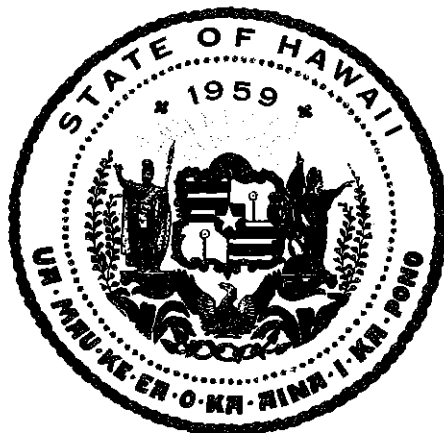


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HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 2
MANAGEMENT SUPPORT REPORTS

TK3351
H35
PI
T2

Department of Planning and Economic Development

**HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM**

PHASE I

TASK 2

MANAGEMENT SUPPORT REPORTS

Prepared by

G. A. Chapman of Parsons Hawaii

for the

State of Hawaii

Department of Planning and Economic Development

APRIL 1982

ACKNOWLEDGEMENTS

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 2 work efforts, the following identifies those who have had the most visible influence.

First credit must be given to Mr. Edward Y. Hirata, Vice President, Engineering and Project Manager for Hawaiian Electric Company and his excellent staff, led by Mr. Gary N. Okura, HDWC Program Project Engineer and Mr. T. Simmons, Senior Planning Engineer. Their timely advice, guidance and critical review of the schedules and cost information contained in this Task 2 Report have been invaluable.

Credit must also be given to those within Parsons Hawaii who have given their valuable time and efforts to the development of this Report. This includes Mr. I. J. Blatner, General Manager, Mr. J. G. Dittmar, Manager Business Development and Mr. M. E. Oliver, Engineering Manager and Mr. F. V. Hermann, Senior Planner.

Finally, credit must be given to Ms. R. Takamori and Mr. J. Keawe for the preparation of the schedules and charts and Ms. J. Okamura and J. Tong for their patience in coordinating the work efforts, typing, retyping and proofing the Report and concern for detail and high quality.

To all of the above and the many others who have contributed to the successful completion of Task 2 work efforts, we offer our sincerest thanks.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 2
PROGRAM DEFINITION
AND SCHEDULE

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM
PROGRAM DEFINITION AND SCHEDULE

The following, in concert with the Program Management Plan, Quality Assurance Plan, Program Mobilization Plan, the Work Breakdown Structure (WBS) and the Cost Information included either in this Task Report or the Task 1 - General Management Reports, constitute the Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program) definition. To the extent presently possible, all major tasks and subtasks have been identified.

The schedule identifies the major tasks to be performed during subsequent phases of work and indicates critical meetings and/or review periods. As shown, Program reviews have been scheduled at the initiation and completion of each phase of work for most major tasks. Additionally, Program or progress reviews are scheduled during the performance of the work. These reviews will enable all Program participants to keep abreast of each other's work and allow HECO and Parsons to accurately monitor work activities, schedules and cost expenditures.

Similarly, the design, fabrication and testing review points will enable all Program participants to assure themselves, HECO and Parsons that design work is progressing towards the most cost-effective solution to design problems; that fabrication work is being performed in accordance with the design drawings and specifications; ~~that all required quality assurance/quality control (QA/QC) checking~~ actions are being performed properly; and that all testing programs are being performed in accordance with the established test procedures. Additionally, review at critical points will assist in identification of unforeseen problem areas and allow those areas to be solved prior to progressing to the physical testing of the cable

and repair splices and actual cable deployment stages of the Program that will involve a significant commitment of funds.

The review points shown will be further defined and refined prior to the initiation of each phase of work. This definition and refinement will be accomplished in consultation with all Program participants to assure a fully coordinated work effort.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM PROGRAM SCHEDULE

APRIL 1982

-3-

FUNDING PERIOD AND TASK DESCRIPTIONS		1981			1982					1983					1984					1985																							
		SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN								
PHASE I	STATE FY 81-82 - PRELIMINARY PROGRAM DEFINITION																																										
	1. GENERAL MANAGEMENT																																										
	2. MANAGEMENT SUPPORT																																										
	3. PRELIMINARY ROUTE SURVEY ANALYSIS																																										
	4. PRELIMINARY PROTOTYPE CABLE DESIGN CRITERIA																																										
	5. PRELIMINARY CABLE VESSEL INVENTORY & CAPABILITY SURVEY																																										
	6. PRELIMINARY DEFINITION OF LEGAL & INSTITUTIONAL CONSTRAINTS																																										
	7. PRELIMINARY COMPUTER SIMULATION MODEL TESTS																																										
	8. PHASE I SUMMARY REPORT																																										
PHASE IIA	FEDERAL FY 82 - FINAL PROGRAM DEFINITION																																										
	1. CABLE DESIGN & VERIFICATION																																										
	2. REPAIR SPLICE DESIGN & VERIFICATION																																										
	3. CHS [®] DESIGN, PROCUREMENT & INSTALLATION																																										
	4. AT-SEA ROUTE SURVEYS																																										
	5. AT-SEA CABLE DESIGN & VERIFICATION																																										
	6. PROGRAM MANAGEMENT & TECHNICAL SUPPORT																																										
	STATE FY 82-83 - FINAL PROGRAM DEFINITION																																										
	A-1 ENVIRONMENTAL ANALYSES (EA/REIS)																																										
PHASE IIB	A-2 ELECTRICAL GRID SYSTEMS INVESTIGATION																																										
	A-3 COMPUTER SIMULATION MODELING																																										
	A-4 PUBLIC INFORMATION & LEGAL CONSTRAINTS																																										
	A-5 PROGRAM MANAGEMENT & TECHNICAL SUPPORT																																										
	FEDERAL FY 83 - DESIGN & VERIFICATION																																										
	1. CABLE DESIGN & VERIFICATION																																										
	2. REPAIR SPLICE DESIGN & VERIFICATION																																										
	3. CHS [®] DESIGN, PROCUREMENT & INSTALLATION																																										
	4. AT-SEA ROUTE SURVEYS																																										
PHASE IIC	5. AT-SEA CABLE DESIGN & VERIFICATION																																										
	6. PROGRAM MANAGEMENT & TECHNICAL SUPPORT																																										
	STATE FY 83-84 - DESIGN & VERIFICATION																																										
	A-1 ENVIRONMENTAL ANALYSES (PERMITS)																																										
	A-2 ELECTRICAL GRID SYSTEMS INVESTIGATION																																										
	A-3 COMPUTER SIMULATION MODELING																																										
	A-4 PUBLIC INFORMATION & LEGAL CONSTRAINTS																																										
	A-5 PROGRAM MANAGEMENT & TECHNICAL SUPPORT																																										
	FEDERAL FY 84 - SYSTEMS VALIDATION & CABLE TEST																																										
PHASE IIC	1. CABLE DESIGN & VERIFICATION																																										
	2. REPAIR SPLICE DESIGN & VERIFICATION																																										
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	STATE FY 84-85 - SYSTEMS VALIDATION & CABLE TEST																																										
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A-3 COMPUTER SIMULATION MODELING																																											
A-4 PUBLIC INFORMATION & LEGAL CONSTRAINTS																																											
A-5 PROGRAM MANAGEMENT & TECHNICAL SUPPORT																																											

◊ - PROGRAM OR PROGRESS REVIEW MEETINGS ▽ - DESIGN REVIEW MEETINGS ⊙ - FABRICATION REVIEW MEETINGS ◼ - TESTING REVIEW MEETINGS CHS[®] - CABLE HANDLING SUPPORT SYSTEMS

HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 2
COST SUMMARY

COST SUMMARY FOR
HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM AND
COMMERCIAL INTERISLAND CABLE SYSTEM

GENERAL AND SUMMARY

This cost summary has been developed to indicate the costs of the remaining phases (IIA, B and C) of the Hawaii Deep Water Electrical Transmission Cable Demonstration Program (HDWC Program) and to provide a preliminary planning level estimate of the costs of an interisland cable system. The costs for Phases IIA and the Federally funded portion of Phase IIB are based on Fiscal year funding increment submittals to appropriate funding agencies. All other costs are based on data provided by participating organizations for specific portions of work. All costs shown are given in terms of April 1982 dollars, escalated at a rate of ten percent per annum to the period of performance. As of April 1982, the following schedule of performance is being forecast:

- Phase IIA - Final Program Definition and Systems Design -
April 1982 through July 1983 - Federal FY 82
and State FY 82-83 funding increment
- Phase IIB - Systems Design and Verification - January 1983
through June 1984 - Federal FY 83 and State
FY 83-84
-
- Phase IIC - Systems Validation and Cable Operations and
Test - January 1984 through January 1985 -
Federal FY 84 and State FY 84-85

As shown in Table 8, total program costs for which Federal or State funds will be sought are estimated to be \$15,803,227. Total estimated participating organization cost share amounts are \$892,310. Total private source funding is \$25,000. Total HDWC Program costs are presently estimated to be \$16,720,537.

The costs shown for the commercial interisland cable system are based upon data generated during the Preliminary Route Survey Analysis, discussions with appropriate equipment suppliers and discussions with appropriate HECO personnel. The interisland cable system costs are also stated in terms of April 1982 dollars. An escalation factor has not been applied due to the preliminary order-of-magnitude nature of the estimates. The interisland cable system costs are provided as a planning level estimate only and will be updated in future phases of the HDWC Program as additional data becomes available.

At present (April 1982) the interisland cable system is estimated to require five years to complete from the bidding and procurement phase through on-line systems testing. Based on a HDWC Program completion of December 1984, the earliest "on-line" date for a commercial cable system would be, therefore, 1990.

COST ESTIMATES

The estimated costs of the HDWC Program are shown in Tables 1 through 8. The costs of the commercial interisland cable system are shown in Table 9. ~~The assumptions upon which the commercial interisland cable system are based are given in Table 10.~~

TABLE 1

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE I - FY 81-82 STATE FUNDING INCREMENT COSTS
PRELIMINARY PROGRAM DEFINITION AND SYSTEMS DESIGNS

<u>Task Description</u>	<u>Total State Funding Required</u>	<u>Private Sources Funding Requirement</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Requirement</u>
1. General Management	\$ 72,642	\$ 6,372	\$ 22,289	\$ 101,303
2. Management Support	72,642	6,372	22,289	101,303
3. Preliminary Route Survey Analysis	50,435	4,424	16,885	71,744
4. Preliminary Prototype Cable Design Criteria	42,313	3,712	11,403	57,428
5. Preliminary Cable Vessel Inventory and Capability Survey and Conceptual Design Studies	27,581	2,419	6,193	36,193
6. Preliminary Definition of Legal and Institutional Constraints	Deferred to Phases IIA, IIB and IIC			
7. Preliminary Computer Simulation Modeling	---	---	25,000	25,000
8. Phase I Summary Report	<u>19,387</u>	<u>1,701</u>	<u>6,010</u>	<u>27,098</u>
TOTAL	\$285,000	\$25,000	\$110,069	\$420,069

TABLE 2

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIA - FY 82 FEDERAL FUNDING INCREMENT COSTS
FINAL PROGRAM DEFINITION AND SYSTEMS DESIGNS

<u>Task Description</u>	<u>Total Federal Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
1. Cable Design and Verification	\$ 392,505	\$ 39,251	\$ 431,756
2. Repair Splice Design and Veri- fication	35,440	3,544	38,984
3. Cable Handling Support Systems (CHSS) Design, Procurement and Installation	160,986	12,395	173,381
4. At-Sea Route Surveys	253,500	25,350	278,850
5. At-Sea Cable Design Verification and Cable Criteria Document Develop- ment	-0-	-0-	-0-
6. Program Management and Technical Support	<u>366,400</u>	<u>56,255</u>	<u>422,655</u>
TOTALS	\$1,208,831	\$136,795	\$1,345,626

TABLE 3

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIA - FY 82-83 STATE FUNDING INCREMENT COSTS
FINAL PROGRAM DEFINITION AND SYSTEMS DESIGNS

<u>Task Description</u>	<u>Total State Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
A-1. Environmental Analyses	\$ 216,723	\$ 21,672	\$ 238,395
A-2. Electrical Grid System Integration Investigations	168,777	54,900	223,677
A-3. Computer Simulation Model Tests of Cable Mechanical and Structural Properties	50,000	5,000	55,000
A-4. Public Information Program and Legal and Institutional Constraint Analyses	50,000	15,000	65,000
A-5. Program Management and Technical Support	<u>364,500</u>	<u>36,450</u>	<u>400,950</u>
TOTAL	\$ 850,000	\$133,022	\$ 983,022

TABLE 4

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIB - FY 83 FEDERAL FUNDING INCREMENT COSTS^{a/}
FINAL SYSTEMS DESIGNS AND VERIFICATION

<u>Task Description</u>	<u>Total Federal Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
1. Cable Design and Verification	\$ 172,800	\$ 17,280	\$ 190,080
2. Repair Splice Design and Verification	187,200	18,720	205,920
3. Cable Handling Support Systems (CHSS) Design, Procurement and Installation	3,479,990	26,073	3,506,063
4. At-Sea Route Surveys	-0-	-0-	-0-
5. At-Sea Cable Design Verification and Cable Criteria Document Development	-0-	-0-	-0-
6. Program Management and Technical Support	<u>544,406</u>	<u>72,851</u>	<u>617,257</u>
TOTALS	\$4,384,396	\$134,924	\$4,519,320

^{a/} All costs shown in terms of April 1982 dollars escalated to the FY 83 time period

TABLE 5

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIB - FY 83-84 STATE FUNDING INCREMENT COSTS^{a/}
SYSTEMS DESIGN AND VERIFICATION
(ESTIMATED)

<u>Task Description</u>	<u>Total State Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
A-1. Environmental Analyses	\$ 150,000	\$ 15,000	\$ 165,000
A-2. Electrical Grid System Integration Investigations	225,000	55,000	280,000
A-3. Computer Simulation Model Tests of Cable Mechanical and Structural Properties	50,000	5,000	55,000
A-4. Public Information Program and Legal and Institutional Constraint Analyses	50,000	5,000	55,000
A-5. Program Management and Technical Support	<u>375,000</u>	<u>37,500</u>	<u>412,500</u>
TOTAL	\$ 850,000	\$117,500	\$ 967,500

^{a/} All costs shown in terms of April 1982 dollars escalated to the FY 83-84 time period

TABLE 6

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIC - FY 84 FEDERAL FUNDING INCREMENT COSTS^{a/}
SYSTEMS VALIDATION AND CABLE OPERATIONS AND TEST
(ESTIMATED)

<u>Task Description</u>	<u>Total Federal Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
1. Cable Design and Verification	\$1,300,000	\$ 30,000	\$ 330,000
2. Repair Splice Design and Veri- fication	500,000	50,000	550,000
3. Cable Handling Support Systems (CHSS) Design, Procurement and Installation	4,000,000	40,000	4,040,000
4. At-Sea Route Surveys	-0-	-0-	-0-
5. At-Sea Cable Design Verification and Cable Criteria Document Develop- ment	2,300,000	25,000	2,325,000
6. Program Management and Technical Support	500,000	50,000	550,000
TOTAL	\$7,600,000	\$195,000	\$7,795,000

^{a/} All costs shown in terms of April 1982 dollars escalated to the FY 84 time period

TABLE 7

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

PHASE IIC - FY 84-85 STATE FUNDING INCREMENT COSTS^{a/}
SYSTEMS VALIDATION AND CABLE OPERATIONS AND TEST
(ESTIMATED)

<u>Task Description</u>	<u>Total State Funding Required</u>	<u>Amount to be Cost Shared by Program Participants</u>	<u>Total Task Costs</u>
A-1. Environmental Analyses	\$ -0-	\$ -0-	\$ -0-
A-2. Electrical Grid System Integration Investigations	250,000	25,000	275,000
A-3. Computer Simulation Model Tests of Cable Mechanical and Structural Properties	25,000	5,000	30,000
A-4. Public Information Program and Legal and Institutional Constraint Analyses	50,000	5,000	55,000
A-5. Program Management and Technical Support	<u>300,000</u>	<u>30,000</u>	<u>330,000</u>
TOTAL	\$ 625,000	\$ 65,000	\$ 690,000

^{a/} All costs shown in terms of April 1982 dollars escalated to the FY 84-85 time period

TABLE 8

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM

COST SUMMARY^{a/}
PHASES I, IIA, IIB AND IIC

<u>Phase</u>	<u>Federal Funding Requirement</u>	<u>State Funding Requirement</u>	<u>Private Sources Funding Requirement</u>	<u>Cost Shared Amounts^{b/}</u>	<u>Total Costs</u>
I	-0-	\$ 285,000	\$ 25,000	\$ 110,069	\$ 420,069
IIA	\$1,208,831	850,000	-0-	269,817	2,328,648
IIB	4,384,396	850,000	-0-	252,424	5,486,820
IIC	7,600,000	625,000	-0-	260,000	8,485,000
TOTAL ^{c/}	13,193,227	\$2,610,000	\$ 25,000	\$ 892,310	\$16,720,537

^{a/}All costs shown in terms of April 1982 dollars escalated to Fiscal year of phase performance

^{b/}Cost shared amounts include both Federal and State funding programs

^{c/}Total public sector funds required equal \$15,803,227

TABLE 9

ORDER OF MAGNITUDE COSTS^{a/}
COMMERCIAL INTERISLAND CABLE SYSTEM

<u>Route</u> ^{b/}	<u>Estimated Cost</u>
A-1	\$ 399,300,000
A-2	401,300,000
A-3	374,700,000
A-4	376,700,000
B-1	354,700,000
B-2	356,700,000
B-3	346,700,000
B-4	368,800,000
B-5	333,900,000

^{a/}Costs shown in terms of April 1982 dollars

^{b/}Routes shown on Figure 1

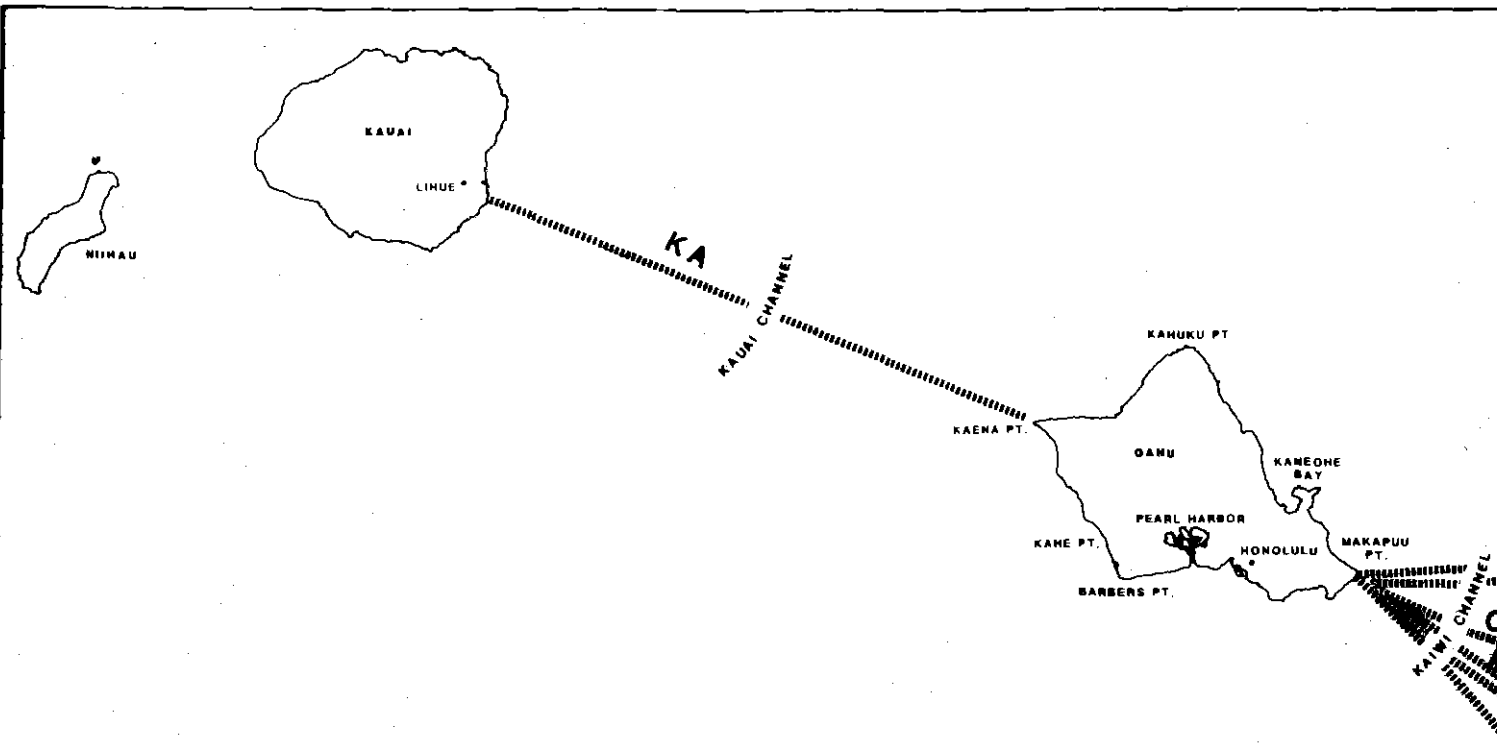


FIGURE 1
ALTERNATIVE CABLE ROUTE



TABLE 10

COMMERCIAL INTERISLAND CABLE SYSTEM
COST ASSMPTIONS

A. Costs Include:

1. Installation vessel operating costs of \$40,000 per day.
2. Underwater cable transport cost (East Coast to Hawaii) of 45 days at \$25,000 per day.
3. Underwater cable cost of \$57.50 per foot (\$910,800/CKT mile) based on Simplex Phase I Report. Cable system consists of three cables (two energized and one spare). This is material cost only.
4. AC/DC convertor station at \$120 per KW or \$60 million per 500 MW station. Two stations required for a total of \$120 million.
5. Overhead transmission line costs of \$400,000 per mile of DC circuit.
6. Contingency of ten percent.

B. Costs do not include:

1. HECO system expansion (i.e. Makapuu Point to HECO grid).
2. Cable vessel modification/construction costs.
3. AC switchyard costs (land and equipment).
4. Engineering costs for System Planning and AC/DC convertor/invertor stations.
5. Installation of AC/DC convertor/invertor station.

6. Financing, operating and maintaining the system.

C. Costs based on "Energy Transport" portion of overall plan as shown on Figure 2. Routes based on Parsons "Preliminary Route Survey Analysis."

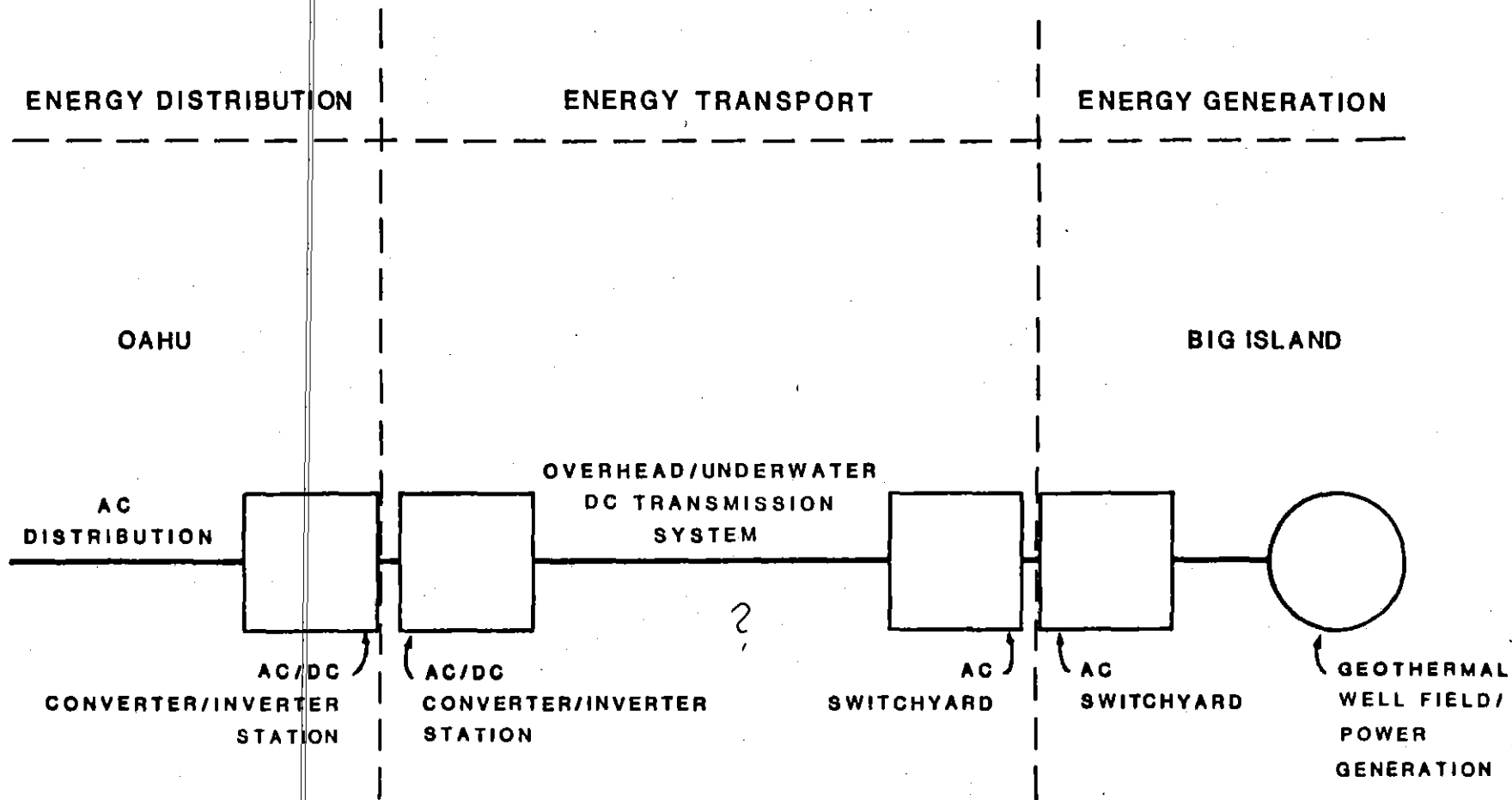
D. System reliability criteria will have impact on costs (e.g. number/size of overhead circuits, number/size of underwater cables, backup capability of AC/DC equipment, etc.).

E. Environmental, technical and economic factors must be evaluated to determine recommended alignment.

HAWAII DEEPWATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

FIGURE 2

ENERGY GENERATION, TRANSPORT AND DISTRIBUTION SYSTEM



HAWAII DEEP WATER ELECTRICAL TRANSMISSION
CABLE DEMONSTRATION PROGRAM

PHASE I

TASK 2
PRELIMINARY PLANNING
LEVEL SCHEDULE

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE
DEMONSTRATION PROGRAM
PRELIMINARY PLANNING LEVEL SCHEDULE
FOR THE
HAWAII INTERISLAND COMMERCIAL CABLE SYSTEM

The establishment of an interisland commercial cable system to electrically intertie the major Hawaiian islands is dependent upon many factors. These include, but are not limited to, proving that it is technically and economically feasible to make such an intertie; that there is an alternate energy power generation source, such as geothermal; that, even if technically and economically feasible, a legal and institutional regime is available to allow the intertie to operate; and that financing for such a system can be obtained. Assuming that all factors indicate that such a system is possible, the time required to bring that system "on-line" must be examined. The chart concluding this section is provided as a preliminary planning level estimate of the time required to issue bid documents, manufacture and deploy the cable, manufacture and install ancillary land-side terminals and test a commercial cable system.

The preliminary schedule is based on the successful attainment of the following goals:

- (1) That the present HDWC Demonstration Program is successfully completed on schedule at the end of 1984.
- (2) That the technical and economical feasibility of an inter-island cable system is proven.
- (3) That the present geothermal resource exploration and development programs in the Puna District of the Big Island confirm the presence of a 500 to 1,000 MW economically exploitable resource by late 1983 or early 1984.

- (4) That the procurement bid documents and contract award(s) for the manufacture and installation of the cable and terminal equipment can be accomplished in a one-year period. If not well planned, procurement could extend over the one-year period due to the complexities of a likely world-wide tender offer. Based on previous submarine cable projects and engineering experience with complex projects, however, it presently appears that a one-year procurement period is reasonable.
- (5) That the route survey work can be accomplished within a six-month period. Of all commercial cable system tasks, this is probably the least critical except where routing may affect cable design and fabrication factors.
- (6) That the cable is assumed to be manufactured, shipped to Hawaii and deployed within a three and one-half year period. (At present, it is reported that the world-wide manufacturing capability of cable companies with HVDC cable experience is 150 miles per year. If, as noted in the Preliminary Route Survey Analysis Report, the commercial interisland system consists of three cables approximately 260 miles (420 km) in length, the world-wide manufacturing capabilities will require expansion. Based on discussions with cable company representatives, it appears that manufacturing capabilities will be expanded in the foreseeable future to enable manufacturing of the required Hawaii cable lengths in the time period shown.)
- (7) That installation of landside equipment, (i.e. AC/DC inversion-conversion equipment, overland transmission lines, etc.) can be accomplished within the construction

periods shown. (Based on discussions with terminal equipment suppliers and appropriate HECO planning personnel, the noted assumption appears to be valid.)

- (8) The the commercial cable system will successfully pass the six-month testing period for operability, reliability and maintainability characteristics.
- (9) That by late 1989 or early 1990, a source will be available to transmit electrical power through the cable system.

It presently appears that all of the major goals and related time frames, upon which the schedule is based, can be met. However, the schedule shown will be reviewed and up-dated during each subsequent phase of the HDWC Program. This effort will ensure that a realistic schedule for an interisland commercial cable system will have been developed at the completion of the HDWC Program.

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM
 PRELIMINARY PLANNING LEVEL SCHEDULE
 FOR THE
 HAWAII INTERISLAND COMMERCIAL CABLE SYSTEM

APRIL 1982

HAWAII DEEP WATER CABLE DEMONSTRATION PROGRAM	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
PHASE I: PRELIMINARY PROGRAM DEFINITION		██████████								
PHASE IIA: FINAL PROGRAM DEFINITION AND SYSTEMS DESIGNS		██████████	██████████							
PHASE IIB: SYSTEMS DESIGNS AND VERIFICATION			██████████							
PHASE IIC: SYSTEMS VALIDATION AND CABLE OPERATIONS AND TESTS				██████████						

HAWAII INTERISLAND COMMERCIAL CABLE SYSTEM	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
COMMERCIAL CABLE PROCUREMENT, BIDDING AND AWARD					██████████					
ROUTE SURVEYS						██████████				
CABLE MANUFACTURE						██████████	██████████	██████████		
TERMINAL EQUIPMENT MANUFACTURE							██████████			
CABLE DEPLOYMENT								██████████	██████████	
TERMINAL CONSTRUCTION								██████████	██████████	
OVERLAND CONSTRUCTION							██████████	██████████	██████████	
SYSTEM TESTING									██████████	
SYSTEM ON-LINE										██████████ →