procedures described herein are applicable to all Program participants for the remaining phases of the Program.

3.2 TECHNICAL PROCEDURES

Since the majority of the HDWC Program work is primarily of an RD&D nature, Program participants are generally able to follow their own established procedures to accomplish given work tasks. However, in some instances, the funding agencies, HECO or Parsons may require specific procedures to be followed to insure uniformity of final work products. When such procedures are specified they will be so indicated in contract documents and Scopes of Services. In all cases, established applicable international, national, or industry accepted codes and standards will be followed. This is especially critical in the areas of cable design and testing, cable vessel design and construction/modification and at-sea route surveying. Also, in all cases specific procedures to be followed by a given Program participant shall be provided to Parsons, HECO or funding agencies, for review and approval prior to the initiation of work. Specific technical procedures that shall be followed by Program participants are described below.

3.2.1 RESPONSIBILITY

The principal project manager, engineer or investigator for each Program participant shall have the responsibility for the adequacy and accuracy of all work performed by that organization and shall be responsible for ensuring that a given Program participant interfaces and coordinates properly with other Program participants.

3.2.2 EXTERNAL DESIGN INPUTS

Copies of all design inputs provided by one Program participant to another shall be provided to Parsons and/or HECO prior to its use by the receiving organization. Parsons shall have the responsibility of properly distributing such external inputs to other Program participants as required.

3.2.3 INTERNAL DESIGN INPUTS

The principal project manager, engineer or investigator for each organization shall insure that all team members within that organization interface and coordinate their activities daily. Significant or substantive decisions regarding a given organization's design or work efforts resulting from this interfacing and coordination shall be transmitted to Parsons in a timely manner.

The principal project manager, engineer or investigator shall also conduct periodic quality control checks during the progress of a given work task to assure that all work is proceeding on schedule and within the cost budgets established. Notices of these QC checks and the results thereof shall also be transmitted to Parsons in a timely manner.

3.3 PREPARATION OF DESIGN DRAWINGS OR REPORTS

This subsection applies to both design drawings and engineering reports prepared during the conduct of the HDWC Program work. Therefore, where applicable, "design drawings" are synonymous with "engineering reports" and the procedures and controls identified as applicable to design drawings also shall be applicable to reports. In general, engineering drawings are divided into four categories:

- Sketches
- Preliminary Design Drawings
- Final Design Drawings
- Multi-Sheet Drawings

Engineering sketches are used to establish design concepts and transmit basic ideas in an informal manner. Sketches are not to be used for fabrication or construction purposes. However, pertinent sketches shall be retained by the principal project manager, engineer or investigator as part of the organization's project files and be available to HECO or Parsons upon request. Should sketches be transmitted outside a given organization to another Program participant, a copy of these sketches shall be provided to Parsons.

Preliminary design drawings and reports shall be prepared on standard size drawing paper, not to exceed 30" x 40" (reports on 8-1/2" x 11" bond paper) and shall establish a design baseline. ~~Preliminary design drawings shall be titled, numbered and dated.~~ They are not to be used for fabrication or construction purposes. Preliminary design drawings will be developed to specific levels of design (30, 50 or 60 percent) as specified in Scopes of Services or other contract documents and only issued in accordance with Parsons or HECO's directives.

Final design drawings and reports are those that are prepared to portray the final engineering effort and issued to Parsons and HECO for approval prior to fabrication and construction. Upon approval by Parsons and HECO, the drawings or reports will become controlled documents in accordance with the procedures described below in subsection 3.8. All drawings will show both English and metric dimensions with metric dimensions shown in parentheses. Multi-sheet drawings shall be avoided, to the maximum extent possible, during the conduct of the HDWC Program.

3.4 PREPARATION OF SPECIFICATIONS

The principal project manager, engineer or investigator for each Program participant shall be responsible for the preparation of applicable specifications and the technical adequacy and accuracy of those specifications. Specifications shall be prepared to the same level as accompanying design drawings. Preliminary specifications shall be concise and state the basics such as size, material and operating conditions. They shall be identified in accordance with the documentation control procedures described below, and shall only be issued to Parsons or HECO for review and approval.

Final specifications to be used for procurement or construction shall contain all the information for material selection, testing and acceptance requirements, capacity and ratings, installation requirements and QA requirements. Completed specifications shall be issued only to HECO and Parsons for review and approval purposes. The specifications shall be identified in accordance with the documentation control procedures described below. Specifications for construction or fabrication purposes shall only be issued to persons outside the HDWC Program upon the express written approval of Parsons and HECO.

3.5 CODES AND STANDARDS

As noted in subsection 3.2, all established applicable international, national and industry accepted codes and standards shall be followed during the conduct of HDWC Program work. When requested, Program participants shall provide, at no cost, copies of codes or standards that are not readily available to either Parsons or HECO.

3.6 SPECIAL STUDIES

In essence, the majority of the HDWC Program consists of the conduct of special studies. Due to the wide variation in technical understanding of the audiences that will receive copies of the various reports and studies, all reports are to be prepared such that they are readily understandable by lay persons, but are to have sufficient technical backup to be able to withstand close technical scrutiny. Report formating will be up to the individual organizations, but reports shall be organized in a logical manner that enables the reader to proceed from subject to subject easily and logically.

3.7 QUALITY CONTROL

All Quality Control and Quality Assurance procedures are identified and described in the Quality Assurance Plan that is separate from, but a part of, by reference, this PMP.

3.8 DOCUMENTATION CONTROL

It shall be the responsibility of the principal project manager, engineer or investigator of each Program participant to insure that the documentation control procedures identified below and in the QA Plan are followed. These procedures apply to all data, criteria,

correspondence, meeting notes, design drawings, specifications, and calculations or reports and all reports prepared as task work. Program participants shall use their standard transmittal forms or transmittal letters when passing information from one organization to another. In those cases where Program participants correspond directly with one another, Parsons shall be provided copies of the correspondence. All documents, as identified above, shall be assigned a control number by each organization. Letters shall be identified with a letter number or serial number. Drawing numbers and report numbers shall be assigned per the standard procedures of each organization. Each report or drawing shall also be identified with the following, either in the title or elsewhere on the cover sheet of reports and within the title block of drawings:

> "Prepared for Hawaiian Electric Company and Parsons Hawaii as a portion of the Hawaii Deep Water Cable Program"

All reports and drawings shall be dated and, where appropriate, signed and stamped by the principal project manager, engineer or investigator. Authors of all reports shall be identified on the cover sheet and assisting preparers identified within the body of the report. In the case of drawings, the drafter and checker shall also initial or sign and date the drawings in appropriate title block spaces.

In no case shall any drawings, specifications, calculations, special studies or reports be issued to anyone outside the HDWC Program without the express written approval of Parsons and HECO. Precautions shall be taken by responsible organization personnel to insure that information of any kind is not released without the express written approval of Parsons and HECO.

SECTION 4

FISCAL FUNCTIONS AND CONTROLS

4.1 GENERAL

In this section the procedures and controls to be utilized by HECO and Parsons to insure that all costs and schedules are maintained during the conduct of the HDWC Program are discussed and described.

4.2 ORGANIZATION AND RESPONSIBILITIES

As Systems Integration Manager, Parsons will be responsible to HECO to insure that all work is performed within established schedules and budgetary constraints of any given phase of work. To accomplish this, Parsons, in consultation with Program participants and HECO, will develop an overall program schedule for each phase of work. This schedule will link time frames to cost expenditures or cash flow and will be monitored during the progress of the work. Each Program participant will be required to submit, along with monthly status reports, monthly cost reports that indicate the actual expenditure of funds versus budgeted amounts. Initial budgets for Program participants will be those initially submitted by the organization or those finally negotiated with the funding agencies.

Upon submittal of both the narrative reports and cost reports, Parsons will thoroughly review requests for payment prior to forwarding those requests to HECO for payment. HECO, in turn, will thoroughly review Parsons requests for payment prior to forwarding them to funding agencies for payment. This series of checks and balances will insure that the work is progressing as scheduled and

that payments requested are for the actual amount of work accomplished.

Invoicing will follow the general format established during Phase I work activities as shown in Figure 3. All monthly narrative and cost reports will be submitted to Parsons by the fifth day of each month to insure that Parsons is able to submit a narrative and cost report to HECO by the tenth day of each month. Financial records shall be maintained by each Program participant as specified in the contract documents.

FIGURE 3

SAMPLE MONTHLY INVOICE FORMAT

INVOICE

No. _____

Date _____

Parsons Hawaii
P. O. Box 29909
Honolulu, Hawaii 96820

ATTENTION: Mr. Gordon A. Chapman

To invoice you for Consultant Services rendered from _____ through _____, in connection with the Hawaii Deep Water Cable Program task work, pursuant to our Contract dated _____ _____.

Invoice for Month of _____

Task	Work Item	Budgeted $ Amount	Percent Complete as of _____	$ Amount Complete
-		$	%	$
-				
-				
	TOTALS	$_____	_____ %	$_____

Total Complete $_____
Less Retention (10%) _____
Less Prior Invoice _____
Total Due This Invoice $_____

I certify that the above invoice is correct and just, and that payment therefor has not been received.

COMPANY NAME

_____
Name and Title of Responsible Employee

HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1

WORK BREAKDOWN STRUCTURE

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM WORK BREAKDOWN STRUCTURE

GENERAL

As noted in other reports prepared for the Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program), the work to be performed during the remaining phases consists of numerous independent, yet directly and/or indirectly, interrelated tasks. The work to be performed has been organized and defined within a product and end-item oriented framework and organizational structure. The Work Breakdown Structure (WBS) provides a planned approach for the full integration of all of the Program technical and control functions. As such, the WBS will be utilized by Hawaiian Electric Company (HECO) as Prime Contractor and Parsons Hawaii (Parsons) as Systems Integration Manager, to:

- Identify all contract line items and end items.
- Identify all WBS elements negotiated for external reporting.
- Identify responsible Program participant for each WBS element.
- Provide a framework for the planning, budgeting, and scheduling of all work, accumulation of costs, and allocation of resources to that work.
- Assist in monitoring project cost, schedule, and technical performance.
- Provide a structure for the orderly summarization of work performance to selected levels of detail.
- Identify work requiring special attention and its replanning, when necessary.
- Break work down into manageable segments according to the way work is done.

The terminal elements of the WBS will be controlled by Parsons through HECO and the funding agencies. All proposed changes to the WBS will be submitted to HECO and funding agencies for review and approval.

As noted above, one of the principal uses of the WBS is to provide a framework for the planning, budgeting, scheduling, cost reporting and allocation of resources to the required work. The process of developing Scopes of Services, budgets and schedules for each cost account is an interactive one. The process begins with the Systems Integration Manager (Parsons) developing preliminary scopes of services, budgets and cost accounts in consultation with Program participants. The process ends when mutually agreeable scopes of services, budgets and schedules are developed. These items allow Parsons to monitor work progress from a realistic baseline and enable cost accounts to be monitored, reported and billed.

WBS DICTIONARY

A WBS dictionary will be prepared by Parsons as an accessory to the WBS chart. The dictionary will provide a scope of services description for each major task element. The dictionary will establish the framework for reporting Program costs, schedules and technical performance. This documentation will facilitate uniform planning, assignment of responsibilities and the reporting of item status for all work required by the contracts. The dictionary will consist of the following two parts:

- Part I, Index; lists WBS elements extending to those at the cost account level (sample per Figure 1).
- Part II, Task Definitions: contains individual entries describing the contents and type of effort associated with WBS tasks contained in the index (sample per Figure 2).

WORK BREAKDOWN STRUCTURE DICTIONARY PART I – INDEX											PROJECT/CONTRACTOR (1)		CONTRACT NO. (2)	DATE (3)
LINE NO. (4)	WBS ELEMENTS (5)										CONTRACTOR WBS CODE (6)	BUDGET AND REPORTING CLASSIFICATION (7)	PHASE (8)	OTHER (9)
	INDENTURE LEVEL									LEVEL				
	1	2	3	4	5	6	•	•	•					

Figure 1
WBS Dictionary: Part I – Index

WORK BREAKDOWN STRUCTURE DICTIONARY PART II – ELEMENT DEFINITION	WBS ELEMENT CODE: TITLE: CONTRACTOR: (1)

INDEX LINE NO. (2)	REVISION NO. AND AUTHORIZATION (3)	DATE (4)

APPROVED CHANGES (5)

SYSTEM DESIGN DESCRIPTION NUMBER: TITLE: (6)	FUNDING DOCUMENTS (7)

ELEMENT TASK DESCRIPTION (8)

COST CONTENT

WORK STATEMENT

Figure 2
WBS Dictionary: Part II – Element Definition

The WBS dictionary will be maintained in a current status throughout the life of the Program by Parsons.

HDWC PROGRAM WBS

Figure 3 is the WBS for the HDWC Program, as presently defined and organized. As shown, work efforts have been defined to Level V on the WBS and to lower levels in the accompanying outline. Narrative and technical reporting by Program participants will generally be to Level V, except in those cases where more detailed reporting is required. These specific instances will be identified in scopes of services or other contract documents for specific tasks. Cost reporting will generally be to Level IV unless specifically required for lower levels.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM
DETAILED WORK BREAKDOWN STRUCTURE OUTLINE

1.0 HAWAII DEEP WATER CABLE PROGRAM

1.1 PRIME INVESTIGATOR

1.1.1 Program Management
1.1.2 Technical Support
1.1.3 System Integration

1.1.3.1 Phase I - Preliminary Program Management

1.1.3.1.1 General Management

a. Program Management Plan
b. Program Detail Work Breakdown Structure
c. Quality Assurance Plan
d. Program Mobilization Plan

1.1.3.1.2 Management Support

a. Contract Management
b. Coordination and Meetings
c. Demonstration Program Definition and Schedule
d. Develop Costs for Demonstration Program and Interisland Cable System
e. Overall Planning Schedule for Interisland Cable System

1.1.3.1.3 Preliminary Route Survey Analysis

a. Underwater Routes
b. Overland Routes

1.1.3.1.4 Preliminary Prototype Cable Design Criteria

a. Design Criteria Requirements
b. Conductor

c. Insulation and Shielding
d. Sheath and Jacket
e. Armor and Outer Covering
f. Alternative Baseline Design Concepts
g. Cable Design Verification
h. Cable Fabrication Factors
i. Cable Construction Memorandum
j. Cable Design Alternatives Costs
k. Special Design Considerations

1.1.3.1.5 Preliminary Cable Ship Inventory and Capabilities Survey

a. Literature Survey
b. Field Survey
c. Conceptual Design Studies

1.1.3.1.6 Prepare Phase I Reports

1.1.3.2 Phase IIA - Final Program Definition

1.1.3.2.1 Cable Design and Verification

a. Define Final Prototype Cable Design
b. Define Cable Fabrication Scenario
c. Define Detailed Design Verification Test Program
d. Conduct Design Verification Test Protocol
e. Initiate Design Verification Tests
f. Cable Design Input Coordination

1.1.3.2.2 Repair Splice Design and Verification

a. Preliminary Definition of Critical Splice Design Considerations
b. Prepare Final Prototype Splice Design

c. Define Prototype Splice Design Test Protocol
d. Computer Simulation Modeling Design Input

1.1.3.2.3 Cable Handling Support Systems (CHSS) Design

a. Cable Vessel Preliminary Design
b. Cable Handling Support Systems
c. CHSS Design Input Coordination

1.1.3.2.4 At-Sea Route Surveys

a. Review and Synthesize Existing Data
b. Select General and Detail Survey Areas
c. Perform Surveys

1.1.3.2.5 Environmental Analyses

a. Prepare EA/EIS
b. Public Informational Meetings and Hearings
c. Finalize EIS

1.1.3.2.6 Electrical Grid System Integration Investigations

a. Alternate Energy Programs Coordination
b. Systems Planning and Design

1.1.3.2.7 Computer Simulation Modeling

a. Determination of Critical Mechanical Properties
b. Data Gathering
c. Define Cable Test Protocol

1.1.3.2.8 Public Information Program and Legal and Institutional Constraints Analyses

a. Public Information Program
b. Legal and Institutional Constraints Analyses

1.1.3.2.9 Program Management and Technical Support

a. Program Management
b. Technical Support

1.1.3.3 Phase IIB - Systems Design and Verification

1.1.3.3.1 Cable Design and Verification

a. Final Prototype Cable Design Verification
b. Define Final Prototype Cable Fabrication Specification
c. Cable Design Input Coordination

1.1.3.3.2 Repair Splice Design and Verification

a. Final Definition of Splice Design
b. Fabricate Repair Splices
c. Perform Design Verification Tests
d. Repair Splice Design Input Coordination

1.1.3.3.3 Cable Handling Support Systems Design and Procurement

a. Cable Vessel Final Design
b. Cable Handling Support Systems (CHSS) Final Design

1.1.3.3.4 Environmental Analyses

a. Environmental Permit Preparation
b. Submit Permits
c. Public Information Meetings and Hearings
d. Finalize Permits

1.1.3.3.5 Electrical Grid System Integration Investigations

a. Preliminary System Design
b. Systems Integration Planning

1.1.3.3.6 Computer Simulation Modeling

a. Materials Analyses
b. Cable and Repair Splice Design Input
c. Public Information Program Input

1.1.3.3.7 Public Information Program and Legal and Institutional Constraints Analyses

a. Public Information Program
b. Legal and Institutional Constraints Analyses

1.1.3.3.8 Program Management and Technical Support

a. Program Management
b. Technical Support

1.1.3.4 Phase IIC - Systems Validation and Cable Operations and Test

1.1.3.4.1 Cable Design and Verification

a. Fabricate At-Sea Cable Length
b. Ship Cable Test Length to Hawaii
c. Assist with Cable Deployment
d. Perform *In-Situ* Testing
e. Retrieve, Examine and Re-Test Cable
f. Prepare Commercial Cable Criteria Document
g. Public Information Program Input
h. Electrical Grid System Integration Investigation Design Input

1.1.3.4.2 Repair Splice Design and Verification

a. Coordinate Repair Splice Fabrication with Cable Test Length Fabrication
b. Perform *In-Situ* Tests
c. Retest Splice Design Following Cable Retrieval
d. Provide Design Criteria Input to Commercial Cable Criteria Document
e. Public Information Program Input

1.1.3.4.3 Cable Handling Support Systems Design, Procurement and Installation

a. Cable Vessel Construction/ Modification
b. Cable Handling Support Systems (CHSS)

1.1.3.4.4 Electrical Grid System Integration Investigations

a. Complete System Planning
b. Initiate Final System Design
c. Prepare Preliminary Commercial Cable Procurement Documents
d. Public Information Program Input

1.1.3.4.5 Public Information Program and Legal and Institutional Constraints Analyses

a. Public Information Program
b. Legal and Institutional Constraints Analyses

1.1.3.4.6 Program Management and Technical Support

a. Program Management
b. Technical Support

HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1

QUALITY ASSURANCE PLAN

SUMMARY

The Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program) is a unique project involving governmental agencies, an electric utility company and a wide diversity of specialties from private industry. At any given time during the conduct of the Program, several separate but interrelated tasks and subtasks are being conducted. Therefore, this Quality Assurance Plan (QAP) has been prepared to assure funding agencies and the Prime Contractor that all work is proceeding on schedule, within budgetary constraints and at the highest technical level possible.

This QAP establishes the procedures by which a quality control (QC) system is to be implemented by each Program participant, describes the procedures for controlling the technical quality of all work to be performed and is binding on all Program participants for the remaining phases of work. This QAP is preliminary at this point and should be considered a dynamic document that will be updated and further defined as Program work progresses.

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SECTION 1

INTRODUCTION AND PROGRAM DEFINITION

1.1 INTRODUCTION

The Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program) is a unique project involving governmental agencies, an electric utility company and a wide diversity of specialties from private industry. This technical evaluation program is being or is expected to be funded from a number of sources including the State of Hawaii, the United States Department of Energy (DOE), possibly other Federal agencies and the Program participants themselves. Initial funding is from the State of Hawaii, Hawaiian Electric Company (HECO) and cost sharing by the Program participants that are identified below.

A standard requirement of most Federal agencies for projects of this type is the establishment of a Quality Assurance Plan (QAP) that describes the procedures for controlling the technical quality of all work to be performed. This requirement has been adopted for this Program because of the technical nature of the work to be performed and the diversity of specialties involved.

In order for the project to successfully proceed through the many stages of study, reporting, fabrication and, finally, deployment and design verification, it is necessary to establish a viable Quality Assurance Program that is applicable to all of the Program participants. As a result, the QAP contained hereinafter has been prepared and is binding upon all Program participants.

It is to be noted that the QAP establishes the procedures by which a quality control (QC) system is to be implemented by each

Program participant, and all applicable regulatory requirements, codes and standards that are presently identifiable have been listed.

1.2 PROGRAM DEFINITION

The HDWC Program has been designed to lead to the determination of the technological and economic feasibility of intertying the major Hawaiian Islands into a unified electrical grid system. This grid system will utilize various renewable alternate energy resources and traditional energy resources for power generation. In order for this grid system to become a reality, deep water transmission cables will be required to link the islands together. Although underwater electrical transmission cables are presently in use in the United States as well as numerous other countries, cables that would function in the Hawaiian environment have not yet been tested. Between the islands of Hawaii and Maui, a distance of some 30 miles (48 km), water depths are as great as 7,000 feet (2,100 m). Similarly between the islands of Oahu and Molokai, a distance of 25 miles (40 km), water depths reach 2,200 feet (670 m). The specific goals of the HDWC Program are to:

- Develop a cable design that will permit high voltage direct current (HVDC) transmission over distances of at least 150 miles (240 km) and at water depths up to 7,000 feet (2,100 m).
- Electrically, structurally and mechanically test the developed cable design to determine its reliability, maintainability and operability characteristics.
- Design and verify a cable repair splice that will function within acceptable limits in the Hawaiian environment.
- Develop a vessel capable of deploying and retrieving an HVDC cable over the distances and in the water depths found in the Hawaiian environment.

- Develop the required cable deployment, repair and retrieval procedures and experience in Hawaii.
- Develop a public information and educational program to widely disseminate information regarding the HVDC submarine cable and its relationship to Hawaii's alternate energy programs.
- Define and analyze the legal and institutional constraints that currently exist with regard to an interisland cable system, and develop the strategies for realistically and legally overcoming those constraints.
- Develop a design criteria document that specifies the allowable operability, reliability and maintainability limits of an HVDC submarine cable and the allowable deployment, retrieval and repair procedures.

In order to accomplish these specific goals, the Program phasing and tasks described in Section 4 have been identified as being required in the order they are shown. (Note: The phasing described may undergo change, due to budgetary constraints, as the HDWC Program proceeds. However, it is unlikely that substantive changes to the overall HDWC Program will be made.)

The following lists the HDWC Program participants and their primary area of responsibility:

- Hawaiian Electric Company (HECO) - Prime Contractor and Electrical Grid System Integration Investigator
- Parsons Hawaii (Parsons) - Systems Integration Manager, Technical Support and Environmental Analyses
- Simplex Wire and Cable Company (Simplex) - Cable and Repair Splice Design, Verification and Fabrication
- Hawaiian Dredging and Construction Company (HD&C) - Cable Vessel and Cable Handling Support Systems Design and Verification
- University of Hawaii Manoa - Hawaii Institute of Geophysics (HIG) - At-Sea Route Surveys

- University of Hawaii Manoa - Hawaii Natural Energy Institute (HNEI) - Computer Simulation Modeling
- Department of Planning and Economic Development (DPED) - Legal and Institutional Constraint Analyses and Public Information Program

The present HDWC Program is also designed to be a continuation of other present and proposed laboratory cable testing programs that are being conducted outside the HDWC Program. Confirming laboratory mechanical, structural and electrical tests will be performed on the HDWC Program cable prior to deployment. The most significant aspects of the HDWC Program will be *in-situ* mechanical and structural tests and the development of the commercial cable criteria.

The laboratory and *in-situ* tests are expected to lead to the overall end purpose of the HDWC Program. That is, the determination of the technical and economic feasibility of electrically intertying the Hawaiian Islands.

The accomplishment of the several goals listed above will require the expertise of several technical disciplines. The team of public and private groups participating in the present HDWC Program will provide program management; submarine cable design; hydrographic surveys and analyses; marine environmental analyses; naval architecture; electrical, mechanical and structural engineering analyses and design; marine transportation and logistics; deep ocean cable deployment and retrieval; renewable energy resource program interfacing; and electrical generation and power grid interfacing. The numerous tasks that must be performed to accomplish the HDWC Program goals require that the quality of all work is monitored by pre-established policies and procedures as outlined in Sections 2 and 5 of this QAP. Brief descriptions of the tasks

to be conducted during the remainder of the HDWC Program are given in Section 4. As additional information becomes available and at the initiation of each phase of work, these task descriptions will be updated. The task descriptions are provided to further amplify the Program Team interfacing necessary to successfully accomplish the several tasks.

SECTION 2

QUALITY ASSURANCE PROGRAM

2.1 GENERAL

The purpose of Quality Assurance (QA) for this Program is to provide confidence that the required level of technical quality will be consistently achieved in engineering design; field surveys and analyses; marine transportation and logistics; ocean cable deployment and retrieval, energy resource interfacing, electric generation and power grid interfacing; and program management. All of these functions must be achieved with a minimum, but adequate, expenditure of funds. The responsiblity for quality of the various Program activities rests with the responsible manager of the applicable activity. An independent monitoring of QA and QC will be conducted by Parsons, in their role as the Systems Integration Manager.

2.2 QUALITY SYSTEM

Program participants may utilize their own quality programs and procedures for each task of work for which they have responsibility if they conform to the requirements stated herein and they are formally approved by Parsons and HECO. The approved QA System then becomes a commitment to which the various Program participants will perform uniform controlled work.

The QA System provides the project with assurance that compliance with specified contractual quality requirements is attained. The System consists of planned actions that will be systematically applied during the various elements of work by all Program participants. Such actions will include definitions of responsibilities

and authorities of office and field personnel implementing the QAP (i.e., design control and changes, including field deviations and changes; material substitutions; document control; purchased materials/equipment/services; special processes; inspections and tests; measurement and calibrations; handling/shipping/ storage; nonconformances and corrective actions; quality records; management assessments; and surveillance). The broad controls for QA are contained hereinafter in this Section. The specifics for implementing these controls are provided in Section 3.

2.3 PROGRAM INTERFACES

In the following subsections the Program internal and external interfaces are described. These interfaces rely on both the Program participants' own approved methods of control for their work and those that apply to the interactions of Program participants.

2.3.1 INTERNAL INTERFACES

Each Program participant shall identify, in writing, its internal interfaces for managing the flow of pertinent information between organizational units for work on the HDWC Program. Each organizational unit shall define and document its responsibilities in sufficient detail to cover the preparation, review, approval, distribution and revision of documents. Systematic methods shall be established by each organization for communicating needed information, including changes and, where necessary, to initially transmit information orally or by other informal means. This transmittal shall be confirmed promptly by a controlled document as defined in Section 3.

2.3.2 EXTERNAL INTERFACES

The external interface between Program participants affecting the quality of work are identified in Section 3 of this QAP and includes those organizations providing criteria, designs, specifications, surveys and analysis, transportation and logistics, cable deployment and retrieval, program interfacing and program management. Responsibilities of each Program participant are defined in sufficient detail to cover preparation, review and approval of documents involving interfaces. Lines of communication are specified to control the flow of information between Program participants. Provisions are made whereby information transmitted from one organization to another will be documented in specifications, drawings or other controlled documents that are uniquely identified and issued by authorized persons. Where it is necessary to transmit information orally or by other informal means, provisions are made whereby the transmittal shall be confirmed promptly by a controlled document.

2.4 ENGINEERING DESIGN CONTROL SYSTEM

The procedures included herein have been prepared to assure that appropriate design criteria are correctly translated into specifications, drawings, instructions, and for specifying quality requirements. The Documentation Control discussed in Section 3 contains procedures defining how design activities are to be carried out including format requirements, identification system, review and approval requirements, issuance and distribution, revisions and indication of status. Responsibilities for preparation, review, approval and verification of design documents are also defined. Design adequacy shall be verified by the originating agency and shall be accomplished by individuals other than those who accomplished the work. Documentation shall be made traceable to the items of interest.

When analyses are required to verify designs, they shall include:

- Identifying documents to permit ready reference and retrieval;
- Defining the objective of the analyses;
- Defining design inputs and their sources;
- Documenting the results of literature searches or other applicable background data;
- Documenting assumptions and identifying those assumptions that must be verified as the design proceeds;
- Alternate calculation (performed by individuals other than those who accomplished the work to verify the correctness of the original calculation);
- Identifying computer calculations, including computer type, code or programming, inputs and outputs; control of changes, maintenance of a copy of each revision, periodic check using new and old data to insure no changes are made unknowingly; and
- Review and approval.

2.5 DESIGN CHANGE CONTROL PROCEDURES

The following procedures have been established for consideration of changes to approved design documents, including field changes:

- Impact of the change;
- Recording of required actions; and
- Transmittal of information concerning the change to all affected persons and organizations.

To effect design changes, documents that reflect the design change shall be reviewed and approved by the same participating organizations that reviewed and approved the original design documents. The lead organization will have access to pertinent background information, have demonstrated competence in the specific design area of interest, and have an adequate understanding of the requirements and intent of the original design.

2.6 QUALITY DOCUMENTATION PROCEDURES

A project of this size generates a large number of documents and records needed to verify compliance with specifications. The following procedures have been established for control of Program documents such as drawings, specifications, requisitions, purchase orders, vendors data, procedures, standards and directives. These measures establish the standards for preparation, review, approval and issuance of documents and revisions thereto. Procedures for assuring that the latest editions or revisions are presented and used by the responsible Program participant personnel at the locations where the work is performed are also provided. The applicable documents shall contain acceptance criteria that is appropriate to the item in question.

Document identification shall include:

- Title
- Applicable Revisions
- Date of Issue
- Other relevant information that would precisely identify the document to be used

Documents shall be prepared, in all cases, under the direction of the responsible manager of the agency or Program team organization having primary responsibility for the item of work. Review and approval shall be accomplished by Parsons and HECO, with other agencies as specified for unique items of work. Revisions will be fully explained, identified with a revision number and issued to all original recipients of the effected document. The above-mentioned responsible manager will be responsible for providing all using agencies with original submittals and revisions as advised by Parsons.

The records/documents include inspections and tests, sub-contractor work, monitoring reports, material analyses, special processes certifications, nonconformance or deviation statements and personnel qualifications. Obsolete documents, when identified, shall be marked accordingly and disposed or retained in obsolete files. A duplicate set of project documents relating to Quality will be maintained by the lead organization of a given task in separate and secure files.

2.7 QUALIFICATION TESTING PROCEDURES

In cases where the adequacy of a design is to be verified by a qualification test, the testing will be identified and documented. Testing will demonstrate adequacy of performance under the most adverse conditions to be expected in service. Pertinent operating modes will be considered in determining the final design conditions ~~where the test program confirms the adequacy of the tested design.~~

Qualification test procedures will include provisions for assuring that:

- Prerequisites for the given test have been met;
- Adequate instrumentation of the required range and accuracy is available and used; and
- Necessary monitoring is performed.

Prerequisites include:

- Calibrated Instrumentation
- Appropriate Equipment
- Trained Personnel
- Condition of Test Equipment and Item to be Tested
- Suitable Environmental Conditions
- Provisions for Data Acquisition
- Authorized Signatures
- Evaluation Results

2.8 PURCHASED MATERIALS, EQUIPMENT, OR SERVICES

Materials, equipment or services shall be purchased or subcontracted under controlled conditions. The following procedures shall govern the activities and personnel for source evaluations, vendor selections, evaluation of vendor/subcontractor quality documents, source inspections, and examination and/or test of items at the fabrication and construction sites.

Requirements for design, QA, QC and documentation of other contractual requirements shall be specified in requisitions, purchase orders and other procurement documents. Contractors, vendors or subcontractors will provide QA Systems based on the criteria specified in the procurement documents and consistent with the applicable requirements of the contract and specifications of the QAP. Applicable portions shall be imposed on subtier contractors

as required. Purchase requisitions, purchase orders and subcontracts will be reviewed and approved by designated project quality personnel to verify that appropriate QA, QC and documentation, required within these purchase documents, has been included.

2.9 SPECIAL PROCESSES

Processes affecting quality, such as nondestructive testing, heat treatment, welding, cleaning, plating and coating shall be controlled and documented for compliance with codes, standards and contractual requirements. Procedures for handling, controlling and retention of documents (i.e., material certificates, NDE welding certificates/qualifications, radiographs, material analyses, etc.) will be prepared in accordance with quality records, and implemented.

Welding and nondestructive examinations shall be accomplished by qualified personnel using qualified procedures in accordance with applicable codes and standards. Qualification documentation submitted for approval shall be retained as a part of the permanent quality records. Approved procedures will be monitored for proper implementation at vendor shops by QC Engineers or Inspectors and at fabrication and construction sites by engineers assigned to the work by the responsible Resident Field Engineers.

2.10 INSPECTION AND TEST

2.10.1 INSPECTION

Inspections will be planned and implemented by vendors, contractors, subcontractors and at receipt at the jobsite to the extent necessary to assure that materials, equipment, items

or services conform to applicable drawings, specifications, codes, standards or other designated requirements.

Inspection results will be documented by the responsible inspection personnel. Acceptance tests shall be performed by appropriately qualified individuals other than those who performed the work. Documented inspections shall be made part of the permanent quality records.

2.10.2 TEST

Tests required to demonstrate that items conform to applicable requirements shall be identified, controlled and documented. Tests shall be performed in accordance with applicable codes, standards and other written instructions that incorporate approved acceptance criteria.

Tests performed by vendors, contractors and subcontractors shall be monitored by Vendor QC Engineers or Inspectors at the shops and, if applicable, by the Resident Field Engineer or his engineering designees at the field fabrication and construction sites.

Documented tests shall be made part of the permanent quality records.

2.10.3 MEASUREMENT AND CALIBRATION

Measurement and test equipment (e.g., tools, gauges, instruments, etc.) used for activities affecting quality shall be controlled, calibrated and adjusted at manufacturer's specified frequencies to maintain accuracy standards within designated limits.

Control of measuring and test equipment used for acceptance testing shall be described in applicable instruction or procedure documents and developed by the Resident Field Engineer or his designee at the fabrication and construction sites. Calibration of such equipment shall be traceable to National Standards or, if none exist, the basis for calibration shall be documented and approved by responsible authority.

Vendor or subcontractor equipment used for measuring and test acceptance work shall be controlled through their QA Systems and monitored for compliance by the Resident Field Engineer or his designee at the site, and Vendor QC Engineers or Inspectors at the shops.

2.11 HANDLING, STORAGE, AND SHIPPING

Handling, storage, cleaning, packaging, shipping and preservation of items shall be controlled to prevent damage or loss and to minimize deterioration and shall be in accordance with the applicable codes, standards and specifications, as identified by the originating agency.

Responsible engineers shall identify and employ appropriate requirements to preclude potential damage or deterioration of specifications, data sheets, requisitions, purchase orders or subcontracts.

~~Vendors, subcontractors and jobsite personnel are responsible~~ for assuring that handling, storage, cleaning, packaging and preservation of items are in conformance with the requirements specified. Contractor's Vendor QC Inspector (shops) and personnel performing site inspections (fabrication and construction) shall monitor proper implementation of these requirements.

2.12 NONCONFORMANCE

Items that deviate from specified requirements shall be controlled and documented to assure proper dispositions are employed for corrective actions.

Nonconforming materials, equipment, components, systems and activities, such as fabrication and erection, shall be controlled by a nonconformance procedure which identifies, evaluates, segregates, disposes and verifies the item of deviation. Dispositions shall be made by engineering and/or contractor personnel responsible for the work.

Contractors, vendors and subcontractors will control nonconforming items by implementation of their QA Systems. Vendor QC Engineers or Inspectors shall monitor the items at vendor shops for proper implementation; site personnel performing inspections or overseeing inspections shall also perform surveillance of required subcontractors' nonconformance procedures.

2.13 CORRECTIVE ACTION

Conditions adverse to quality shall be promptly investigated, documented, evaluated and corrected. The cause of the condition shall be determined and corrective action taken to preclude recurrence. Identification, cause and corrective action planned and implemented for significant conditions shall be documented and reported to the appropriate levels of Project Management. Implementation of corrective action shall be verified by documented follow-up action.

All project personnel have the responsibility to identify or report conditions adverse to quality.

Responsible project engineering personnel shall determine the necessary corrective actions to be taken to resolve the nonconformances.

2.14 QUALITY RECORDS

Records consistent with applicable codes, standards, specifications and contractual requirements shall be specified, prepared, compiled and maintained by responsible managers to furnish documentary evidence of quality for items, services and activities.

Required records shall be legible, identifiable and retrievable, and shall be protected against damage, deterioration or loss.

Requirements and responsibilities for record transmittal, distribution, retention, maintenance and disposition shall be established and documented.

Responsible managers and assigned engineers shall be responsible for controlled distribution, storage and turnover of records.

2.15 QUALITY AUDITS

Audits performed shall be planned and scheduled to verify compliance with the QAP implementing procedures, codes, standards and other contractual requirements.

Scheduled audits shall plan for a frequency of one audit per quarter (average) or as required depending on Program activity levels.

Audits shall be performed by trained and experienced personnel who do not have direct responsibility for performing, controlling or inspecting the items or activities to be audited.

Audit results are reported to the responsible manager and to Project Management responsible for the activity audited for review and appropriate action. Closeout action shall be taken as appropriate for each audit finding.

The responsible QA Manager shall maintain a status log of audits, reports issued, responses and closeout of findings.

Audits and results shall be documented and made part of the permanent project quality records.

SECTION 3

QUALITY CONTROL PROGRAM

3.1 GENERAL

The Quality Control (QC) System provides the Program with the assurance that compliance with specified contractual quality requirements is attained. The QC System consists of planned actions that are systematically applied during the entire program. Such actions include responsibilities and authorities of Program participants implementing the QAP (i.e., design control and changes, substitutions, document control, nonconformances and corrective actions, quality records, procurement, manufacturing, management assessments and surveillance). The following paragraphs describe the technical approach and methods for accomplishing the principal tasks of the Program. Methods to be used stress the definitions and assessment of technical problems and the development of solutions to those problems to attain the required level of quality.

HECO, in their role as Prime Contractor, as a minimum, will conduct Program reviews at the initiation, mid-point and completion of each Program phase. These reviews will focus on progress versus schedule and expenditure versus budget. HECO will also review and comment on all reports and review and approve every report prior to its submittal to funding agencies.

Within the framework of the Program team, Parsons has been assigned the principal functions of Systems Integration Manager. In their role, as Systems Integration Manager, Parsons will participate in or perform each of the Tasks described in Section 4. The work of all teams' members will be coordinated by Parsons using the principles of systems engineering, configuration management and

interface control. All technical documentation generated by the team will be reviewed and analyzed by Parsons to assure conformance with system requirements.

The following paragraphs briefly describe the principal management concepts to be employed throughout the performance of the HDWC Program.

3.2 DOCUMENTATION CONTROL

All reporting requirements of the funding agencies will be met. Documentation Control will consist of a system of identification, cataloging, filing and retrieval for all Program documents.

Documents to be delivered under this Program will be prepared by the most expeditious and economical means, giving due regard to the kind of document, quality, quantity, user's needs and cost factors. Reports will be delivered by the most rapid and reliable means available, consistent with due dates. Documents required for Government program reviews will be delivered sufficiently in advance of review dates to assure effective use of time during such reviews.

Conceptual and preliminary design drawings will be prepared in accordance with standard engineering practice, reflecting required information in logical sequence and disclosing engineering design information in sufficient detail to enable evaluation of the concepts. They will form a basis for further design detailing. Each drawing and report developed, from conceptual to final, will be assigned an individual number. The format for drawings will provide a title block identifying the project, the item, changes block, designer, project manager, professional approval space and

date. Revisions to design documents will be by official revision change, identifying the revised items, with distribution to all original recipients. Following approval by the responsible manager, all drawings and reports will be statused and maintained by a Data Control Center. Design information transmitted from the initiator to Parsons, HECO or other Program team members, shall be documented in specifications, drawings or other controlled documents, and issued by the responsible manager. Where it is necessary to transmit design information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document.

3.3 MANAGEMENT CONTROLS AND REVIEWS

Project controls must focus on cost and schedule planning, cost performance measurement, timely monitoring and reporting, and early identification of problem areas with applied corrective action. These controls will be extended to all participating organizations.

The controls will focus on:

- Intelligent proposal planning
- Careful selection of key personnel
- Accurate depiction of the work to be done
- Close control of resources through task responsibilities and time-phased budgets
- Well-conceived master and detail schedules
- Direct lines of communication
- Strict coordination and control of the work of all Program participants through the use of review boards and working groups

Subcontractor cost and technical performance will be monitored by telecon, by monthly reports and by frequent meetings. The information will be reported by HECO to the funding agencies by telecon, in formal contractual reports, and during reviews.

Formally scheduled, periodic reviews of project progress, current activity and plans will be a management process to insure team communication, task coordination, and management visibility and control. The HDWC Program will utilize a selection of review types and frequencies that past experience indicates will best achieve management objectives at minimum cost.

The Parsons Project Manager, assisted by his Project Controls Manager, Technical Consultant Staff and HECO Program Review Board will chair formal review meetings as required. As a minimum, these meetings will be held bi-weekly. The principal objectives to be obtained in these meetings will be to review and assess project status and conditions in all management areas and to identify and assign action on any current and potential problems. A purpose of these meetings is to present project status and obtain policy guidance. Solutions to problems are to be addressed and resolved, as are subcontractor problems or situations that may require company or corporate-level contacts.

3.4 PROGRAM REVIEW BOARD/TECHNICAL CONSULTANT STAFF

In order to assure the successful performance and completion of each Program Task and subtask, HECO and Parsons have established a Program Review Board and Technical Consultant Staff respectively. The overall purpose of these two review agencies will be to assure the highest level of task performance by all Program team members and to assure that all Tasks and subtasks are performed within the Program schedule and budget constraints.

3.4.1 PROGRAM REVIEW BOARD

HECO's Program Review Board is composed of appropriate engineering and operating staff members who are able to adequately review Program progress and submittals. The Program Review Board will conduct the Program reviews, report reviews and generally oversee the conduct of the proposed Program. Where required, the Program Review Board will seek the advice and guidance of HECO's "in-house" engineering expertise or call upon special consultants to provide additional technical information.

3.4.2 TECHNICAL CONSULTANT STAFF

Parsons Technical Consultant Staff is composed of appropriate engineering, quality assurance, planning and administrative staff members to assure the technical adequacy and accuracy of work performed. When required, technical consultants will be called upon to provide special expertise.

The Technical Consultant Staff will conduct reviews of all aspects of the proposed Program prior to the submission of plans and reports to HECO. The Technical Consultant Staff will provide the necessary assurance that the quality of all plans and reports are consistent with the Program contractual requirements.

SECTION 4

HDWC PROGRAM PHASING AND TASKS

The following paragraphs describe the overall phasing and tasks that will be performed during the remainder of the program. Also described are the technical and reporting interfaces between the various organizations performing different tasks. The task numbers and general headings listed below will be used for the remainder of the Program for both those tasks proposed for Federal and those proposed for State funding.

4.1 HDWC PROGRAM PHASING

At present (April 1982), the HDWC Program consists of two major phases (I and II) with Phase II being composed of three subphases (A, B and C). Phase I was conducted during the October 1981 through April 1982 period. Phase IIA is presently scheduled to be conducted during the April 1982 through July 1983 period; Phase IIB from August 1983 through March 1984; and Phase IIC from April 1984 through December 1984. Since the State of Hawaii and Federal fiscal years do not coincide and due to the requirement to keep work efforts moving forward without significant temporal gaps, portions of Phases IIA, B and C will, at times overlap (see Task 2 - Management Support Reports, Section 1).

4.2 FEDERALLY FUNDED TASKS

The Final Program Definition phase (Phase IIA) is comprised of Federally funded tasks (1 through 6) and State funded tasks (A-1 through A-5). Each group is discussed separately. Initial or preliminary work will be conducted during Phases I or IIA and proceed to completion in Phases IIB or C.

4.2.1 TASK 1 - CABLE DESIGN AND VERIFICATION

Task 1 advances the engineering of the cable to a final design by utilizing the preliminary cable design criteria studies performed during Phase I work activities. Final design parameters will be established with assistance by State of Hawaii supported computer simulation modeling tests of the cable mechanical and structural characteristics. Environmental data from Task 4, At-Sea Surveys, will be incorporated. The preferred designs will be subjected to further analyses. The most cost-effective design for use in the deep water environment that surrounds the Hawaiian Islands will be selected. The selected final cable design will be used to manufacture 1,000 feet (305 m) of cable for design verification testing purposes.

The following items are included in the scope of services for cable design.

- Definition of practical manufacturing constraints for the conductor and specification of manufacturing requirements for the conductor.
- Analysis of dielectric core design for electrical and mechanical stress distribution. Definition of flexible paper/impregnant combinations to provide optimal electrical performance and satisfactory mechanical performance.
- Definition of manufacturing specification for the cable electrical core, quality control requirements and scenario for manufacture of prototype and at-sea trial cable.
- Define final prototype cable design.
- Perform detailed operational electrical and mechanical performance analyses on preliminary final prototype cable design.

- Define manufacturing specification for complete prototype cable.

The design work will be conducted primarily by Simplex with design assistance and benefit-cost analysis provided by HNEI, Parsons and HECO.

Following completion of the final cable design, 1,000 feet (305 m) of cable will be manufactured for use in cable design verification. The manufacturing work, which will be performed by Simplex and monitored by Parsons, will also include the design, manufacture and installation of the test sheave around which bending tests will be conducted. This equipment will become the property of the U.S. Government at the conclusion of all HDWC Program work. It is likely that the Program participants would negotiate a purchase or buy-back cost for the test sheave.

Lengths of the cable will be structurally, electrically and mechanically tested. These tests will subject the cable to simulated cable-laying and retrieving conditions and to conditions expected to be encountered in the field. The electrical tests will be used as a measure of any damage the cable has experienced in the structural, mechanical and hydrostatic tests.

The test programs will include both mechanical tests, such as tension-elongation and crushing tests, as well as the suggested tests outlined in CIGRE paper 21-08, and electrical tests.

The result of the cable design and verification effort will be criteria to be used in the fabrication of a 20,000-foot (6,100 m) long at-sea operations test cable length.

4.2.2 TASK 2 - REPAIR SPLICE DESIGN AND VERIFICATION

The cable must be deployed and retrieved in deep water. It also must be repairable by splice in a field environment and in the factory during fabrication. This task will develop an acceptable design for a repair splice.

In general, the splice in a cable is the "weak-link" in the cable system. However, in the case of a deep water cable, the splice must be designed to be as strong as the rest of the cable. Such a splice design will insure the cable electrical integrity during deployment/retrieval operations. This is made more difficult due to the deepwater conditions found in Hawaii. A repair splice must be capable of restoring the damaged cable segment to its original integrity, and must be simple enough to be performed on the open ocean in field conditions, which are totally unlike factory conditions. The tensions to be placed on the cable during deployment/retrieval operations in the Alenuihaha Channel [approximately 125,000 pounds (56,625 kg)] have not been experienced previously, and therefore, present the unique opportunity to advance the state-of-the-art in the design of repair splices.

The fabrication and design verifications to be conducted are similar to those described in Task 1 for the cable. The work to be performed under this task will be under the direction of Simplex, with design input from HNEI, Parsons and HECO.

4.2.3 ~~TASK 3 - CABLE HANDLING SUPPORT SYSTEMS (CHSS)~~ DESIGN, PROCUREMENT AND INSTALLATION

The deployment of the submarine cable will require the modification and procurement of a vessel. Existing commercial

or military cable vessels are not applicable/available for this Program.

The cable handling support systems (CHSS) equipment to deploy and retrieve the cable from the vessel must be capable of operating under unprecedented tension, bend radii and other conditions. For example, maximum cable static tensions expected during at-sea deployment during the technical evaluation program will be approximately 125,000 pounds (56,625 kg). Further, the deep sea electrical transmission cable, because of its internal construction and torque balance armor, will need to be fed onto and deployed from a rotating turntable assuming cable design employing counterwound, armored layer systems. New cable handling support systems must, therefore, be designed, procured and installed.

The CHSS consist of the cable handling and laying equipment on board the cable vessel. The CHSS include the following:

- Cable tension machines and supports
- Overboarding sheave
- Turntable
- Troughing and fairleading arm
- Cable positioning system
- Integrated control, communications, measurement, and recording systems

Design criteria will be established for the CHSS. Sources of existing and new equipment to satisfy design criteria will be surveyed for availability and applicability. If existing

equipment is applicable, preliminary specifications will be developed for required modifications. New equipment requirements will be discussed with equipment designers and manufacturers and specifications for new equipment will be developed. Cost estimates and tradeoffs for subsystem components of the laying vessel will be analyzed to obtain optimum mix of system components.

Based on cable vessel work initiated under Phase I, the HDWC Program will require a specially adapted cable vessel to accomplish the at-sea cable verification work of Task 5. The cable-laying vessel most likely will be a modified barge, similar to flat deck cargo barges in use on many ocean-going routes. The size and capacity of the barge will be governed by the size and weight of the CHSS and the cable itself, plus the equipment and machinery necessary for auxiliary functions - navigation, housekeeping, etc. All marine engineering work accomplished will be performed in accordance with industry standards and procedures and will incorporate the latest marine engineering/naval architecture institutional design standards and methods.

Data from the at-sea route survey (Task 4) will be used to analyze environmental loading data and establish hydrodynamic loading on the cable during deployment. Vessel response, current profiles, and vortex shedding effects on the cable will be determined as well as the resulting static/dynamic loads and stresses on the cable. This data is integral to Tasks 1 and 2, and the CHSS.

The cable laying vessel operating scenario will be developed with the system requirements as to seakeeping, resupply, access, positioning, and measurement and recordation of data.

Cost analyses will select the vessel and vessel configuration to be used from identified candidate solutions.

Following the selection of the CHSS and vessel, the modification/fabrication integrations will be designed, procured and installed. The following design items will be covered:

- Cable stowage system design
- Integrated control, communications, measurement, and data recording systems
- Mooring and towing arrangements
- New and/or modified structure design
- Machinery support and foundations design
- Specify CHSS components
- Specify other items to be procured
- Required power plant, mechanical and piping systems design
- Required electrical, instrumentation, and control systems design
- Specify safety equipment

Operating plans and manuals and safety plans must be developed.

The final fabricated vessel or CHSS (depending on buy/lease provisions of the vessel) will be the property of the U.S. Government. It is likely that the Program participants would negotiate a purchase or buy-back cost.

The cable vessel modification design and the CHSS design and verification work will be performed by Dillingham Corporation (HD&C) assisted by their subcontractor, Morris Guralnick Associates, Inc. (MGA), naval architects and marine engineers, who are familiar with the requirements of cable-laying systems. The cable vessel modifications and equipment installations will be performed by a competent, experienced U.S. shipyard. Parsons and HECO will supply procurement, supervision, coordination, inspection and technical and management input.

4.2.4 TASK 4 - AT-SEA ROUTE SURVEYS

General and detailed at-sea surveys will be conducted to determine the bathymetry, geologic character and bottom sediment characteristics of the Alenuihaha Channel area, and to better understand the thermal resistivity (RHO) of sediments typical of the Hawaiian interisland sea bottom. Data obtained from the at-sea route surveys will provide criteria for the cable design (Task 1). This will assure that the final cable design is properly armored to protect against abrasion and chaffing, and to properly size the conductor and dielectric. The surveys will be conducted by the Hawaii Institute of Geophysics (HIG) utilizing their research vessel *Kana Keoki*. Parsons and HECO will provide supervision, coordination and technical support.

The surveys will include the following work efforts:

- Bottom Sampling - Piston coring and rock dredging to obtain samples for engineering properties studies and chemical analysis. The data gathered during these studies will be used to determine the type of substrata on which the cable will lie and to determine if there are chemical constituents in the bottom sediments that might react with the cable covering.

- Side-scan - Sea floor mapping will be accomplished utilizing a new side-scan sonar system developed by HIG. This specially designed SEAMARC II side-scan sonar system is capable of making contour maps of the ocean floor to identify the ocean bottom characteristics of the at-sea cable testing area.

- Bottom Photography - A Benthos camera system to obtain photographs of all areas of the bottom showing different characteristics in the side-scan records. If available, a CCD large area camera will be used to obtain coverage of larger areas of the bottom than possible with the Benthos system. These cameras also will be used to monitor deployment/retrieval operations to ensure proper placement of the cable.

- Sediment Thickness - A 3.5 KHz pinger probe will be used to produce detailed maps of sediment distribution and thickness. This information will help to avoid a cable routing that might subject the cable to burying and retrieval difficulties.

- Surface and Subsurface Currents - Surface currents will be calculated from ship's drift and from tracking surface current drogues. Subsurface current profiles will be measured with an Aanderra profiling current meter. For the Alenuihaha Channel site, a current meter array will be deployed for approximately three months. This will provide an indication of the current pattern changes with time and help predict probable cable movement characteristics during deployment/retrieval operations.

Following the completion of all route surveys and current measurements, the data collected will analyzed and presented in a detailed report. The report will include bathymetric and sediment characteristics maps, selected bottom photographs, all environmental data collected and recommendations regarding the most favorable cable routings. Additionally, recommendations regarding the most favorable deployment/retrieval months and timing also will be provided.

4.2.5 TASK 5 - AT-SEA CABLE DESIGN VERIFICATION AND CABLE CRITERIA DOCUMENT DEVELOPMENT

Following successful completion of the design verification programs described in Tasks 1 and 2, a 20,000-foot (6,100 m) long length of cable will be fabricated for at-sea design verification in the Hawaiian deep water environment. The length of cable will be shipped to Hawaii, deployed and retrieved by the cable vessel and CHSS described in Task 3. Following the at-sea verification work, the design will be reverified in the laboratory. The accomplishment of this task will verify the cable design, cable vessel and CHSS and provide the design and operational inputs required for the cable criteria document.

The performance of this Task will be by all principal Program participants, including HECO, Parsons, Simplex, HD&C, HNEI and HIG. Simplex will perform cable fabrication work, Parsons and HD&C will coordinate and accomplish shipping of the cable, Simplex, HD&C, HECO, Parsons, HIG and HNEI will be involved with the deployment, retrieval and verification work, and Simplex, HECO and Parsons will prepare the criteria document.

In essence, all system components will have been verified at the completion of this task. The cable criteria document will define the design, operability, reliability and maintainability characteristics of a HVDC submarine cable applicable for use in deep water environments. The document will be prepared such that it can be used by governmental agencies, private groups or public utilities.

4.2.6 TASK 6 - PROGRAM MANAGEMENT AND TECHNICAL SUPPORT

The following describes the Program Management and Technical Support work to be accomplished by HECO and Parsons.

Hawaiian Electric Company is the prime contractor for the HDWC Program. Parsons Hawaii, in turn, will be under direct contract to HECO and will issue subcontracts to all other Program participants.

HECO, in their role of Prime Contractor, as a minimum, will conduct program reviews at the initiation, middle and completion of each program phase. These reviews will focus on progress versus schedule and expenditure versus budget. Since HECO's management will be responsible for all reports, HECO will review and comment on all phase reports and approve every report prior to submittal to DOE.

Within the framework of the project team, Parsons Hawaii has been assigned the principal functions of Systems Integration Manager. Specific management subtasks that will be provided by Parsons include the following:

- Contract Management of All Program Participants - Work under this subtask will include all administrative, financial and technical adequacy controls required to maintain the overall HDWC Program costs, schedule and technical information levels. Parsons will act as authorized representative for HECO to assure that the quantity and quality of work meets HECO and DOE standards and is performed within the work scheduled and costs allocated.

- General Management - Work under this subtask will include the general coordination of all Program participants' work and the monitoring of that work to assure that the Program Management Plan and Quality Assurance Plan, prepared during Phase I work efforts, are followed.

In order to accomplish the Program Management task, HECO and Parsons will employ a system of project controls that focus on intelligent planning, close control of the resources available, direct lines of communication between all program participants and strict coordination and control of the work of all participants through the use of review committees and technical working groups.

Parsons will maintain adequate fiscal controls by thoroughly reviewing all subcontractor progress payment requests prior to forwarding the requests to HECO. This will assure that the amount requested accurately reflects the actual work accomplished. HECO will, as Prime Contractor, carefully review Parsons payment requests prior to submission to the funding agency for payment. This series of checks and balances will prevent subcontractor's overstating the amount of work performed, insure maintenance of work schedules and provide the funding agency with the assurances that work efforts are maximized over the period of performance.

Since all program participants have been involved with previous DOE or other Federal agency contracts and are therefore familiar with Federal agency auditing procedures, the maintenance of proper financial records is, in general, a routine matter. All financial records associated with the HDWC Program will be available for audit purposes, both during and following completion of the contract work.

Technical support in the form of report review and analysis and the conduct of specific subtasks will be provided by both HECO and Parsons. All reports will be critically reviewed for technical content, first by Parsons and then by HECO prior to submittal to DOE. Parsons review will be accomplished through a

Technical Consultant Staff consisting of in-house electrical engineers and outside private consultants who have experience with various aspects of high voltage direct current transmission cables. The use of a Technical Consultant Staff, rather than assigning a full-time engineering staff to the project, results in considerable cost savings and accomplishes the same desired end results, that is adequate and competent technical review of the work performed. HECO's review will be performed by its Technical Assistance Subcommittee which will focus its review on the adequacy, accuracy and readability of the reports with respect to the overall goals of the Program.

Specific technical tasks to be accomplished by HECO and Parsons include engineering analyses of cable, cable vessel and CHSS designs, fabrication inspection and monitoring, equipment procurement and systems analysis and engineering.

4.3 STATE FUNDED TASKS

4.3.1 TASK A-1 - ENVIRONMENTAL ANALYSES

Following the precepts of the National Environmental Policy Act of 1969 and the President's Council on Environmental Quality (CEQ) EIS Regulations of November 29, 1978 (40 CFR Parts 1500-1508), a programmatic EIS will be prepared for the HDWC Program. Parsons will have the responsibility for the preparation of the EA/EIS. The EIS will follow the format identified in the above noted CEQ Regulations and objectively and thoroughly examine the environmental impacts of the Program. The data to be utilized during the preparation of the EIS will be that collected during the conduct of Task I above, that generated during previous OTEC Bench Mark studies off Kahe Point, Oahu, and Keahole Point, Hawaii, and that collected during an on-going HECO environmental monitoring

program pursuant to the requirements of a current NPDES permit for their two 144-inch (3.7 m) diameter thermal effluent pipes from the Kahe Generating Station.

Following completion of the EIS, the report will be submitted to appropriate agencies for critical review and comment and subsequently submitted to relevant State, local and Federal agencies and the general public for review and comment. All procedures as outlined in the previously noted CEQ Regulations will be strictly adhered to, ensuring final acceptance of the EIS.

In order to assure that the HDWC Program is accurately and adequately described in the Programmatic EIS, Parsons will consult with all team members for their input.

Following the preparation of the EA/EIS, as described above, all environmental permit applications will be prepared by Parsons and submitted following acceptance of the EIS. The principal permit applications required for the HDWC Program include a U.S. Army Corps of Engineers Permit, as administered under Section 10 of the River and Harbor Act of 1899 and Section 404 of the 1972 Amendments to the Federal Water Pollution Control Act, and a Conservation District Use Permit, as administered by the State of Hawaii Department of Land and Natural Resources. Additional permits that may be required include a Special Management Area Permit, as administered by the City and County of Honolulu Department of Land Utilization and authorized by the Coastal Zone Management Act. As indicated above, Parsons will coordinate all activities under this Task and will consult with all other Program team members to assure that the permit applications are complete.

4.3.2 TASK A-2 - ELECTRICAL GRID SYSTEM INTEGRATION INVESTIGATIONS

Within the next five to ten years, HECO is faced with the probability that at least 400 MW of electrical power, generated by renewable, alternate energy sources, will be available for possibly feeding into the present grid systems of the Big Island, Maui and Oahu. The transmission and integration of this power will require detailed investigations into the ability of these grid systems to accept the power and investigations into the improvements or design work required to enable the grid systems to accept the power. This work will be conducted by HECO with HDWC Program interfacing with Parsons and Simplex.

4.3.3 TASK A-3 - PERFORM COMPUTER SIMULATION MODEL TESTS OF CABLE MECHANICAL AND STRUCTURAL PROPERTIES

Utilizing present state-of-the-art technology developed from previously conducted submarine cable design and test programs, the cable design developed during Task 4 above, will be subjected to an on-line series of computer simulation test programs. The static and dynamic loads to be placed on the cable during deployment and retrieval will be analyzed and the cable design verified. Once the design has been verified through computer modeling, test lengths of the cable will be manufactured and physically tested.

The technical responsiblity for the performance of this Task has been assigned to HNEI, with input and interfacing as required from HECO, Parsons and Simplex.

4.3.4 TASK A-4 - PUBLIC INFORMATION PROGRAM AND LEGAL AND INSTITUTIONAL CONSTRAINT ANALYSES

One of the most important aspects of any research and development project is the transference of the knowledge gained to the greatest number of people. This concept is especially critical for programs dealing with the potential distribution of electrical power generated by alternative energy sources. During the performance of this Task, a public information and educational program will be defined and designed by DPED to provide the widest dissemination of information generated during the conduct of the remaining HDWC Program phases and tasks. The program developed will require consultation with all Program team members especially HECO and Parsons, to ensure that the latest HDWC Program information is infused into the public information and educational program.

Following the definition of the public information and educational program, the program will be designed. DPED will design the program such that the greatest transference of information to the greatest number of people is accomplished. It is envisioned that the program initially will describe upcoming tests and other activities and how they relate to an interisland cable system that will draw together Hawaii's diverse energy sources. The program will allow DPED, as the State Energy Resource Coordinator, to coordinate the present HDWC Program with on-going and future geothermal, biomass, direct solar, wind and OTEC programs. The HDWC Program is especially important to the Hawaii Integrated Energy Assessment, a DPED study involving the integrated development of all alternate energy sources in Hawaii and a proposed HNEI program to implement the various county energy self-sufficiency plans.

In order to assure not only the success of the present Program but also the implementation of an interisland deep water electrical cable system (assuming the economic and technical feasibility of such a system is proven during the HDWC Program), the legal and institutional constraints must be identified. Once known, the jurisdictional backdrop for the State and local government and public utility can be developed. This development will minimize or allow avoidance of legal and procedural problems in the future. Additionally, the institutional foundation for an interisland cable system will be established.

The performance of the technical aspect of this Task also has been assigned to DPED. The Director's staff and the Deputy Attorney General for the Department regularly work with Coastal Zone Management (CZM) personnel and act as a liaison between other agencies during the development of new projects. In addition to the DPED staff, CZM personnel and the State Attorney General's Office, DPED will consult with HECO, Parsons and HD&C regarding specific aspects of the Program.

The information generated during this Task will be utilized in the development and preparation of the programmatic EIS and environmental permit applications. Standard legal and institutional analyses procedures will be utilized during the performance of this Task.

4.3.5 TASK A-5 - PROGRAM MANAGEMENT AND TECHNICAL SUPPORT

Throughout the conduct of the HDWC Program, Parsons as Systems Integration Manager, will be performing a number of management subtasks. These subtasks include the development and preparation of subcontractor scopes of services and contracts; monitoring adherence to the scopes of services, schedules and

budgets; monitoring quality control and quality assurance programs; documentation control; preparation of summary reports and the general overall management of the HDWC Program. As such, Parsons will be coordinating the efforts of the several Program team members to ensure maximum interfacing. These actions will be conducted to maintain maximum effectiveness and efficiency of all Program team members and to effect a cost-effective program.

Performance of all of the preceding tasks will culminate in the preparation of reports and/or design drawings. These items will be produced by the technical team leader for each task, reviewed and assembled by Parsons, further reviewed by HECO and submitted to funding agencies. The reports will be prepared such that both technical and lay persons can optimally benefit from their contents. The reports will also serve as reference documents for future programs and provide the program traceability and substantiation required by funding agencies.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 1

PROGRAM MOBILIZATION PLAN

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM PROGRAM MOBILIZATION PLAN

GENERAL

This Program Mobilization Plan (Mobe Plan) has been prepared to describe the activities and actions of HDWC Program participants at the initiation of future phases of work. Mobilization planning emphasis has been placed on Phase IIA work. General planning is provided for Phases IIB and IIC. The actions and activities described herein will be further defined and refined prior to the initiation of work on each phase, after definitive schedules and budgets have been established. A simplified work flow diagram for Phase IIA work is included to supplement the narrative descriptions of actions and activities (Figure 1).

HAWAIIAN ELECTRIC COMPANY (HECO)

As Prime Contractor, Hawaiian Electric Company (HECO), in association with Parsons Hawaii (Parsons), will negotiate prime contracts with funding agencies for the work to be accomplished. HECO will then issue a subcontract to Parsons for all technical task work to be accomplished by Parsons, Simplex Wire and Cable Company (Simplex), Hawaiian Dredging and Construction Company (HD&C), Hawaiian Institute of Geophysics (HIG) and Hawaii Natural Energy Institute (HNEI) and program management work to be performed by Parsons. Upon receipt of contracts from funding agencies and, concurrently, issurance of a subcontract to Parsons, HECO will initiate management and technical task work.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

FIGURE 1
SIMPLIFIED WORK FLOW DIAGRAM
PHASE IIA WORK ACTIVITIES

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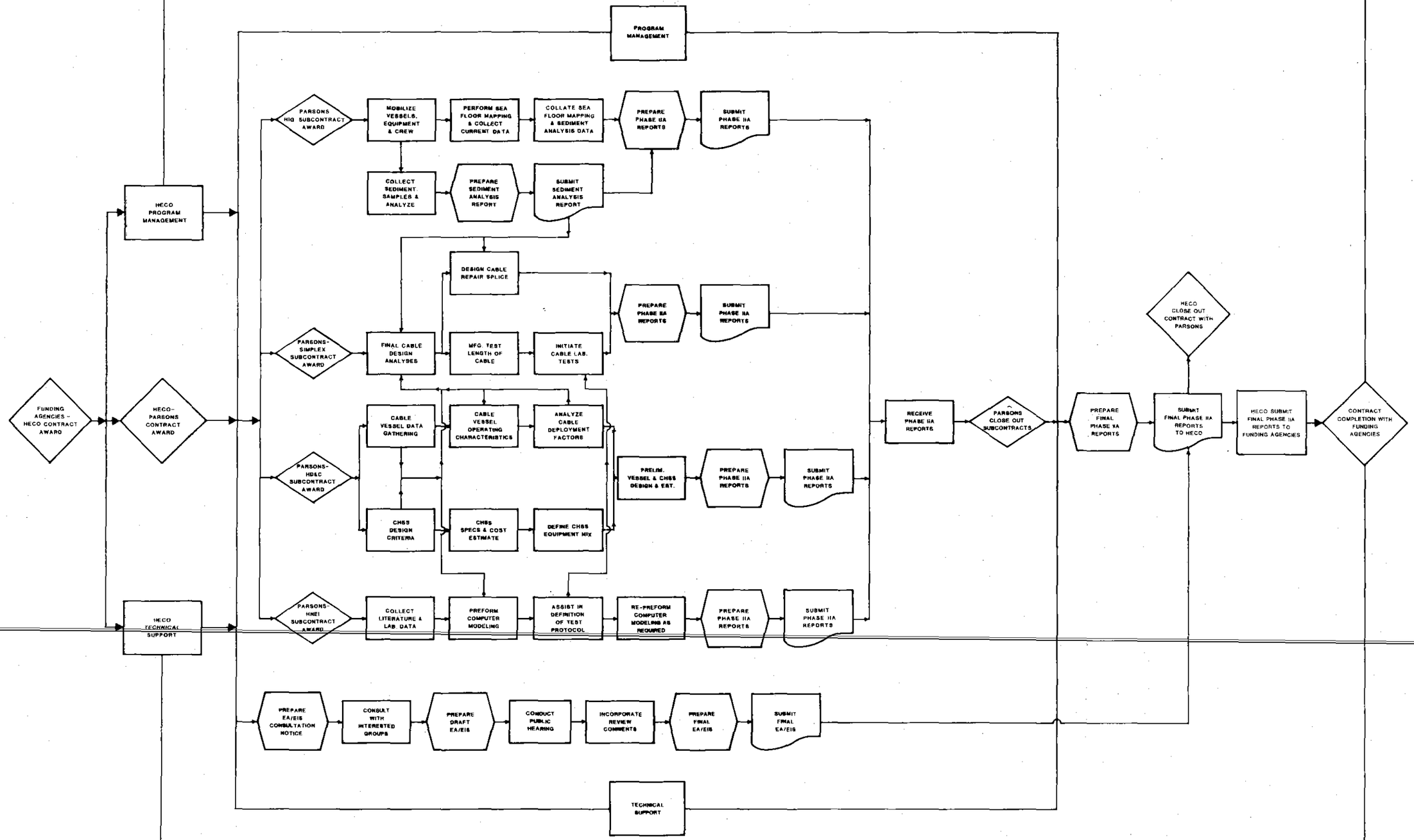

Management tasks to be conducted by HECO include contract monitoring, processing payment requests and forwarding them to funding agencies, work progress monitoring and attending program progress review meetings.

Technical task work will include electrical grid system integration investigations and review of all reports for technical adequacy and accuracy. Regularly scheduled technical review meetings also will be conducted by HECO's Management and Technical Review Board (see Task 2 - Management Support Reports, Section 1, HDWC Program Schedule).

At present, it is contemplated that a workshop type meeting with all Program participants will be held at the initiation of Phase IIA work. Such a meeting will enable each Program participant to indicate their particular concerns and ideas regarding the interrelationship of their work with others. This will allow HECO and Parsons to fully coordinate Phase IIA work efforts and insure that all required Program activity work is included in future funding requests.

HECO mobilization will be limited to the personnel required to perform the management and technical work. This will include systems planning and engineering, operations, finance and management personnel.

PARSONS HAWAII (Parsons)

Parsons activities during Phase II work efforts will include both management and technical tasks. Management work will include development of contracts and scopes of services for all subconsultants, contract negotiation assistance, contract monitoring, schedule and cost monitoring and preparation of payment requests

for submittal to HECO. Parsons also will update, as required, the Program Management Plan, Quality Assurance (QA) Plan, HDWC Program and interisland commercial cable system schedules and costs and this Mobilization Plan.

Parsons technical task work will include the conduct of cost-benefit studies regarding cable designs cable vessel operation and planning scenarios and other subjects as required; reviewing for technical adequacy and accuracy technical task reports as submitted by Program participants; systems integration planning and cost estimating as required; and route survey analyses updating as required. Parsons will also prepare the requisite EA/EIS, based on information generated by other Program participants and that developed by Parsons specifically for the HDWC Program. This work will conclude with the submission of the final EA/EIS to HECO and the appropriate governmental agencies.

In addition, Parsons will perform any required quality assurance/quality control (QA/QC) checks for cable fabrication activities, test sheave fabrication and procurement activities to be performed in Phases IIA, IIB and IIC.

Parsons mobilization efforts will include the technical and management personnel required to perform the above-noted tasks. Included are project management, scheduling/cost control/contracts administration, electrical engineering, cost-benefit analysis, procurement, QA/QC, vendor inspection and environmental analysis personnel.

SIMPLEX WIRE AND CABLE COMPANY (Simplex)

Simplex activities during Phase IIA work efforts will include final design of the prototype test cable, design of a repair splice, the

design, fabrication and installation of a test sheave, the fabrication of a 1,000-foot (305 m) long length of the test cable and the initiation of physical tests on the cable length. Additionally, Simplex will provide consultant services to others regarding systems integration investigations and cable vessel/cable handling support systems (CHSS) design. This work will require program management, cable engineering, marine engineering, systems engineering, contract administration and cost analysis personnel.

Initial mobilization efforts will include cable and marine engineers to perform final cable design and at-sea route survey input activities. Personnel also will be required to provide input to the cable vessel and CHSS design efforts by others and to initiate repair splice design work.

Following development of the final prototype cable design, Simplex efforts will include procurement of cable construction components, fabrication of the test length of cable and design, fabrication and installation of the test sheave. This work will include cable and marine engineering, procurement, cable factory, QA/QC, cost analysis and contract administration personnel.

Physical testing of the cable length will include mobilization of cable engineering and test personnel in addition to the cost analysis, procurement and program management personnel noted previously.

HAWAIIAN DREDGING AND CONSTRUCTION COMPANY (HD&C)

HD&C activities during Phase IIA will include preliminary design of the cable vessel and CHSS. The basic tasks include gathering and analyzing environmental loading data; establishing hydrodynamic loading on the cable during deployment; determining vessel response,

current profiles and vortex shedding effects on the cable determining the static/dynamic loads and stresses on the cable. HD&C will furnish that data to Simplex and apply that data to the CHSS requirements. Additionally, HD&C will develop and update the lay vessel operating scenario; and identify vessel/system requirements as to seakeeping, resupply, access, positioning, measurement and recordation of data.

The CHSS work to be performed will include establishing the CHSS design criteria; surveying sources of existing and new equipment to satisfy the design criteria; developing preliminary specifications for new and modified equipment based on discussions with equipment designers and manufacturers; preparing cost estimates and tradeoffs for subsystem components of the lay vessel; identifying the optimum mix of system components; and identifying the CHSS elements that will be used in the final design.

The above work will require HD&C to mobilize marine architects and engineers, computer systems analysts, physical oceanographers, contract administrators, cost analysts and program management personnel. Since the overall cable vessel design work is dependent upon, among others, CHSS equipment identification, this CHSS work will begin concurrently with final candidate cable vessel identification and systems arrangement preliminary design work.

The overall work effort will then proceed through preliminary design of the cable vessel and CHSS, preliminary construction or procurement specification preparation and cost estimating.

UNIVERSITY OF HAWAII MANOA - HAWAII INSTITUTE OF GEOPHYSICS (HIG)

The at-sea route survey work to be performed by HIG during Phase IIA includes surface and subsurface current measurements, sediment and

bottom material sampling and sea floor mapping. Since the data to be gathered, especially that concerned with sediments and sea floor mapping, will be utilized by Simplex during final cable design efforts, it is imperative that the sediment analysis work begin immediately after issuance of a Notice to Proceed. Although the sea floor mapping and environmental data collection work results will be required by both Simplex and HD&C, this information is not as critical as the sediment characteristics data. Therefore, HIG will be required to mobilize a vessel capable of, at least, collecting sediment samples at the initiation of Phase IIA work. This could involve the use of a vessel other than the *Kana Keoki* if the *Kana Keoki* cannot be scheduled for use at the initiation of Phase IIA work.

Following the initial sediment sampling program, all remaining task and subtask work must be performed. At present, it is estimated that all work can and should be performed within nine months of issuance of a Notice to Proceed. This schedule must be kept due to the interdependent nature of work being performed by others.

HIG mobilization efforts will be concentrated on early deployment of scientific and technical personnel and equipment to first gather and analyze sediment samples and second, to perform the remaining work tasks. Schedules for the required work will be developed by HECO, Parsons and HIG, after a definitive Phase IIA schedule has been established.

UNIVERSITY OF HAWAII MANOA - HAWAII NATURAL ENERGY INSTITUTE (HNEI)

The Phase IIA work by HNEI consists of computer simulation modeling of critical cable materials. The modeling will primarily be concerned with mechanical, structural and electrical stress properties and, as such, will be conducted intermittently during the course of

Phase IIA overall work efforts. It is anticipated that HNEI will perform some services early in Phase IIA for input into final cable design. Following this work, and the inclusion of HNEI results into the final cable design, a period of temporary inactivity will occur until cable design work progresses to the point that additional HNEI computer generated design inputs are required.

HNEI mobiliztion efforts will be primarily directed towards initial data gathering of literature and laboratory sources, the development of modeling criteria and, finally, the conduct of the computer modeling and resultant generation of design input data.

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT (DPED)

DPED Phase IIA work efforts are presently planned to include initial analyses of the legal and institutional constraints affecting a commercial interisland cable system and development of a HDWC Program public informational program. Although both of these major tasks are important to the overall HDWC Program, neither is a critical path element. Hence, both tasks can be accomplished while cable, repair splice, vessel and CHSS design actions are proceeding.

DPED mobilization efforts will begin with the identification of qualified legal and institutional constraints investigators, proceed to the identification of the type, quantity and quality of data required and, finally, to the development of definitive scopes of services, work schedules and cost estimates.

Following the completion of the above, initial work efforts will be directed towards identification of applicable laws and regulations and preliminary definition of existing institutional constraints. This work will be primarily conducted through literature searches of case law and existing regulations.

The public information program to be developed will be based on the overall purposes of the HDWC Program and the results generated by the Program at given periods of time. As such, the public information program will be developed from inputs by all Program participants. These inputs will be in the form of progress reports and/or technical task reports.

Initial mobilization efforts will be directed towards bringing professional public information program development personnel together, educating them about the HDWC Program and its status and defining the general purposes of the informational program. It is expected that the information specialists, in consultation with HECO and Parsons, will develop a meaningful informational program that can be directed to the general public.

SCHEDULE

The presently defined overall HDWC Program schedule is given in the Task 2 - Management Support Reports (Section 1) and is not repeated here. However, Phase IIA schedule is provided (Figure 2). As shown, the majority of the work tasks will be initiated concurrently. That is, all participating organizations must be prepared to mobilize their team members as soon as definitive schedules and scopes of services are developed and contracts and Notices to Proceed issued. All Program participants will be required via contract documents to pursue their work diligently and maintain the specific schedules established for their work.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

FIGURE 2
PHASE IIA SCHEDULE

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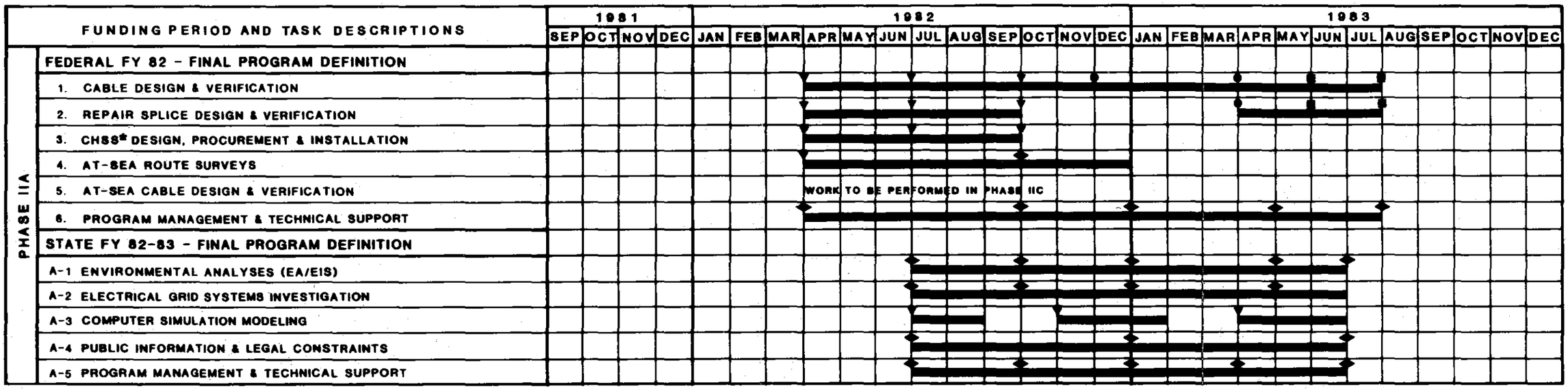

◆ PROGRAM OR PROGRESS REVIEW MEETINGS
● FABRICATION REVIEW MEETING
▼ DESIGN REVIEW MEETING
■ TESTING REVIEW MEETING