HAWAII DEEP WATER CABLE PROGRAM

PHASE II

REASSESSMENT OF CABLE VESSEL AVAILABILITY

Prepared by

L. Lopez and F. McHale of Hawaiian Dredging and Construction Company

Prepared for

The Ralph M. Parsons Company, Hawaiian Electric Co., Inc.
and the U.S. Department of Energy

DECEMBER 1983
HAWAII DEEP WATER CABLE DEMONSTRATION PROGRAM

REASSESSMENT OF CABLE VESSEL AVAILABILITY

Ref: "Preliminary Cable Vessel Ship Inventory and Capabilities"
MGA Report Dated 26 March 1982

I. Background

The referenced report summarized a survey of existing cable vessels to determine their applicability and availability to the HDWC Program. This report concluded that none of the existing vessels were applicable to the program without major modifications to the cable handling equipment.

In addition, it was unclear that any of the candidate cable vessels would be available for the cable laying operation schedule for March 1985.

The report further recommended that the FOSS 286 barge be outfitted with the necessary equipment and used as the cable vessel. A conceptual design and cost estimate for this approach was prepared.

As a result of technical discussions with Parsons, HECO and DOE, HD&C was requested to reassess the applicability and availability of the most likely candidate cable vessels.

The following sections discuss the latest work.

II. Reassessment

On March 8, 1983, Morris Guralnick Associates, Inc. was tasked with updating the vessel availability portion of Ref
1. This effort resulted in the March 23, 1983 (MGA report), which is attached as Appendix A.

Representatives for Parsons, Simplex, HD&G met with MGA in San Francisco on April 4, 1983 to review the report. The results of the meeting concluded that the vessels APACHE, SKAGERRAK, FOSS 286 and the SUSITNA were potential candidates for the program's cable vessel. Although the MGA March 82 report suggested the APACHE and SKAGERRAK might not be available for the program, the latest information indicate they could be available. The SUSITNA was not identified in the March 82 report and its addition to the list of candidates resulted from discussions with Mr. Schoephoester of Northern Offshore. The SUSITNA has been used to lay high voltage cable in Alaska.

Appendix B is a summary of required modifications to the candidate vessels for the range of cable characteristics specified by Simplex.

III. Cable Vessel Proposals

Subsequent to the April 4 meeting, Parsons and HD&G concluded it would be more efficient and cost effective for HD&G to directly contact the candidate cable vessel owners and continue the effort initiated by MGA.

HD&G prepared and submitted an RFP, Appendix C, to the candidate cable vessels, and received replies from Santa Fe Engineering (Appendix D), Pirelli Cable Corporation (Appendix E), and Chugach Electric (Appendix F). Although the Chugach reply expressed interest in providing the
SUSITNA for the program, no cost or technical data was provided.

Table 1 is a summary of the pertinent cost data extracted from Appendix D, E and the MGA report which proposed the use of the FOSS 286 barge.

IV. Evaluation of Proposals

The criteria upon which the cable vessel proposals are evaluated is (from Appendix C):

1) Ability of vessel to perform the cable laying operation safely in sea state specified.

2) Cost and cost sharing.

3) Ability to commit vessel for deployment in early 1985.

4) Other terms and conditions.

Comments

1) Santa Fe and Pirelli indicate that the vessels proposed are capable of the cable laying operation in the sea state specified.

2) None of the proposers offered any cost sharing.

3) The APACHE is available in the timeframe of early 1985, however, a significant increase in cost results if the vessel is used after February 15, 1985 ($7,927,000 vs. $14,787,000). The time estimates developed for the program and the estimate provided by Pirelli do not support the possibility of completing the cable laying operation prior to February 15, 1985. Therefore, the higher value will be used for comparison. This large cost increase results from the fact that APACHE's prime business starts after February when sea conditions...
### TABLE 1
SUMMARY OF RFP RESPONSES

<table>
<thead>
<tr>
<th>Task 1</th>
<th>Santa Fe</th>
<th>Pirelli</th>
<th>MGA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>APACHE</td>
<td>SUSITNA</td>
<td>H.P. LADING</td>
</tr>
<tr>
<td>Design/Procurement</td>
<td>3,500,000</td>
<td>3,500,000</td>
<td>3,500,000</td>
</tr>
<tr>
<td>Fab/Test Laying Equipt.</td>
<td>Note 3</td>
<td>Note 2</td>
<td>Note 2</td>
</tr>
<tr>
<td>Task 2</td>
<td>1,335,000</td>
<td>8,000,000</td>
<td>20,000,000</td>
</tr>
<tr>
<td>Mob/Demob</td>
<td>3,485,000</td>
<td>Note 1</td>
<td>Note 1</td>
</tr>
<tr>
<td>Prior 2/15/85</td>
<td>1,335,000</td>
<td>8,000,000</td>
<td>20,000,000</td>
</tr>
<tr>
<td>After 2/15/85</td>
<td>3,485,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 3</td>
<td>2,930,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Cable Laying/Ret Operation</td>
<td>7,640,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior 2/15/85</td>
<td>7,640,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 2/15/85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 4</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Other Services Radio Navigation</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Misc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>7,927,000</td>
<td>13,512,000</td>
<td>11,662,000</td>
</tr>
</tbody>
</table>

Note 1. Includes the cost of tugs.
Note 2. Includes primarily tensioning equipment turntable, overboard sheave.
Note 3. Santa Fe response did not consider the need for linear tensioning, therefore 3,5M is used to be consistent with Pirelli response.
Note 4. MGA estimated cost for equipment is based on moderate cable tensioning loads - similar to Pirelli/Santa Fe basis. In addition, MGA costs provide for auxiliary marine equipment in addition to cable handling equipment.
improve. Prior to that time, APACHE is essentially in a standby mode and therefore can offer a reduced cost.

4) Pirelli provided cost data on five vessels (including the APACHE); however, additional effort is required to determine availability of the vessels. Pirelli recommended the A.D. 7 (Italy) as the cable laying vessel for technical and economic reasons (estimated cost $8,662,000).

5) The FOSS 286 costs are the same as reported in the March 82 report. No effort was expended to update these estimates, since no significant change in equipment or requirements were identified. Additionally, the owners of the 286 were requested to propose on the use of the barge, however, they offered to support the program but did not provide any cost estimates.

6) The vessels under consideration fall into two broad categories as follows:

<table>
<thead>
<tr>
<th>Self-Propelled</th>
<th>Non Self-Propelled</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE</td>
<td>SUSITNA</td>
</tr>
<tr>
<td>SKAGERRAK</td>
<td>H.P. LADING</td>
</tr>
<tr>
<td>A.D. 7</td>
<td>FOSS 286</td>
</tr>
</tbody>
</table>

Another factor that must be weighed in before a final selection can be made is the required maneuverability and controllability and how well any candidate vessel can meet these requirements. The self-propelled vessels have the advantage of following a predetermined
track with relative small deviations when compared to the non self-propelled vessels. However, a requirement for such close tracking has not been identified. Additional analysis on the requirements for stationkeeping will be necessary to resolve this matter.

7) A reduction in cost would be realized if the sea trial site were closer to the cable manufacturers plant. However, it is unlikely that the combination of bottom profile and depth, sea and wind conditions, and currents, could be located at sites other than the Alenuihaha Channel. Duplicating these conditions is important since each element contributes to the cablelaying/retrieving equipment design, and cable vessel requirements.

Conclusion

The ranking of cable vessels based on cost is:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>A.D. 7</td>
</tr>
<tr>
<td>2)</td>
<td>FOSS 286</td>
</tr>
<tr>
<td>3)</td>
<td>H.P. LADING</td>
</tr>
<tr>
<td>4)</td>
<td>SUSITNA</td>
</tr>
<tr>
<td>5)</td>
<td>SKAGERRAK</td>
</tr>
<tr>
<td>6)</td>
<td>APACHE</td>
</tr>
</tbody>
</table>

It appears that the A.D. 7, recommended by Pirelli, could represent a significant savings ($2.2M) over the FOSS 286 proposal by MGA. Additionally, the A.D. 7 has been used for cable laying operations in ocean ocean environment and should provide greater assurance of a successful deployment.
Before any firm conclusion can be reached, however, it will be necessary to confirm the cost estimate, the availability of the A.D. 7, review data supporting its ability to operate in the Alenuihaha Channel, and obtain more data regarding its design. Since the A.D. 7 is a foreign vessel, it will also be necessary to confirm there are no legal barriers to use the vessel on a Federally-funded project.
REPORT ON
CABLE SHIP AVAILABILITIES

Prepared by
MORRIS GURALNICK ASSOCIATES, INC.

for
HAWAIIAN DREDGING AND CONSTRUCTION CO.
1580 Makaloa Street
Honolulu, Hawaii 96814

March 23, 1983
I. Introduction

This report has been developed in preparation for Phase II of the Hawaii Deep Water Electrical Transmission Cable (HDWC) Demonstration Program. Its purpose is to update the vessel availability portion of the "Preliminary Cable Ship Inventory and Capabilities" report dated 29 January 1982 which was prepared as part of the Phase I effort.

Vessel owners/operators were contacted to discuss present and future commitments for their vessels through mid 1985. The late '84 - mid '85 period was emphasized since it is felt that this time frame will be required to cover vessel acquisition and modification, cable transport, cable deployment and retrieval, and vessel demobilization to meet the July 31, 1985 end date.

The results of the availability survey are provided in the following sections.

II. U.S. Flag Vessels

A. U.S. Government

1) Vessels - USNS ZEUS
   USNS ALBERT J. MYER
   USNS NEPTUNE
   USNS AEOLUS

2) Person Contacted - Mr. Jim Coleman
   NAVELEX PME 124
   Washington, DC
   (202) 692-8820

3) Vessel Schedules
   The MYER, NEPTUNE and AEOLUS are currently operating for U.S. Government communication cable laying operations and the ZEUS is scheduled for delivery in January, 1984.

   Exact schedules for the vessels are classified and therefore
cannot be released without proper authorization. Mr. Coleman did say, however, that all of the vessels are fully committed throughout the '84-'85 time frame.

Based on a brief description of the power cable and the project, Mr. Coleman voiced the opinion that it would not be economically feasible to convert any of the government cable ships for this project. He cited the lack of deck space to provide stowage for a reel or turntable and the need to provide much larger overboarding sheaves as two problems that would be expensive to overcome. He also voiced the opinion that the Navy may be reluctant to commit a vessel to a shipyard conversion in view of the delays and other experiences they encountered in recent conversion projects of their own.

B. Santa Fe Engineering and Construction Co.

1) Vessels - APACHE
   CHICKASAW
2) Person Contacted - Mr. Bob Warren
   Santa Fe Engineering and Construction Co.
   Orange, CA
   (714) 558-1300
3) Vessel Schedules
   The APACHE is normally assigned to the North Sea for pipelaying operations in the summer months (May - September) and is idle during the winter (October - April) unless special projects can be found. They have no firm commitment for '84 or '85 although they are currently bidding work for the summer of '84.
   
   The CHICKASAW is normally assigned to the Gulf Coast region for pipelaying operations. They currently have no plans for this vessel for either '84 or '85.
He felt that either vessel could be adapted to the needs of the program and that the APACHE would be the better candidate of the two. He stated that they normally charter the APACHE at about half the daily rate during the winter months since she would otherwise be idle.

As a less expensive alternative, Mr. Warren said that Santa Fe also has portable reels which could be mounted on the deck of a barge or supply vessel for short term cable laying operations.

C. Transoceanic Cable Ship Co. (AT&T)

1) Vessel - LONG LINES
   SALERNUM

2) Person Contacted - Mr. Vince Tomalonis
   Transoceanic Cable Ship Co.
   Morris Township, NJ
   (201) 326-4410

3) Vessel Schedule
   The C/S LONG LINES is currently completing transatlantic TAT-7 and will enter the shipyard about May for a one month maintenance period. The remainder of '83 will be spent on cable guard duty out of its North Carolina base.

   In 1984, the ship is tentatively scheduled for U.S. Navy work in the Pacific for the 2nd and 3rd quarters, but no firm commitments have been made. It is firmly scheduled for work on a fibre optics system to the Canary Islands during the last quarter of '84 and extending into early '85. Beyond that, nothing is scheduled until the next transatlantic lay in 1988.

   As a point of interest, Mr. Tomalonis stated that Transoceanic is going to purchase the Italian cable ship...
SALENUM and convert it to American flag and crew. (Data sheets on this vessel are attached). It will then be based in Hawaii by late '84 or early '85 to replace the CABLE ENTERPRISE on Pacific cable repair duty.

Although this vessel as configured could not meet the HDWC requirements, it has been modified temporarily in the past by the Italians to lay power cable.

III Foreign Vessels

A. COFLEXIP

1) Vessels - FLEXSERVICE 1
   FLEXSERVICE 2
   FLEXSERVICE 3
   STAD - FLEX

2) Person Contacted - Mr. Phillipe De Panafieu
   COFLEXIP
   23 Avenue Neuilly
   75116 Paris, France
   011-33-1-747-11-42

3) Vessel Schedules
   The FLEXSERVICE 1 is currently operating off Brazil for PETROBRAS. They have firm contracts for this vessel through 1984, with an option for 1985. These commitments would appear to rule out this vessel as a viable candidate.

   Mr. De Panafieu felt that any one of the other three vessels operated by Coflexip could be converted for the HDWC program. The FLEXSERVICE 2 is currently in the Arabian Gulf and is contracted through May of 1984. They have no firm or potential commitments beyond that time. The FLEXSERVICE 3 is currently operating between Europe and the Middle East. However, this vessel is under contract to
Electricité de France (EDF) to lay power cables between France and England during July and August of both 1984 and 1985. Hence it would not be available for the HDWC time frame.

The STAD - FLEX is currently working in the Mediterranean off Europe and has no firm commitments for 1984 or '85. COFLEXIP also has available a series of portable reels for use on other vessels.

B. Standard Telephon og Kabelfabrik A/S (STK)

1) Vessel - C/V SKAGERRAK
2) Person Contacted - Mr. O.I. Gilbertson
   STK
   591 Camino de la Reina
   San Diego, CA
   (619) 295-5181

3) Vessel Schedule
   The vessel is currently under contract to the British Columbia Hydro and Power Authority to lay power cables between the mainland and Vancouver Island, British Columbia. This project is expected to be completed in November, 1983.
   There are no firm commitments for the vessel beyond that time although they are negotiating for a project that would take approximately 3 months during the summer of 1984.
   Mr. Gilbertson stated that the ship's present capability is limited to approximately 50 metric tons line pull and that the maximum required for the Vancouver project is 32 tons. Thus some modification would be required for the HDWC project as configured. He also emphasized that the availability of the vessel would be dependent upon setting a firm schedule as soon as possible and making some commitments to STK to hold that time slot.
SECTION III. CABLESHIP DATA AND STATISTICS
Part 2. Individual Ship Data Displays (Continued)

Reference numbers: Lloyd's: 5107738
ABS: 402623
Flag: Italy
Builder: Prof. Ernesto Fasano, N.A.
Builder: see remarks
Date laid down: 1952
Laid down as what: cable ship
Date launched: 1953
Date commissioned: 1954
Data converted: -
Converted from what: -
Functions: cable laying and repair
Base: Naples
Operating areas: all oceans

Number of drums (w.d.):
- Diameter: 10.0 feet
- Type of drive: electric
- Force: 16 tons at 4 knots
- Type of flying:
- Type of drawoff gear: hydraulic knives
- Effective diameter: 4.9 feet
- After cable engine type:
- Diameter of drum: none
- Type of drive: -
- Force: -
- at what speed: -
- Type of flying: -
- If no after gear, method of payout:
- Stern sheave or chute: uses forward drums
- Effective diameter: 6.8 feet
- Plow handling device:
- Ship's bollard pull: none
- Mast height above keel: 35 tons
- No. of main cable tanks:
- Coiling capacity: 98.5 feet
- No. of spare cable tanks:
- Coiling capacity: 3
- Allowable cable and repeater deadweight:
- Number of cable tens that can be loaded:
- Coiling capacity: 23,307 cubic feet
- Weight each:
- -
- Repeater storage method and location:
- Capacity of bunkers:
- Rate of use, cruising:
- working:
- in port:
- 1800 tons
- none
- -
- racks, in hangar, upper deck, way of tank hatches
- 382 tons
- 15 tons per day
- 5
- 7000 nm
- 200 tons
- 200
- 12 tons per day
- Evaporator capacity:
- Number of persons that can be berthed:
- 110
- as crew
- 92
- as other
- 18
- Number of single cabins:
- Test room adequacy for repairs:
- laying:
- 5 (score 0.5)
- Remarks:

SECTION III. CABLESHIP DATA AND STATISTICS

Part 2. Individual Ship Data Displays (Continued)

SALERNUM in 1954, and below, after fitting of bow gantry in 1957
SECTION III. CABLESHIP DATA AND STATISTICS

Part 2. Individual Ship Data Displays (Continued)

General Arrangement, SALERNUM
## CABLE VESSEL REQUIREMENTS FOR THREE POTENTIAL HDWC DEMONSTRATION CABLES

<table>
<thead>
<tr>
<th>Cable Vessel Requirements</th>
<th>Cable Designation Per Simplex 4/12/83 Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low - 4.9&quot; O.D.</td>
</tr>
<tr>
<td>Reel/Turntable Capacity - LBS</td>
<td>420,000</td>
</tr>
<tr>
<td>Reel/Turntable Min. Hub Dia. - FT</td>
<td>13.0</td>
</tr>
<tr>
<td>Overboarding Sheave Min. Dia. - FT</td>
<td>33.0</td>
</tr>
<tr>
<td>Cable Drum Min. Dia. - FT</td>
<td>33.0</td>
</tr>
<tr>
<td>Max Design Tension During Deployment &amp; Retrieval - LBS</td>
<td>127,000</td>
</tr>
<tr>
<td>Max Rating for Tensioning Equipment (Design Tension + 0.65) - LBS</td>
<td>195,000</td>
</tr>
<tr>
<td>Number of 10 Tonne Linear Machines Read for Full Tension</td>
<td>9</td>
</tr>
</tbody>
</table>

*Overall Dimensions 4960 mm x 1240 mm x 2340 mm. (16.5' L x 4' W x 7.8' H)*

10 tonne Brondel machine was selected by MGA because it represented the largest state-of-the-art least cost cable tensioning machine available at the time.

### APPENDIX B
**C/S SKAGERRAK**  
**REQUIRED MODIFICATIONS FOR**  
**THREE POTENTIAL CABLE SIZES**

<table>
<thead>
<tr>
<th>Vessel Requirement</th>
<th>Cable Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low - 4.9&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>Med. - 5.4&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>High - 6.0&quot; O.D.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turntable</th>
<th>Exist. Load Cap. 7000 t.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mods Required None</td>
</tr>
<tr>
<td></td>
<td>Exist. Hub Dia. - 39 FT</td>
</tr>
<tr>
<td></td>
<td>Mods Required None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overboarding Sheave</th>
<th>Exist. Dia. - 32.8 FT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mods Required None Increase to 39 FT Increase to 45 FT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable Drum</th>
<th>Exist Dia. - 32.8 FT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max Tension for this Dia = 225,000#</td>
</tr>
<tr>
<td></td>
<td>Mods Required None Increase to 39 FT Increase to 45 FT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tensioning Capability</th>
<th>Drum - 77,000#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Linear - 19,000#</td>
</tr>
<tr>
<td></td>
<td>Total 96,000#</td>
</tr>
<tr>
<td>Mods Required</td>
<td>Add 5-10 tonne linear machines OR Increase drum cap. by 99,000#</td>
</tr>
<tr>
<td></td>
<td>Add 11-10 tonne linear machines OR Increase drum cap. by 148,000 and add 4-10 tonne linear machines</td>
</tr>
<tr>
<td></td>
<td>Add 16-10 tonne linear machines OR Increase drum cap. by 148,000 and add 9-10 tonne linear machines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accomodations</th>
<th>Exist. Manning None</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Navigation Equipment</th>
<th>Exist. Equip. is Adequate for HDWC</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Propulsion</th>
<th>Exist. - 7200 HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mods Required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maneuvering</th>
<th>Exist. - 1320 HP Thruster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mods Required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Mods Required</th>
<th>None</th>
</tr>
</thead>
</table>
# APACHE

**REQUIRED MODIFICATIONS FOR THREE POTENTIAL CABLE SIZES**

<table>
<thead>
<tr>
<th>Vessel Requirement</th>
<th>Cable Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low - 4.9&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>Med. - 5.4&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>High - 6.0&quot; O.D.</td>
</tr>
</tbody>
</table>

### Reel
- **Exist. Load Cap. 2000 t.**
  - Mods Required: None
- **Exist. Hub Dia. - 54 FT**
  - Mods Required: None

### Overboarding Sheave
- **Exist. - None**

### Cable Drum
- **Reel Provides 200,000#**
- **Tensioning**
  - Per telecon w/Simplex 4/19/83 - Main reel should not be used for storage and tensioning.

### Tensioning Capability
- **Reel - 200,000#**
- **Linear - 80,000#**
- **Total - 280,000#**
  - Mods Required: Provide 6-10 tonne linear machines, Provide 11-10 tonne linear machines, Provide 16-10 tonne linear machines (or a combination of new cable drum & linear machine)

### Accommodations
- **Exist. Crew - 123**
  - Mods Required: None

### Navigation Equipment
- **Exist. Equip. is Adequate for HDWC**

### Propulsion
- **Exist. - 7200 SHP**
  - Mods Required: None

### Maneuvering
- **Exist. 4 Thrusters @ 800 HP Ea.**
  - Mods Required: None
- **Other Mods Required**
  - None
FOSS 286
REQUIRED MODIFICATIONS FOR
THREE POTENTIAL CABLE SIZES

<table>
<thead>
<tr>
<th>Vessel Requirement</th>
<th>Cable Designation</th>
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<tbody>
<tr>
<td></td>
<td>Low - 4.9&quot; O.D.</td>
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<td></td>
<td>Med. - 5.4&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>High - 6.0&quot; O.D.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turntable</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mods Required</td>
<td>New 16' Dia.</td>
<td>None - Use Linear Hauler</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overboarding Sheave</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - None</td>
<td>New 33' Dia.</td>
<td>New 39' Dia.</td>
</tr>
<tr>
<td>Mods Required</td>
<td>New 45' Dia.</td>
<td>None - Use Linear Hauler</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable Drum</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>None - Use Linear Hauler</td>
<td>None - Use Linear Hauler</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tensioning Capability</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add 9-10 tonne linear machines</td>
<td>Add 15-10 tonne linear machines</td>
<td>Add 20-10 tonne linear machines</td>
</tr>
<tr>
<td>(or a combination of new cable drum &amp; linear machine)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accommodations</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Accommodations for 15 People</td>
<td>No Overnight Berthing Required</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Navigation Equipment</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add positioning system, radios - min.</td>
<td>required to supplement equipment on tugs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Propulsion</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Be Provided With Tugs</td>
<td>2 Tugs @ 3600 SHP Each</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maneuvering</th>
<th>Exist. - None</th>
<th>Mods Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Be Provided With Tugs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Other Mods Required | |
| Lifesaving Equipment, Power for Linear Haulers | Power for Misc. Services, Fuel Tank(s) |
SUSITNA
REQUIRED MODIFICATIONS FOR
THREE POTENTIAL CABLE SIZES

<table>
<thead>
<tr>
<th>Vessel Requirement</th>
<th>Cable Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low - 4.9&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>Med. - 5.4&quot; O.D.</td>
</tr>
<tr>
<td></td>
<td>High - 6.0&quot; O.D.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turntable</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. Load Cap.</td>
<td>400 T.</td>
</tr>
<tr>
<td>Mods Required</td>
<td>None</td>
</tr>
<tr>
<td>Exist. Hub Dia.</td>
<td>19 FT</td>
</tr>
<tr>
<td>Mods Required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overboarding Sheave</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - Trough Midships Stbd.</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td>New 33' Dia.</td>
</tr>
<tr>
<td></td>
<td>New 39' Dia.</td>
</tr>
<tr>
<td></td>
<td>New 45' Dia.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable Drum</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - None</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td>None - Provide linear handlers</td>
</tr>
<tr>
<td></td>
<td>None - Provide linear handlers</td>
</tr>
<tr>
<td></td>
<td>None - Provide linear handlers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tensioning Capability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mods Required</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accommodations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. Crew - 26</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Navigation Equipment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - None</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Propulsion</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - None</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td>To be Provided with Tugs</td>
</tr>
<tr>
<td></td>
<td>2 Tugs @ 3600 HP Each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maneuvering</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exist. - None</td>
<td></td>
</tr>
<tr>
<td>Mods Required</td>
<td>To be Provided with Tugs</td>
</tr>
</tbody>
</table>

| Others Mods Required  |                         |

To be Provided with Tugs
Hawaiian Dredging & Construction Company

HAWAII DEEP WATER CABLE DEMONSTRATION PROGRAM

Request for Proposal

A. Introduction

The Hawaii Deep Water Cable (HDWC) Demonstration Program is a Department of Energy and State of Hawaii sponsored R&D project dedicated to the development of a high voltage DC cable that can be laid in the deep open ocean waters from the Island of Hawaii to the Island of Oahu in the Hawaiian chain. This program is being developed in anticipation of large quantities of excess electrical power being produced by geothermal energy on the Island of Hawaii which can be used on the heavily populated Island of Oahu.

In addition to the R&D associated with developing the underwater cable, there are two other major elements of the program:

1) Bathymetrical surveys to select the routing of the cable and,

2) Outfitting a cable laying vessel capable of handling large loads associated with weight of the cable in 7000 ft. of water and the environmental loads due to currents, waves and wind.

Hawaiian Dredging & Construction Company is the principal subcontractor responsible for the selecting and outfitting of the cable laying vessel.

APPENDIX C
A survey conducted by Morris Guralnick & Associates, Inc., to determine the capabilities of existing cable laying vessels has concluded that no vessel currently has the capability of handling the loads associated with the HDWC although there are candidates which could be modified for the service.

To further investigate the possible candidates, HD&C is soliciting proposals for the modification and use of these vessels for laying 20,000 ft. of the HDWC in mid-1985.

B. Instructions to Proposers

1) The logistic and load requirements for the vessel are outlined in paragraph C below.

2) The proposer is to include all costs including management coordination, design, modification, transit, operation, and overhead and profit.

3) The U.S. Department of Energy believes the owners of the selected vessel will greatly benefit from the upgrading and experience gained in laying the demonstration cable. It is hoped that proposers would explore the possibility of cost sharing.

4) HD&C plans to select only one vessel for further negotiations. If more than one proposal is attractive, HD&C will conduct a further screening effort.

5) The cost of preparing and presenting the proposal will not be reimbursed.

6) Presently, the precise characteristics of the cable are not defined. However, it is expected that the
characteristics will be within the range specified in Paragraph C. The proposer is to indicate the maximum condition of cable weight, size, length, or vessel loads that his vessel can handle after modification.

7) HD&C prefers a negotiated fixed price contract for the design, modification and transiting tasks and a day rate for the cable laying phase.

8) Proposer to include the following costs:
   a) Equipment and vessel modification: design, procurement, fabrication, agency approvals
   b) Seakeeping study and dynamic analysis of cable during laying
   c) Equipment and vessel testing
   d) Equipment removal and reconversion (if required)
   e) Vessel transit: home port to conversion yard, conversion yard to East Coast to pick up cable (assume 7 days cable loading time), East Coast to Honolulu, Hawaii, for deployment, transit to Kawaihae Harbor, Hawaii
   f) Other vessels required for logistic support, transiting and/or stationkeeping
   g) Crew costs
   h) Assume at sea deployment time:
      24 hrs. Honolulu to Kawaihae Harbor, Hawaii
      12 hrs. Preparation
      6 hrs. Laying cable
      6 hrs. Holding
12 hrs. Retrieve cable
24 hrs. Return to Honolulu

9) The requirements and conditions noted in this solicitation are to be treated as preliminary.

10) Each proposal should explicitly address the ability to perform the cable laying and retrieval in the sea state noted in paragraph C.

11) Identify services and equipment required to be supplied by others.

12) Proposer should provide sufficient information describing the program elements and the related cost including locations where the work will be performed.

C. Outline of Cable Vessel Requirements

1) Cable characteristic:

Length: 20,000 ft.: Demonstration section
(Unknown): Permanent cable longest section

<table>
<thead>
<tr>
<th>Cable Weight</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Diameter (in.)</td>
<td>4.9</td>
<td>5.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Weight in Air (lb./ft.)</td>
<td>21</td>
<td>31</td>
<td>41</td>
</tr>
<tr>
<td>Weight in Seawater (lb./ft.)</td>
<td>13</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>Max. Install. Tension (lb.)</td>
<td>127,000</td>
<td>209,000</td>
<td>282,000</td>
</tr>
</tbody>
</table>

Min. Untensioned Bend

Radius (ft.) 6.5 8 8

Min. Bend Radius

During Install. (ft.) 16.5 19.5 22.5
2) The following data represents the preliminary wind, wave and current design criteria:

Wind : 35 knots

Sea Waves: Significant Wave Height $H_s = 8$ ft.
: Significant Wave Period $T_s = 6$ sec.

Swell Waves: $H = 4$ ft.

Swell Wave Period $T = 13$ seconds

Direction: From $147^\circ - 236^\circ$ T

Currents: See Table below

PRELIMINARY OPERATIONAL DESIGN CURRENT FOR THE HDWC PROGRAM CABLE LAYING VESSEL IN THE ALENUIHAHA CHANNEL

<table>
<thead>
<tr>
<th>Depth Below (ft)</th>
<th>Current (knots)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.94</td>
</tr>
<tr>
<td>50</td>
<td>2.80</td>
</tr>
<tr>
<td>100</td>
<td>2.68</td>
</tr>
<tr>
<td>150</td>
<td>2.58</td>
</tr>
<tr>
<td>200</td>
<td>2.51</td>
</tr>
<tr>
<td>250</td>
<td>2.44</td>
</tr>
<tr>
<td>300</td>
<td>2.39</td>
</tr>
<tr>
<td>400</td>
<td>2.32</td>
</tr>
<tr>
<td>650</td>
<td>2.22</td>
</tr>
<tr>
<td>800</td>
<td>1.97</td>
</tr>
<tr>
<td>1000</td>
<td>1.65</td>
</tr>
<tr>
<td>1200</td>
<td>1.34</td>
</tr>
<tr>
<td>1300</td>
<td>1.2</td>
</tr>
</tbody>
</table>
D. Selection Criteria

Each proposal will be evaluated based on the following:

1) Ability of vessel to perform the cable laying operation safely in sea state specified.

2) Cost and cost sharing.

3) Ability to commit vessel for deployment in early 1985 (and cost of such commitment if any).

4) Other terms and conditions.

E. Schedule

Proposals are to be delivered to HD&C at 1580 Makaloa Street, Suite 840, Honolulu, Hawaii 96814, no later than 4:30 p.m. on May 6, 1983. HD&C will notify each proposer by May 15, 1983 regarding the results of its evaluation.

Please contact Mr. Frank McHale or Louis Lopez at (808)735-3276 for any clarification or other information required.
OBJECT: HAWAII DEEP WATER CABLE
S.F.H.O. 452

In response to your recent enquiry dated 21 April 1983, Santa Fe Offshore Construction Company (Contractor) has requested to submit herewith their budget estimate for the above referenced work for your consideration.

The contractor proposes to utilize the self propelled, dynamically positioned reel ship "Apache" for performing the work.

Brief description of "Apache"

I. Vessel Description

Class: A.B.S. A1
Flag: United States of America

Length: 403 ft. 3 ins. overall
Beam: 70 ft.
Depth: 28 ft. 6 ins. to main deck
Draft, operating: 18 ft. 2 1/2 ins.

Speed, cruising: 11 knots
Speed, laying: 2 knots (HAK)

Main propulsion:
Diesel:
Propellers:
Shipboard power: 3 each 900 kW generators

Bow Thrusters:
Stern Thrusters:
Thruster power:
Emergency power:

Quarters, air conditioned: 123 men (2 man cabins)
Hospital: 6 man

APPENDIX D
DYNAMIC POSITIONING SYSTEM

The Apache is equipped with a Honeywell/Norcontrol dynamic positioning system which controls the two variable pitch main propellers and the bow and stern tunnel thrusters. The system is fully automatic and can be pre-programmed to follow any specified lay route or to hold any fixed position and heading. The system can receive its position reference from Honeywell AS7 acoustic beacons, Motorola Mini Ranger, Artemis, Syledis or any other conventional position fixing system.

MOORING SYSTEM

The Apache is equipped with a four-point mooring system which includes the following:

- Bow anchors: 2 each 30,000 lbs.
- Stern anchors: 2 each 28,000 lbs.
- Anchor winches: 2 - intercontinental double drum
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
</tr>
</thead>
</table>
| Reel                      | **Flange Diameter**: 82 ft.  
|                           | **Hub Diameter**: 54 ft.  
|                           | **Width Between Flanges**: 22 ft.  
|                           | **Weight Capacity**: 2800 lbs.  
| **Straightener Tensioner**| **Adjustable Hydraulic Track Type**  
|                           | Reel tension of 200,000 lbs. developing a total tension of 280,000 lbs.  
|                           | **A + R Winch**:  
|                           | Intercontinental 300,000 lbs.  
|                           | **Capacity**:  

**Crane**

- **Crawler**: 1 Manitowoc 4100 with 30 ft. boom capacity 400,000 lbs.

- **Pedestal**: 2 Seaking 2300 with 100 ft. boom capacity 90,000 lbs.

- **Davits**: 4

**Navigation and Communication Equipment**

The Apache is fully equipped to perform accurate navigation functions, and has a full complement of communications equipment.

**Major System Includes:**

1. **Sperry HK37 Gyrocompass**
2. **Raytheon HD DE-420, X-Band and S-Band Radars**
3. **Raytheon Digital and White Line Depth Sounders**
4. **ITT Full Synthesized 25 Watt VHF-FM**
5. **ITT NAV - 25 B/35A Shipborne Communications Console for World Wide Use.**
6. **ITT VHF-FM 5 Watt "Walkie-Talkie"**
7. **ITT Emergency Lifeboat Communications Equipment**
8. **ITT ST-1610 Communications Package for Public/Private Telex Operation for World Wide Use**
9. **P.A. System**
10. **Harsat Satellite Communications System**

**Miscellaneous Equipment**

1. **Jet Pump**: 1,000 gph 600 p.s.i.
2. **Air Compressors**: 600 cfm 125 p.s.i.
3. **Water Hacks**, Aquachem 5-300
5. **Electric Shop**, Equipped with Oscilloscopes, Meters, Workbenches, Battery Chargers, etc.

**Fuel Consumption**

- **7,000 U.S. Gals/day** Ave. during transit operations
- **5,000 U.S. Gals/day** Ave. during lay operations
WIND SPEED, WIND DIRECTION AND VESSEL HEADING ARE CONTINUOUSLY MONITORED BY THE HONEYWELL MICROSAD SYSTEM.

WATER DEPTH BELOW THE VESSEL IS CONTINUOUSLY MONITORED BY A RAYTHEON ECHO SOUNDER AND IS RECORDED ON A GRAPH CHART.

1. SCOPE OF WORK

CONTRACTORS' ESTIMATE IS BASED ON PERFORMING THE FOLLOWING ITEMS OF WORK.

1.1. DESIGN AND MODIFICATIONS TO VESSEL (INCLUDING A.B.C.D. OF PARAGRAPH B.8 OF THE RFP)

1.2. MOBILIZATION/DEMOBILIZATION OF VESSEL TO/FROM U.S. EAST COAST PORT.

1.3. A. LOAD VESSEL WITH CABLE IN U.S. COAST PORT (7 DAY ALLOWANCE)
   B. TRANSIT VIA PANAMA CANAL TO HAWAII.
   C. DEMONSTRATION AT JOB SITE (3.5 DAY ALLOWANCE)
   (BUDGET ESTIMATE DAY RATE DURING CABLE LAYING PHASE U.S.D. 80,000) PERFORMANCE OF DEMONSTRATION BETWEEN 1 JAN - 15 FEB 1985
   U.S.D. 115,000 PERFORMANCE OF DEMONSTRATION IN 1985 BUT AFTER 15 FEB.
   D. RETURN TO U.S. COAST PORT TO OFFLOAD CABLE.
   E. REMOVE CABLE (7 DAY ALLOWANCE).

1. BUDGET ESTIMATE PRICES - ALL PRICES IN U.S. DOLLARS


<table>
<thead>
<tr>
<th>SCOPe OF WORK REF</th>
<th>ITEM</th>
<th>ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>DESIGN AND MODIFICATIONS</td>
<td>300,000</td>
</tr>
<tr>
<td>1.2</td>
<td>MOBILIZATION/DEMOBILIZATION</td>
<td>1,355,000</td>
</tr>
<tr>
<td>1.3.(A,B,C,D,E)</td>
<td>SCOPE OF WORK</td>
<td>2,930,000</td>
</tr>
</tbody>
</table>

ESTIMATE TOTAL USD 4,565,000

1.2 ESTIMATE BASED UPON PERFORMANCE OF THE DEMONSTRATION OFFSHORE HAWAII DURING 1985 BUT OCCURRING AFTER FEBRUARY 15:

(NOTE: INCREASED RATES ARE DUE TO DEMONSTRATION AND SUBSEQUENT DEMOBILIZATION OCCURRING DURING SEASONALLY PRIME OFFSHORE INSTALLATION MONTHS.)

<table>
<thead>
<tr>
<th>SCOPE OF WORK REF</th>
<th>ITEM</th>
<th>ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>DESIGN AND MODIFICATION</td>
<td>300,000</td>
</tr>
<tr>
<td>1.2</td>
<td>MOBILIZATION/DEMOBILIZATION</td>
<td>3,485,000</td>
</tr>
<tr>
<td>1.3.(A,B,C,D,E)</td>
<td>SCOPE OF WORK</td>
<td>7,645,000</td>
</tr>
</tbody>
</table>

ESTIMATE TOTAL USD 11,425,000
THE FOLLOWING ASSUMPTIONS HAVE BEEN MADE IN PREPARING OUR BUDGET ESTIMATE:

3.1. INCLUDED IN THE ESTIMATE ARE:-
- MANAGEMENT CO-ORDINATION
- CREW COSTS
- FUEL, LUBE OIL AND APACHE CONSUMABLES
- INSURANCE COVERAGE DURING THE PERFORMANCE OF THE WORK CONSISTING OF:
  A) ALL MACHINERY FOR CONTRACTORS EQUIPMENT
  B) WORKMEN'S COMPENSATION
  C) GENERAL LIABILITY (LIMIT OF 1,000,000 U.S. DOLLARS)

3.2. EXCLUDED FROM THE ESTIMATE ARE:-
- CABLE AND CLIENTS EQUIPMENT
- COSTS ASSOCIATED WITH CABLE HANDLING ONSHORE
- SURVEYORS AND SURVEY EQUIPMENT TO POSITION VESSEL ON SITE:
- BATHYMETRICAL SURVEYS.
- UNDERWATER RIGGING, DIVING SERVICES
- INSPECTION OF CABLE

CAPABILITIES OF APACHE

AFTER MODIFICATIONS OF APACHE

MAXIMUM CONDITIONS OF CABLE HEIGHT, LENGTH OF LOADS THAT CAN BE HANDLED AFTER MODIFICATIONS AS PER PARAGRAPH 8.6 OF RFP ARE:

1. LOW CABLE HEIGHT (21 LB-FT) - 36 STATUTE MILES
2. MODERATE CABLE HEIGHT (31 LB-FT) - 24 STATUTE MILES
3. HIGH CABLE HEIGHT (41 LB-FT) - 18 STATUTE MILES

CONTRACTOR CONFIRMS THE ABILITY TO PERFORM IN CONDITIONS AS STATED IN PARAGRAPH C OF THE RFP.

NOTES:


CONTRACTOR CURRENTLY HAS NO PRIOR COMMITMENTS FOR THE PROPOSED WORK PERIOD. PERFORMANCE OF WORK IS CONTINGENT UPON EXECUTION OF A CONTRACT CONTAINING MUTUALLY AGREEABLE TERMS AND CONDITIONS AND SUBJECT TO THE AVAILABILITY OF EQUIPMENT.

WE HOPE THIS BUDGET ESTIMATE MEETS WITH YOUR APPROVAL AND WE WOULD BE PLEASED TO MEET YOUR REPRESENTATIVES AT YOUR EASIEST CONVENIENCE TO PROVIDE ANY ADDITIONAL INFORMATION WHICH MAY BE REQUIRED IN CONNECTION WITH OUR ESTIMATE. WE LOOK FORWARD TO THE OPPORTUNITY OF WORKING WITH HAWAIIAN DREDGING ON THIS PROJECT.

REGARDS,

LESTER H. ARBO
AREA MANAGER
SANTA FE (UK) LTD
PROPOSAL FOR THE
HAWAII DEEP WATER CABLE DEMONSTRATION PROGRAM
CABLE LAYING EQUIPMENT AND VESSEL

1.0 Introduction

This proposal is in response to Hawaiian Dredging and Construction Company's letter dated April 21, 1983, "Hawaii Deep Water Cable Demonstration Program."

The Pirelli Group holds a leading position in the design, development, manufacture and installation of power submarine cables throughout the world. Presently we are working with Dillingham Corporation Canada Limited on the installation of the 500 kV A.C. cables at Vancouver, Alberta-British Columbia, Canada and we would be most pleased to work with Hawaiian Dredging and Construction Company on this extremely important and interesting program.

The successful performance of high voltage submarine cables, particularly in deep waters is dependent upon not only the proper design and manufacture of the cable but on the proper installation equipment and techniques. Laying submarine cables is a complex and difficult operation, requiring expert technical and installation supervision to coordinate all of the various aspects of the work. Traditionally, to guarantee reliable performance of the complete cable system, the Pirelli Group acts as the prime contractor with total responsibility for the installation.

Recognizing Hawaiian Dredging and Construction Company's key role in the HDWC demonstration program and its expertise in Hawaiian waters, Pirelli is pleased to submit the following proposal. It should be recognized however, that due to the short time available to research and prepare this proposal, our proposal should be considered as a preliminary one, subject to further discussions and confirmation when more data and information is made available to us. At that time, the responsible parties should be prepared to discuss, negotiate, and agree as to how the project should be structured to best satisfy the needs of the program. Therefore, we are available to discuss any and all aspects of our proposal and of the program at your convenience.
2.0 PROPOSAL

2.1 GENERAL

Pirelli has been active in the design of deep water cables and has recently submitted a proposal to Parsons Hawaii for Cable Design Development Work for the Hawaii Deep Water Cable Program. Based on our experience and our present knowledge of the program, we have taken the "moderate" values of Section C of the Request For Proposal to develop our proposal strategy. The values listed in the "High" column would appear to be in excess of what we believe will be required.

Considering that the weight of 175 miles of submarine cable for use in the open ocean waters from the Island of Hawaii to the Island of Oahu in the Hawaiian chain would be in the order of 13,000 metric tons and that such cable must be laid from a turntable on the cable laying vessel, Pirelli would concur that no vessel currently has the capability of handling the loads envisioned for the HDWC project. The SKAGERRAK, which is the largest cable laying ship with a turntable presently available, has a maximum load handling capability of 7,000 metric tons.

While it is considered that the cable laying equipment required for the actual cable installation must be that which is to be used for the sea trial, a smaller cable laying vessel could be used. The primary purpose of the sea trial is to

- perform a seakeeping study under actual conditions in Hawaiian waters
- check the actual cable laying equipment
- check the laying procedure and perform a dynamic analysis of the cable during laying
- confirm the suitability of the cable design

Therefore, use of the actual cable laying equipment on a smaller, suitable cable laying vessel will not only meet the criteria of the sea trial but would present considerable cost savings. Smaller cable laying vessels are already existing and the transfer of the cable laying equipment to the final cable laying ship in the future would be easily accomplished.

2.2 POTENTIAL VESSELS FOR THE SEA TRIAL

Following are brief descriptions of five potential cable laying vessels for the sea trial with our preliminary comments.
2.2.1 SUSITNA

Owner: CHUGACH Electric Association, Anchorage (Alaska)

Turntable: External diameter: 9 meters
          Maximum load: 300 tons

Technical comment: The SUSITNA is capable of performing the cable laying and retrieval in the sea state specified in section C of the RFP. The vessel requires two tugs, one for towing and one for assistance.

Availability: To be investigated

Daily Rate including tugs: Operation $73,000
                         Stand-by $65,000

2.2.2 H.P. LADING

Owner: N.K.T., Copenhagen (Denmark)

Turntable: External diameter: 19.5 meters
          Maximum load: 1450 tons

Technical comment: The H.P. LADING is capable of performing the cable laying and retrieval in the sea state specified in section C of the RFP. This vessel is self-propelled and therefore requires only one assistance tug.

Availability: To be investigated

Daily Rate including tug: Operation $30,000
                         Stand-by $27,000

2.2.3 APACHE

Owner: SANTA FE INTERNATIONAL CORP, USA

Turntable (vertical): External diameter: 25 meters
                     Maximum load: 1815 tons

Technical comment: The APACHE is capable of performing the cable laying and retrieval in the sea state specified in section C of the RFP. This vessel is self-propelled, and has controllable pitch bow and stern thrusters.

Availability: To be investigated

Daily Rate: Operation $151,000
           Stand-by $145,000
2.2.4 A.D.7

Owner: SADAR INCO, Ancona (Italy)

Turntable: External diameter: 13 meters
Maximum load: 400 tons

Technical comment: The A.D.7 is capable of performing the cable laying and retrieval in the sea state specified in section C of the RFP. The vessel requires two tugs, one for towing and one for assistance.

Availability: to be investigated

Daily Rate including tugs: Operation $23,000
Stand-by $21,000

2.2.5 SKAGERRAK

Owner: NORWEGIAN ELECTRICITY BOARD, Oslo (Norway)

Turntable: External diameter: 29 meters
Maximum load: 7,000 tons

Technical comment: The SKAGERRAK is capable of performing the cable laying and retrieval in the sea state specified in section C of the RFP. The vessel is self-propelled and has dynamic positioning.

Availability: to be investigated

Daily Rate: Operation $50,000
Stand-by $45,000

2.3 COST

Pirelli is a leading designer, manufacturer and installer of submarine cable systems throughout the world. However, inasmuch as Pirelli is not an owner of the previously listed cable laying vessels and due to the limited time available to prepare and submit our proposal, the costs presented herein are based on our extensive previous marine operations and do not reflect actual quotations for the items involved. Pirelli is at the disposal of Hawaiian Dredging and Construction Company to further discuss and negotiate a fixed price contract for the services required for a successful program.

2.3.1 LAYING EQUIPMENT

Design, procurement, fabrication, testing lump sum everything included: $3,500,000
2.3.2 EQUIPMENT AND VESSEL TESTING (included in 2.3.1 above)

2.3.3 EQUIPMENT REMOVAL AND RECONVERSION, if any (included in 2.3.4)

2.3.4 VESSEL TRANSIT, RIGGING AND UNRIGGING

This cost is a function of the type and home location of the vessel. In the development of our proposal we have also assumed that

- The manufacture of the laying equipment and the rigging of the vessels would be carried out close to their relevant home locations.

- the cable would be loaded as per section B 8 e of the RFP. East Coast. No cable transportation cost is foreseen.

- transit is from US East Coast to Honolulu.

- tugs, if any, to be rented at sea-trial site.

- at sea deployment as per section B 8 h of the RFP.

- daily rates as in 2.2.

- weather contingencies are excluded from our quotations.

- SUSITNA : approx. $13,000,000.
- H. P. LADING : approx. 8,000,000.
- APACHE : approx. 20,000,000.
- A.D. 7 : approx. 5,000,000.
- SKAGERRAK : approx. 10,000,000.

2.3.5 OTHER VESSELS REQUIRED FOR LOGISTIC SUPPORT

Assistance boats, as required during the sea-trial: $7,000/day
This item is included in the lump sum in item 2.3.4.

2.3.6 CREW COST

Included in vessel's daily rate.
Skilled cable personnel and cable handlers involved in rigging, unrigging and sea-trial performance: $12,000/day. This item is included in item 2.3.4.

2.3.7 OTHER SERVICES

Radio navigation system: $6,000/day.
Local agency services, local personnel transportation, licenses, work permits etc.: $150,000. Not included in 2.3.4.
2.4 TIME SCHEDULE

(rough evaluation)

1) Design, procurement, fabrication, testing of laying equipment: 14 months.

2) Vessel transit: from 5 to 7 months, plus an approximate dead time of 3-4 months depending upon the choice of vessels.

2.5 LOCATION

The work will be coordinated by Pirelli Cable Corporation from the headquarters at Union, New Jersey in close association with our Affiliates in the Pirelli Group. The location of the manufacture of equipment and vessel modification is a function of which vessel is chosen for the program.

2.6 PRELIMINARY RECOMMENDATIONS

Based on our discussions in section 2.1 GENERAL and the basis of the RFP, wherein it is stated that "the vessel provided for the demonstration test is not necessarily required to be the vessel used for laying the full length operational cable....It is desired that the equipment developed for the demonstration test be applicable to the commercial operation." Pirelli, for economical and technical reasons, recommends that consideration be given to the use of A.D. 7 for the cable laying vessel.
I thought I would reply to your letter dated April 21. I did not have the resources or the staff to respond to your RFP as a turn key in this project.

Do however, have a barge we feel would be suitable for this operation, and would consider making the necessary modifications to meet your requirements on a reimbursable basis. I would also be happy to establish lease rates according to those phases and various usages of the barge throughout the project.

If you would be interested in an arrangement of this type, please contact Chugach Electric, Attention Eric Haehne.

Yours,

Ry Burgess
Chugach Electric

APPENDIX F