 <p>U.S. DEPARTMENT OF ENERGY IDAHO OPERATIONS OFFICE</p> <p>COOPERATIVE AGREEMENT</p> <p>ID FORM-182 (Rev. 05-80) Ref: CMD</p> <p>PURSUANT TO AUTHORITY OF PL 93-410, PL 93-438, PL 93-473, PL 93-577, and PL 95-91</p>	1.a. Agreement No. DE-FC07-80ID12144	1.b. Modification No.								
	2. Agreement Period From: 9-30-80 To: 4-1-82									
3. Participant Name and Address California Division of Mines and Geology 1416 Ninth Street, Room 1341 Sacramento, California 95814	4. Participant Type <input type="checkbox"/> Educational <input checked="" type="checkbox"/> Nonprofit <input checked="" type="checkbox"/> State or Local Government <input type="checkbox"/> Profit									
5. Project Title Microearthquake Survey and Analysis	6. Project Will be Conducted per See Article <u>II</u>									
	7. Technical Reports Are Required See Article <u>II and Appendix B</u>									
8. Principal Investigator(s) or Program Director(s) Name and Address Chris H. Cramer/Donald J. Stierman California Division of Mines and Geology 1416 Ninth Street, Room 1341 Sacramento, California 95814	9. DOE Program Officer (Name and Address) M.A. Widmayer, Energy & Technology Division U.S. Department of Energy, Idaho Operations Office, 550 Second St., Idaho Falls, ID 83401 Telephone No. (208) 526-1466									
10. Accounting and Appropriation Data	11. Method of Payment <input type="checkbox"/> % At Award, % When Requested, 5% Upon <input type="checkbox"/> Letter of Credit Receipt of Final Report <input checked="" type="checkbox"/> Reimbursement <input type="checkbox"/> Other (specify) See Article _____									
12. Submit Vouchers to Director, Contracts Management Div., U.S. Department of Energy, 550 Second St., Idaho Falls, ID 83401										
13. Funding Sources	14. Remarks: The California Division of Mines and Geology's contribution will be the use of its 8-DR100 digital event recorders and ancillary equipment and a cost share of \$41,876. This cost share is subdivided into a guaranteed cost share of \$16,000 and an optional cost share of \$25,876. The University of California, Riverside's contribution will be the use of its single DR-100 digital event recorder and a cost share of \$8,046. DOE's cost share will be \$100,000.									
<table border="0"> <thead> <tr> <th>Source</th> <th>Amount</th> </tr> </thead> <tbody> <tr> <td>DOE:</td> <td>\$ <u>100,000</u></td> </tr> <tr> <td>Participant:</td> <td>\$ <u>49,922</u></td> </tr> <tr> <td>Total Funding:</td> <td>\$ <u>149,922</u></td> </tr> </tbody> </table>	Source	Amount	DOE:	\$ <u>100,000</u>	Participant:	\$ <u>49,922</u>	Total Funding:	\$ <u>149,922</u>		
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15. Amount Obligated By This Action: \$ 100,000										
16. DOE Issuing Office (Name and Address) Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401										
17. DOE Contracting Officer <u>J. F. Marmo</u> <u>9/26/80</u> Signature of Contracting Officer (Date) Name (typed) <u>J. F. Marmo</u> Telephone No. <u>(208) 526-1478</u>	18. Participant Acceptance By <u>Jack Dye</u> <u>9/29/80</u> Signature of Authorized Official (Date) Name (typed) <u>JACK DYE, Assistant Director</u> Program and Management Title <u>Department of Conservation</u>									

SCHEDULE

ARTICLE I - STATEMENT OF JOINT OBJECTIVE

The purpose of this Cooperative Agreement between the United States Department of Energy (DOE or Government) and California Division of Mines & Geology (Participant) is for developing and/or advancing technology for the detection and/or advancing technology for the detection and/or delineation of geothermal resources for the evaluation of the potential usefulness of micro earthquake surveys as a geothermal exploration technique. This action is authorized by Federal law and is in furtherance of the U.S. Government's objective of energy independence.

ARTICLE II - THE PROJECT MANAGEMENT PLAN

A. DOE will provide technical assistance and guidance for the program and will provide a portion of the funding for the program. The Participant is solely responsible for securing all facilities, services, and supplies in order to complete the program. Requirements of the project are further set forth in Appendix B to this Agreement which is titled "PROJECT TASKS, SCHEDULE BACKGROUND, AND REPORTING REQUIREMENTS" and which is made a part hereof by this reference. The Participant shall provide the funding and reports as specifically provided for elsewhere in this Agreement. Any significant changes to the project task must have prior approval of the DOE and Participant.

B. In addition to DOE personnel, the Participant agrees to permit non-DOE personnel who are under contract with DOE, and identified from time to time by the Contracting Officer, to assist the DOE representative in performance of his duties and to have necessary access to the Participant's and major subcontractors' facilities and records pertaining to the project. DOE correspondence, if any, with subcontractors shall be routed through the Participant.

ARTICLE III - FINANCIAL SUPPORT

A. Estimated Cost. The total estimated cost of the work under this Agreement is One Hundred Forty-Nine Thousand Nine Hundred Twenty-Two Dollars (\$149,922). If at any time the Participant has reason to believe that this or any revised estimate is in error by more than ten percent (10%), the Participant shall so notify DOE in writing and provide DOE with a new estimate.

B. DOE's Financial Support. The total cost to DOE for all the work under this project is One Hundred Thousand Dollars (\$100,000), and under no circumstances will DOE's support exceed this amount. This limitation includes termination costs, if any. The initial increment available is One Hundred Thousand Dollars (\$100,000).

ARTICLE III - FINANCIAL SUPPORT (Cont'd)

C. Participant's Financial Support. All costs in excess of the One Hundred Thousand Dollars (\$100,000) to be provided by DOE, will be borne by the Participant. The estimated cost to the Participant is Forty-Nine Thousand Nine Hundred Twenty-Two Dollars (\$49,922).

D. Obligated Funds. The amount of funds presently obligated to this Agreement by DOE is One Hundred Thousand Dollars (\$100,000).

ARTICLE IV - METHOD OF PAYMENT

A. DOE will make incremental payments by Treasury check to the Participant in the amounts set forth below at such times as the specified milestones are achieved and upon receipt of invoices or vouchers and a cost statement from the Participant. Such invoices or vouchers must be supported by a statement that the costs are allowable as defined in ARTICLE VIII of this Agreement, and will clearly show DOE's cost share and the Participant's cost share.

B. At any time or times prior to final payment under this Agreement, the Contracting Officer may have the costs incurred under this Agreement audited. The total of DOE payments cannot exceed the total, actual, allowable costs incurred. If the Contracting Officer finds, on the basis of audit or otherwise, that allowable costs as defined in ARTICLE VIII do not equal or exceed the amount of funds DOE has agreed to provide, total payments shall be reduced accordingly.

C. Final payment will not be made until the Final Report is received and accepted by DOE. In no event will the final 5% of the amount of obligated funds be paid to the Participant until DOE has received the Final Report and the Final Cost Report described in Article VI of this Cooperative Agreement.

D. As more definitive project cost and schedule data become available, the parties may review the milestone and payment schedule and, by written agreement, make adjustments. Under no circumstances, however, will DOE's costs exceed the amounts provided for in ARTICLE III.

ARTICLE V - TERM OF THE AGREEMENT

The work under this Agreement shall be completed by April 1, 1982, or within any extension of time as may be mutually agreed to in writing by the parties.

ARTICLE VI - PROJECT INFORMATION SYSTEM

Reporting Requirements. The Participant shall furnish to DOE the reports and information identified in Appendix B.

ARTICLE III - FINANCIAL SUPPORT (Cont'd)

C. Participant's Financial Support. All costs in excess of the One Hundred Thousand Dollars (\$100,000) to be provided by DOE, will be borne by the Participant. The estimated cost to the Participant is Forty-Nine Thousand Nine Hundred Twenty-Two Dollars (\$49,922).

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B. At any time or times prior to final payment under this Agreement, the Contracting Officer may have the costs incurred under this Agreement audited. The total of DOE payments cannot exceed the total, actual, allowable costs incurred. If the Contracting Officer finds, on the basis of audit or otherwise, that allowable costs as defined in ARTICLE VIII do not equal or exceed the amount of funds DOE has agreed to provide, total payments shall be reduced accordingly.

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ARTICLE VII - RESPONSIBLE PERSONS AND PERSONNEL

A. The Participant agrees to permit any specified DOE personnel to have necessary access to the Participants and/or major subcontractor's facilities, personnel, and records pertaining to the project. Such DOE personnel may be used to assist the Program Officer in carrying out his responsibilities.

B. (1) The Program Officer for DOE under this Agreement, and the person who shall be the Participant's contact for all technical matters pertaining to this Agreement shall be the person named below or such other person as may be designated in writing by the Contracting Officer:

M. A. Widmayer
Energy and Technology Division
Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401
(208) 526-1466

(2) The representative for the Participant for the purposes of this Agreement shall be the person named below or such other person as may be designated in writing by the Participant:

Chris H. Cramer
Donald J. Stierman
California Division of Mines and Geology
1416 Nineth St., Room 1341
Sacramento, California 95814
(916) 322-9312

ARTICLE VIII - ALLOWABLE COST

Costs shall constitute allowable costs as specified in Subpart 1-15.2 of the Federal Procurement Regulations (41 CFR 1-15) as may be modified by Subpart 9-15.2 of the DOE Procurement Regulations in effect on the date of this Agreement.

ARTICLE IX - ACQUISITION OF GOODS AND SERVICES

A. In furtherance of the work under this Agreement, each subcontract or purchase order for goods or services which, separately, exceeds Ten Thousand Dollars (\$10,000), shall require the written approval of the Contracting Officer. The Participant may request such approval by submitting to the Contracting Officer a copy of the proposed subcontract document along with justification for the selection of the proposed subcontractor. If the Contracting Officer fails to respond to the request for approval within ten (10) days after receiving such request, the Participant may award the subcontract or purchase order.

B. The subcontractors for the goods and services referred to in paragraph A. above, shall be selected competitively except those subcontractors who were specifically identified in the Participant's proposal.

ARTICLE X - TERMINATION

A. It is the express intent of DOE and the Participant to fund their respective cost participation for the project, as such cost participation is set forth under Article III of this Agreement, so as to provide continuity and completion of the project. If, notwithstanding this original intent, it becomes apparent to either party that incremental funding for its cost participation will not be available as needed, either in whole or in part, in order to provide continuity for the completion of work under this Agreement, each party agrees to promptly advise the other of such funding problem, and if practicable and consistent with their mutual interest at the time, the parties may attempt to cooperatively adjust the schedule and/or the content of the work towards best serving the objectives of this Agreement within the available committed and planned funding of each party.

B. Notwithstanding the foregoing, it is understood that DOE may at any time upon giving written notice to the Participant by the Contracting Officer terminate this Agreement for its convenience for any reason.

C. Also, notwithstanding the foregoing, it is understood that the Participant may at any time upon giving written notice to DOE terminate this Agreement for its convenience for reasonable cause. The Participant may not terminate for convenience after seventy-five percent (75%) of DOE's contribution to the project has been committed, and should such termination occur, it will constitute a breach of contract.

D. In the event of termination for convenience by either party, the parties will cooperate to reasonably phase-out the Participant's costs and cost commitments incurred prior to the termination. If the termination is for the convenience of the Government, the termination cost claim may include those costs provided for in paragraph G. of this Article X. If the termination is for the convenience of the Participant, the cost claim may include only those costs incurred prior to termination. In either case, the approved costs will be shared in accordance with the following: sixty-seven percent (67%) Government and thirty-three percent (33%) Participant; provided; however, that the total amount obligated by the Government under this Agreement shall not be exceeded.

E. In the event of termination for convenience by either party, the Participant shall:

(1) Place no further orders or subcontracts for materials, services, or facilities intended to be invoiced to the Government for its contribution.

(2) Terminate all orders and subcontracts to the extent that they relate to the performance of work.

ARTICLE X - TERMINATION (Cont'd)

(3) Notwithstanding subparagraphs E.(1) and (2) above, the Participant has the right to proceed with such orders and subcontracts should it decide to continue performance of the work at its expense only.

F. After a termination for convenience by the Government, the Participant shall submit to the Contracting Officer its termination claim. Such claim shall be submitted promptly but in no event later than one (1) year from the effective date of termination unless one or more extensions in writing are granted by the Contracting Officer.

G. Termination claims:

(1) There shall be included therein the Government's share, as set forth in paragraph D., of the cost of settling and paying claims arising out of the termination of work under subcontracts or orders which are properly chargeable to this Agreement as determined by the Contracting Officer.

(2) There shall be included therein the reasonable costs of settlement, including accounting, legal, clerical, and other expenses reasonably necessary for the preparation of settlement claims and supporting data with respect to the termination and settlement of subcontracts thereunder, together with reasonable storage, transportation, and other costs incurred in connection with the protection or disposition of termination inventory.

H. Costs claimed, agreed to, or determined pursuant to this article must constitute allowable costs as defined in Article VIII, "Allowable Cost."

I. If in the opinion of DOE, the Participant fails to substantially perform under this Agreement and does not cure such failure within a reasonable time after written notice of such failure by the Contracting Officer, DOE may by written notice to the Participant terminate this Agreement. Such termination notice, signed by the Contracting Officer, shall be effective upon receipt by the Participant. The Government shall not be liable for the incurrence of any obligations under this Agreement from the date of the receipt of such termination notice. Upon any such termination, the Participant agrees to promptly, upon DOE's request, transfer to DOE all information resulting from the work performed to the date of the termination notice.

ARTICLE X - TERMINATION (Cont'd)

J. Except with respect to defaults of subcontractors, the Participant shall not be in default by reason of failure to substantially perform under this Agreement if such failure arises out of causes beyond the control and without the fault or negligence of the Participant. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather, but in every case the failure to perform must be beyond the control and without the fault or negligence of the Participant. If the failure to substantially perform is caused by the failure of a subcontractor to perform or make progress, and if such failure arises out of causes beyond the control of both the Participant and a subcontractor, and without the fault or negligence of either of them, the Participant shall not be deemed to be in default unless the supplies or services to be furnished by the subcontractor were reasonably obtainable from other sources. Upon request of the Participant, if the Contracting Officer shall determine that failure to perform was occasioned by any one or more of the aforementioned causes, this Agreement shall be revised accordingly. This provision does not preclude DOE from exercising its right to terminate for convenience.

K. As used in this article, the term "subcontractor" means subcontractor at any tier.

ARTICLE XI - TITLE TO PROPERTY AND SITE RESTORATION

A. The Government will own and maintain title to all items of materials, supplies, and all tangible property purchased in full or in part with Government funds provided under this Agreement. The Government will determine disposition of such property at completion of the work under this Agreement or upon termination by either party and agrees that those costs incurred by the Participant in final disposition will be allowable costs.

B. The Participant agrees that the Government shall not be subject to any obligation to restore or rehabilitate any of the premises, facilities or equipment owned and/or leased by the Participant which are altered, improved or otherwise affected by this Agreement.

ARTICLE XII - INDEMNIFICATION

It is recognized that the Participant as title holder of the facilities to be constructed under this Agreement is responsible for the design, installation, operation, repair and maintenance of such facilities. The Government therefore will not be liable for payment of damages for injuries to any person, or loss of life or personal property, or loss suffered or sustained and arising from use or operation of the facilities which are a subject of this Agreement. The Participant agrees to indemnify and save the Government harmless from any and all claims, demands, damages, actions, costs, or charges against the

ARTICLE XII - INDEMNIFICATION (Cont'd)

Government arising as the result of the above-mentioned injuries, damages, or loss, except for any such damages or claims arising out of the negligent act of the Government, its employees or representatives in the course of their official duties.

ARTICLE XIII - PUBLIC INFORMATION RELEASES

The parties agree that public disclosure or dissemination of new data or information arising out of the design, construction or operation of the project will be coordinated by the parties, it being understood that the intent of both the Participant and DOE is to release all data and information to the greatest practicable extent in order to achieve the objective of obtaining maximum public value from the results of this project. It is understood that the foregoing is not intended to afford either party the right to prevent a public release by the other; however, nothing in this article shall impair the rights of the parties set forth elsewhere in this Agreement, including but not necessarily limited to General Provision 19. entitled "Patent Rights."

APPENDIX A - GENERAL PROVISIONS

COOPERATIVE AGREEMENTS

TABLE OF CONTENTS

	<u>Title</u>	<u>Page</u>
1.	ORDER OF PRECEDENCE.....	1
2.	DEFINITIONS.....	1
3.	INSPECTION.....	1
4.	EXAMINATION OF RECORDS BY COMPTROLLER GENERAL.....	2
5.	CONVICT LABOR.....	2
6.	OFFICIALS NOT TO BENEFIT.....	2
7.	COVENANT AGAINST CONTINGENT FEES.....	3
8.	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHTS INFRINGEMENT.	3
9.	COMPETITION IN SUBCONTRACTING.....	3
10.	AUDIT.....	3
11.	CLEAN AIR AND WATER.....	4
12.	PREFERENCE FOR U.S. FLAG AIR CARRIERS.....	5
13.	USE OF U.S. FLAG COMMERCIAL VESSELS.....	6
14.	PERMITS AND LICENSES.....	7
15.	REPORTING OF ROYALTIES.....	8
16.	AUTHORIZATION AND CONSENT.....	8
17.	NONDISCRIMINATION IN FEDERALLY ASSISTED PROGRAMS.....	8
18.	ADDITIONAL TECHNICAL DATA REQUIREMENTS.....	8
19.	RIGHTS IN TECHNICAL DATA - LONG FORM.....	9
20.	CONTRACTS WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION.....	12
21.	PATENT RIGHTS - LONG FORM.....	13
22.	FLOOD INSURANCE.....	25

TABLE OF CONTENTS (Cont'd)

	<u>Title</u>	<u>Page</u>
23.	UTILIZATION OF LABOR SURPLUS AREA CONCERNS.....	25
24.	LABOR SURPLUS AREA SUBCONTRACTING PROGRAM.....	26
25.	DISPUTES.....	27
<u>ADDITIONAL GENERAL PROVISIONS</u>		
26.	BUY AMERICAN ACT.....	28
27.	UTILIZATION OF SMALL BUSINESS CONCERNS AND SMALL BUSINESS CONCERNS OWNED AND CONTROLLED BY SOCIALLY AND ECONOMICALLY DISADVANTAGED INDIVIDUALS.....	28
28.	UTILIZATION OF WOMEN-OWNED BUSINESS CONCERNS.....	29

APPENDIX A

GENERAL PROVISIONS

COOPERATIVE AGREEMENT

1. ORDER OF PRECEDENCE

In the event of an inconsistency between the provisions of this Agreement, the inconsistency shall be resolved by giving precedence as follows: (a) schedule; (b) statement of work; (c) the general provisions; (d) other provisions of the Agreement, whether incorporated by reference or otherwise; and (e) Participant's technical proposal, if incorporated in the Agreement by reference or otherwise.

2. DEFINITIONS

As used throughout this Agreement, the following terms shall have the meanings set forth below:

A. The term "head of the agency" or "Secretary" as used herein means the Secretary, the Under Secretary, any Assistant Secretary, or any other head or assistant head of the executive or military department or other Federal agency; and the term "his duly authorized representative" means any person or persons or board (other than the Contracting Officer) authorized to act for the head of the agency or the Secretary.

B. The term "Contracting Officer" means the person executing this Agreement on behalf of the Government, and any other officer or civilian employee who is a properly designated Contracting Officer; and the term includes, except as otherwise provided in this Agreement, the authorized representative of a Contracting Officer acting within the limits of his authority.

C. Except as otherwise provided in this Agreement, the term "subcontract" includes purchase orders under this Agreement.

D. The term "DOE" means the U.S. Department of Energy.

3. INSPECTION

The Government, through any authorized representatives, has the right at all reasonable times, to inspect, or otherwise evaluate the work performed or being performed hereunder and the premises in which it is being performed. If any inspection, or evaluation is made by the Government on the premises of the Participant or a subcontractor, the Participant shall provide and shall require its subcontractors to provide all reasonable facilities and assistance for the safety and convenience of the Government representatives in the performance of their duties. All inspections and evaluations shall be performed in such a manner as will not unduly delay the work.

4. EXAMINATION OF RECORDS BY COMPTROLLER GENERAL

A. This clause is applicable if the amount of this Agreement exceeds \$10,000 and was entered into by means of negotiation, including small business restricted advertising, but is not applicable if this Agreement was entered into by means of formal advertising.

B. The Participant agrees that the Comptroller General of the United States or any of his duly authorized Government employees shall, until the expiration of three (3) years after final payment under this Agreement, unless DOE authorizes their prior disposition, have access to and the right to examine any directly pertinent books, documents, papers, and records of the Participant involving transactions related to this Agreement.

C. The Participant further agrees to include in all its subcontracts hereunder a provision to the effect that the subcontractor agrees that the Comptroller General of the United States or any of his duly authorized Government employees shall, until the expiration of three (3) years after final payment under the subcontract, unless the DOE authorizes their prior disposition, have access to and the right to examine any directly pertinent books, documents, papers, and records of such subcontractor, involving transactions related to the subcontract. The term "subcontract" as used in this clause excludes (1) purchase orders not exceeding \$10,000 and (2) subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.

D. The periods of access and examination described in paragraphs A. and B., above, for records which relate to (1) appeals under the "Disputes" clause of this Agreement, (2) litigation or the settlement of claims arising out of the performance of this Agreement, or (3) costs and expenses of this Agreement as to which exception has been taken by the Comptroller General or any of his duly authorized representatives, shall continue until such appeals, litigation, claims or exceptions have been disposed of.

E. Nothing in this Agreement shall be deemed to preclude an audit by the General Accounting Office of any transaction under this Agreement.

5. CONVICT LABOR

In connection with the performance of work under this Agreement, the Participant agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, September 10, 1965 [18 U.S.C. 4082(c)(2)] and Executive Order 11755, December 29, 1973.

6. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

7. COVENANT AGAINST CONTINGENT FEES

The Participant warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Participant for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this Agreement without liability or in its discretion to deduct from the Agreement price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

8. NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHTS INFRINGEMENT

(The provisions of this clause shall be applicable only if the amount of this Agreement exceeds \$10,000.)

A. The Participant shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this Agreement of which the Participant has knowledge.

B. In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this Agreement or out of the use of any supplies furnished or work or services performed hereunder, the Participant shall furnish to the Government when requested by the Contracting Officer, all evidence and information in possession of the Participant pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Participant has agreed to indemnify the Government.

C. This clause shall be included in all Subcontracts.

9. COMPETITION IN SUBCONTRACTING

The Participant shall select subcontractors (including suppliers) on a competitive basis to the maximum practicable extent consistent with the objectives and requirements of the Agreement.

10. AUDIT

A. The Participant shall maintain, and the Contracting Officer or his representative shall have the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this Agreement. Such right of examination shall include inspection at all reasonable times of the Participant's plants, or such parts thereof, as may be engaged in the performance of this Agreement.

10. AUDIT (Cont'd)

B. The materials described above, shall be made available at the office of the Participant, at all reasonable times, for inspection, audit or reproduction, until the expiration of three (3) years from the date of final payment under this Agreement or such lesser time specified in Title 41, Code of Federal Regulations Part 1-20 and for such lesser period, if any, as is required by applicable statute, or by other clauses of this Agreement, or by subparagraphs B.(1) and (2) below:

(1) If this Agreement is completely or partially terminated, the records relating to the work terminated shall be made available for a period of three (3) years from the date of any resulting final settlement.

(2) Records which relate to appeals under the "Disputes" clause of this Agreement, or litigation or the settlement of claims arising out of the performance of this Agreement, shall be made available until such appeals, litigation, or claims have been disposed of.

11. CLEAN AIR AND WATER

[Applicable only if the Agreement exceeds \$10,000 or the Contracting Officer has determined that orders under an indefinite quantity Agreement in any one year will exceed \$100,000 or a facility to be used has been the subject of a conviction under the Clean Air Act [42 U.S.C. 1857c-8(c)(1)] or the Federal Water Pollution Control Act [33 U.S.C. 1319(c)] and is listed by EPA, or the Agreement is not otherwise exempt.]

A. The Participant agrees as follows:

(1) To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Pub. L. 91-604) and section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq., as amended by Pub. L. 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this Agreement.

(2) That no portion of the work required by this Agreement will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date when this Agreement was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

(3) To use its best efforts to comply with clean air standards and clean water standards at the facility in which the Agreement is being performed.

(4) To insert the substance of the provisions of this clause into any nonexempt subcontract, including this subparagraph A.(4).

11. CLEAN AIR AND WATER (Cont'd)

B. The terms used in this clause have the following meanings:

(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by P. L. 91-604).

(2) The term "Water Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by P. L. 92-500).

(3) The term "clean air standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in section 110(d) of the Clean Air Act [42 U.S.C. 1857c-5(d)], an approved implementation procedure or plan under section 111(c) or section 111(d), respectively, of the Air Act [42 U.S.C. 1857(c)-6(c) or (d)], or an approved implementation procedure under section 112(d) of the Air Act [42 U.S.C. 1857c-7(d)].

(4) The term "clean water standards" means any enforceable limitation, control, condition, prohibition, standard, or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

(5) The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency or an air or water pollution control agency in accordance with the requirements of the Air Act or Water Act and regulations issued pursuant thereto.

(6) The term "facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor or subcontractor, to be utilized in the performance of an agreement or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

12. PREFERENCE FOR U. S. FLAG AIR CARRIERS

A. Pub. L. 93-623 requires that all Federal agencies and Government contractors and subcontractors will use U.S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available. It further provides that the Comptroller General of the United States shall disallow any expenditure from appropriated funds for international air transportation on other than a U.S. flag air carrier in the absence of satisfactory proof of the necessity therefor.

12. PREFERENCE FOR U. S. FLAG AIR CARRIERS (Cont'd)

B. The Participant agrees to utilize U.S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available.

C. In the event that the Participant selects a carrier other than a U.S. flag air carrier for international air transportation, he will include a certification on vouchers involving such transportation which is essentially as follows:

CERTIFICATION OF UNAVAILABILITY OF U.S. FLAG AIR CARRIERS

I hereby certify that transportation service for personnel (and their personal effects) or property by certificated air carrier was unavailable for the following reasons: (state reasons).

D. The terms used in this clause have the following meanings:

(1) "International air transportation" means transportation of persons (and their personal effects) or property by air between a place in the United States and a place outside thereof or between two places both of which are outside the United States.

(2) "U.S. flag air carrier" means one of a class of air carriers holding a certificate of public convenience and necessity issued by the Civil Aeronautics Board, approved by the President, authorizing operations between the United States and/or its territories and one or more foreign countries.

(3) The term "United States" includes the fifty states, Commonwealth of Puerto Rico, possessions of the United States, and the District of Columbia.

E. The Participant shall include the substance of this clause, including this paragraph E., in each subcontract or purchase hereunder which may involve international air transportation.

13. USE OF U.S. FLAG COMMERCIAL VESSELS

A. The Cargo Preference Act of 1954 [Pub. L. 664, August 26, 1954, 68 Stat. 832, 46 U.S.C. 1241(b)], requires that Federal departments or agencies shall transport at least 50 percent of the gross tonnage (computed separately for day bulk carriers, dry cargo liners, and tankers) of equipment, materials, or commodities which may be transported on ocean vessels on privately owned United States flag commercial vessels. Such transportation shall be accomplished whenever:

(1) Any equipment, materials, or commodities, within or outside the United States, which may be transported by ocean vessel, are:

(i) procured, contracted for, or otherwise obtained for the agency's account; or

13. USE OF U.S. FLAG COMMERCIAL VESSELS (Cont'd)

(ii) furnished to or for the account of any foreign nation without provision for reimbursement.

(2) Funds or credits are advanced or the convertibility of foreign currencies is guaranteed in connection with furnishing such equipment, materials, or commodities which may be transported by ocean vessel.

Note: This requirement does not apply to small purchases as defined in 41 CFR 1-3.6 or to cargoes carried in the vessels of the Panama Canal Company.

B. The Participant agrees as follows:

(1) To utilize privately owned United States flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved whenever shipping any equipment, material, or commodities under the conditions set forth in A. above pursuant to this Agreement to the extent such vessels are available at fair and reasonable rates for United States flag commercial vessels.

Note: Guidance regarding fair and reasonable rates for United States flag vessels may be obtained from the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, D.C. 20230, Area Code 202, phone 377-3449.

(2) To furnish, within 15 working days following the date of loading for shipments originating within the United States or within 25 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill of lading in English for each shipment of cargo covered by the provisions in A. above to both the Contracting Officer (through the prime Participant in the case of subcontractor bills of lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, D.C. 20230.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this Agreement except for small purchases as defined in 41 CFR 1-3.6.

14. PERMITS AND LICENSES

Except as otherwise directed by the Contracting Officer, the Participant shall procure all necessary permits or licenses and abide by all applicable laws, regulations, and ordinances of the United States and of the State, territory, and political subdivision in which the work under this Agreement is performed.

15. REPORTING OF ROYALTIES

If this Agreement is in an amount which exceeds \$10,000 and if any royalty payments are directly involved in the Agreement or are reflected in the Agreement price to the Government, the Participant agrees to report in writing to the Contracting Officer or Patent Counsel during the performance of this Agreement and prior to its completion or final settlement the amount of any royalties or other payments paid or to be paid by it directly to others in connection with the performance of this Agreement together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit the identification of the patents or other basis on which the royalties are to be paid. The approval of DOE of any individual payments or royalties shall not stop the Government at any time from contesting the enforceability, validity or scope of, or title to, any patent under which a royalty or payments are made.

16. AUTHORIZATION AND CONSENT

The Government hereby gives its authorization and consent for all use and manufacture of any invention described in and covered by a patent of the United States in the performance of this Agreement or any part hereof or any amendment hereto or any contract hereunder (including any lower-tier subcontract).

17. NONDISCRIMINATION IN FEDERALLY ASSISTED DOE PROGRAMS - CIVIL RIGHTS

Recipients of DOE financial assistance awards which are provided under DOE Federal Assistance programs shall comply with Part 1040, Chapter X, Title 10 of the Code of Federal Regulations "Nondiscrimination in Federally Assisted Programs" (10 CFR Part 1040) as published in the FR Vol. 45, No. 116, Friday, June 13, 1980 (pages 40514 through 40535). 10 CFR Part 1040 provided that no person shall on the ground of race, color, national origin, sex, handicap, or age be excluded from participation in, be denied the benefits of, be subjected to discrimination under, or be denied employment, where the main purpose of the program or activity is to provide employment or when the delivery of program services is affected by the recipient's employment practices, in connection with any program or activity receiving Federal assistance from the DOE.

18. ADDITIONAL TECHNICAL DATA REQUIREMENTS

A. In addition to the technical data specified elsewhere in this Agreement to be delivered, the Contracting Officer may at any time during the Agreement performance or within one (1) year after final payment call for the Participant to deliver any technical data first produced or specifically used in the performance of this Agreement except technical data pertaining to items of standard commercial design.

B. The provisions of the "Rights in Technical Data" clause included in this Agreement are applicable to all technical data called for under this Additional Technical Data Requirements clause. Accordingly, nothing contained in this clause shall require the Participant to actually deliver any technical data, the delivery of which is excused by paragraph E. of the "Rights in Technical Data" clause.

18. ADDITIONAL TECHNICAL DATA REQUIREMENTS

C. When technical data are to be delivered under this clause, the Participant will be compensated for appropriate costs for converting such data into the prescribed form, for reproduction, and for delivery.

19. RIGHTS IN TECHNICAL DATA - LONG FORM

A. Definitions.

(1) "Technical Data" means recorded information regardless of form or characteristic, of a scientific or technical nature. It may, for example, document research, experimental, developmental, or demonstration, or engineering work, or be usable or used to define a design or process, or to procure, produce, support, maintain, or operate materiel. The data may be graphic or pictorial delineations in media such as drawings or photographs, text in specifications or related performance or design type documents or computer software (including computer programs, computer software data bases, and computer software documentation). Examples of technical data include research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identification, and related information. Technical data as used herein does not include financial reports, cost analyses, and other information incidental to Agreement administration.

(2) "Proprietary Data" means technical data which embody trade secrets developed at private expense, such as design procedures or techniques, chemical composition of materials, or manufacturing methods, processes, or treatments, including minor modifications thereof, provided that such data:

(i) Are not generally known or available from other sources without obligation concerning their confidentiality;

(ii) Have not been made available by the owner to others without obligation concerning its confidentiality; and

(iii) Are not already available to the Government without obligation concerning their confidentiality.

(3) "Contract Data" means technical data first produced in the performance of the Agreement, technical data which are specified to be delivered in the Agreement, technical data that may be called for under the "Additional Technical Data Requirements" clause of the Agreement, if any, or technical data actually delivered in connection with the Agreement.

19. RIGHTS IN TECHNICAL DATA - LONG FORM (Cont'd)

(4) "Unlimited Rights" means rights to use, duplicate, or disclose technical data, in whole or in part, in any manner and for any purpose whatsoever, and to permit others to do so.

B. Allocation of Rights.

(1) The Government shall have:

(i) Unlimited rights in contract data except as otherwise provided below with respect to proprietary data.

(ii) The right to remove, cancel, correct or ignore any marking not authorized by the terms of this Agreement on any technical data furnished hereunder, if in response to a written inquiry by DOE concerning the propriety of the markings, the Participant fails to respond thereto within sixty (60) days or fails to substantiate the propriety of the markings. In either case DOE will notify the Participant of the action taken.

(iii) No rights under this Agreement in any technical data which are not Agreement data.

(2) The Participant shall have:

(i) The right to withhold proprietary data in accordance with the provisions of this clause.

(ii) The right to use for its private purposes, subject to patent, security or other provisions of this Agreement, contract data it first produces in the performance of this Agreement provided the data requirements of this Agreement have been met as of the date of the private use of such data. The Participant agrees that to the extent it receives or is given access to proprietary data or other technical, business or financial data in the form of recorded information from DOE or a DOE contractor or subcontractor, the Participant shall treat such data in accordance with any restrictive legend contained thereon, unless use is specifically authorized by prior written approval of the Contracting Officer.

(3) Nothing contained in this "Rights in Technical Data" clause shall imply a license to the Government under any patent or be construed as affecting the scope of any licenses or other rights otherwise granted to the Government under any patent.

19. RIGHTS IN TECHNICAL DATA - LONG FORM (Cont'd)

C. Copyrighted Material.

(1) The Participant shall not, without prior written authorization of the Contracting Officer, establish a claim to statutory copyright in any Agreement data first produced in the performance of the Agreement. To the extent such authorization is granted, the Government reserves for itself and others acting on its behalf a royalty-free, nonexclusive, irrevocable, worldwide license for Governmental purposes to publish, distribute, translate, duplicate, exhibit and perform any such data copyrighted by the Participant.

(2) The Participant agrees not to include in the technical data delivered under the Agreement any material copyrighted by the Participant and not to knowingly include any material copyrighted by others without first granting or obtaining at no cost a license therein for the benefit of the Government of the same scope as set forth in subparagraph C.(1) above. If such royalty-free license is unavailable and the Participant nevertheless determines that such copyrighted material must be included in the technical data to be delivered, rather than merely incorporated therein by reference, the Participant shall request the written authorization of the Contracting Officer to include such copyrighted material in the technical data without a license.

D. Subcontracting. It is the responsibility of the Participant to obtain from its contractors technical data and rights therein, on behalf of the Government, necessary to fulfill the Participant's obligations to the Government with respect to such data. In the event of refusal by a subcontractor to accept an article affording the Government such rights, the Participant shall:

(1) Promptly submit written notice to the Contracting Officer setting forth reasons for the subcontractor's refusal and other pertinent information which may expedite disposition of the matter; and

(2) Not proceed with the contract without the written authorization of the Contracting Officer.

E. Withholding of Proprietary Data. Notwithstanding the inclusion of the "Additional Technical Data Requirements" clause in this Agreement or any provision of this Agreement specifying the delivery of technical data, the Participant may withhold proprietary data from delivery, provided that the Participant furnishes in lieu of any such proprietary data, so withheld technical data disclosing the source, size, configuration, mating and attachment characteristics, functional characteristics and performance requirements ("Form, Fit and Function" data, e.g., specification control

19. RIGHTS IN TECHNICAL DATA - LONG FORM (Cont'd)

drawings, catalog sheets, envelope drawings, etc.) or a general description of such proprietary data where "Form, Fit and Function" data are not applicable. The Government shall acquire no rights to any proprietary data so withheld except that such data shall be subject to the "Inspection Rights" provisions of paragraph F., and if included, the "Limited Rights in Proprietary Data" provisions of paragraph G. and the "Participant Licensing" provisions of paragraph H.

F. Inspection Rights. Except as may be otherwise specified in this Agreement for specific items of proprietary data which are not subject to this paragraph, the Contracting Officer's representatives, at all reasonable times up to three (3) years after final payment under this Agreement, may inspect at the Participant's facility any proprietary data withheld under paragraph E. and not furnished under paragraph G. for the purposes of verifying that such data properly fell within the withholding provision of paragraph E., or for evaluating work performance.

20. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION

[This Agreement, to the extent that it is of a character specified in the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), is subject to the following provisions and to all other applicable provisions and exceptions of such Act and the regulations of the Secretary of Labor thereunder.]

A. Overtime Requirements. The Participant or contractor contracting for any part of the Agreement work, which may require or involve the employment of laborers, mechanics, apprentices, trainees, watchmen, and guards, shall require or permit any laborer, mechanic, apprentice, trainee, watchman, or guard, in any workweek in which he is employed on such work, to work in excess of eight (8) hours in any calendar day, or in excess of forty (40) hours in such workweek, on work subject to the provisions of the Contract Work Hours and Safety Standards Act, unless such laborer, mechanic, apprentice, trainee, watchman, or guard receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of eight (8) hours in any calendar day, or in excess of forty (40) hours in such workweek, whichever is the greater number of overtime hours.

B. Violation; Liability for Unpaid Wages; Liquidated Damages. In the event of any violation of the provisions of paragraph A., the Participant and any contractor responsible therefor shall be liable to any affected employee for his unpaid wages. In addition, such Participant and contractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, apprentice, trainee, watchman, or guard employed in violation of the provisions of paragraph A. in the sum of \$10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of eight (8) hours or in excess of his standard workweek of forty (40) hours without payment of the overtime wages required by paragraph A.

20. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION (Cont'd)

C. Withholding for Unpaid Wages and Liquidated Damages. The Contracting Officer may withhold from the Government Prime Participant, from any moneys payable on account of work performed by the Participant or contractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Participant or contractor for unpaid wages and liquidated damages as provided in the provisions of paragraph B.

D. Subcontracts. The Participant shall insert paragraphs A. through D. of this clause in all subcontracts, and shall require their inclusion in all subcontracts of any tier.

E. Records. The Participant shall maintain payroll records containing the information specified in 29 CFR 516.2(a). Such records shall be preserved for three (3) years from the completion of the Agreement.

21. PATENT RIGHTS - LONG FORM

A. Definitions.

(1) "Subject Invention" means any invention or discovery of the Participant conceived or first actually reduced to practice in the course of or under this Agreement, and includes any art, method, process, machine, manufacture, design, or composition of matter, or any new and useful improvement thereof, or any variety of plants, whether patented or unpatented under the Patent Laws of the United States of America or any foreign country.

(2) "Contract" means any contract, grant, agreement, understanding or other arrangement, which includes research, development, or demonstration work, and includes any assignment or substitution of parties.

(3) "States and domestic municipal governments" means the States of the United States, the District of Columbia, Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, and any political subdivision and agencies thereof.

(4) "Government agency" includes an executive department, independent commission, board, office, agency, administration, authority, Government corporation, or other Government establishment of the Executive Branch of the Government of the United States of America.

(5) "To the point of practical application" means to manufacture in the case of a composition or product, to practice in the case of a process, or to operate in the case of a machine and under such conditions as to establish that the invention is being worked and that its benefits are reasonably accessible to the public.

21. PATENT RIGHTS - LONG FORM (Cont'd)

(6) "Patent Counsel" means the DOE Patent Counsel assisting the procuring activity.

B. Allocation of Principal Rights.

(1) Assignment to the Government. The Participant agrees to assign to the Government the entire right, title, and interest throughout the world in and to each Subject Invention except to the extent that rights are retained by the Participant under subparagraph B.(2) and paragraph C. of this clause.

(2) Greater Rights Determinations. The Participant or the employee-inventor with authorization of the Participant may request greater rights than the nonexclusive license and the foreign patent rights provided in paragraph C. of this clause on identified inventions, in accordance with 41 CFR 9-9.109-6. Such requests must be submitted to Patent Counsel (with notification by Patent Counsel to the Contracting Officer) at the time of the first disclosure pursuant to subparagraph E.(2) of this clause, or not later than nine (9) months after conception or first actual reduction to practice, whichever occurs first, or such longer period as may be authorized by Patent Counsel (with notification by Patent Counsel to the Contracting Officer) for good cause shown in writing by the Participant.

C. Minimum Rights to the Participant.

(1) Participant License. The Participant reserves a revocable, nonexclusive, paid-up license in each patent application filed in any country on a Subject Invention and any resulting patent in which the Government acquires title. The license shall extend to the Participant's domestic subsidiaries and affiliates, if any, within the corporate structure of which the Participant is a part and shall include the right to grant sublicenses of the same scope to the extent the Participant was legally obligated to do so at the time the Agreement was awarded. The license shall be transferable only with approval of DOE except when transferred to the successor of that part of the Participant's business to which the invention pertains.

(2) Revocation Limitations. The Participant's nonexclusive license retained pursuant to subparagraph C.(1) of this clause and sublicenses granted thereunder may be revoked or modified by DOE, either in whole or in part, only to the extent necessary to achieve expeditious practical application of the Subject Invention under DOE's published licensing regulations (10 CFR 781), and only to the extent an exclusive license is actually granted. This license shall not be revoked in that field of use and/or the geographical areas in which the Participant, or its sublicensee, has brought the invention to the point of practical application and continues to make the benefits of the invention reasonably accessible to the public, or is expected to do so within a reasonable time.

21. PATENT RIGHTS - LONG FORM (Cont'd)

(3) Revocation Procedures. Before modification or revocation of the license or sublicense, pursuant to subparagraph C.(2) of this clause, DOE shall furnish the Participant a written notice of its intention to modify or revoke the license and any sublicense thereunder, and the Participant shall be allowed thirty (30) days, or such longer period as may be authorized by the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) for good cause shown in writing by the Participant, after such notice to show cause why the license or any sublicense should not be modified or revoked. The Participant shall have the right to appeal, in accordance with 10 CFR 781, any decision concerning the modification or revocation of its license or any sublicense.

(4) Foreign Patent Rights. Upon written request to Patent Counsel (with notification by Patent Counsel to the Contracting Officer), in accordance with subparagraph E.(2)(i) of this clause, and subject to DOE security regulations and requirements, there shall be reserved to the Participant, or the employee-inventor with authorization of the Participant, the patent rights to a Subject Invention in any foreign country where the Government has elected not to secure such rights provided:

(i) The recipient of such rights, when specifically requested by DOE and three (3) years after issuance of a foreign patent disclosing said Subject Invention, shall furnish DOE a report setting forth:

(A) The commercial use that is being made, or is intended to be made, of said invention, and

(B) The steps taken to bring the invention to the point of practical application or to make the invention available for licensing.

(ii) The Government shall retain at least an irrevocable, nonexclusive, paid-up license to make, use, and sell the invention throughout the world by or on behalf of the Government (including any Government agency) and States and domestic municipal governments, unless the Secretary or his designee determines that it would not be in the public interest to acquire the license for the States and domestic municipal governments.

(iii) Subject to the rights granted in subparagraphs C.(1), (2), and (3) of this clause, the Secretary or his designee shall have the right to terminate the foreign patent rights granted in this subparagraph C.(4) in whole or in part unless the recipient of such rights demonstrates to the satisfaction of the Secretary or his designee that effective steps necessary to accomplish substantial utilization of the invention have been taken or within a reasonable time will be taken.

21. PATENT RIGHTS - LONG FORM (Cont'd)

(iv) Subject to the rights granted in subparagraphs C.(1), (2), and (3) of this clause, the Secretary or his designee shall have the right, commencing four (4) years after foreign patent rights are accorded under this subparagraph C.(4), to require the granting of a nonexclusive or partially exclusive license to a responsible applicant or applicants, upon terms reasonable under the circumstances and in appropriate circumstances to terminate said foreign patent rights in whole or in part, following a hearing upon notice thereof to the public, upon a petition by an interested person justifying such hearing:

(A) If the Secretary or his designee determines, upon review of such material as he deems relevant, and after the recipient of such rights, or other interested person, has had the opportunity to provide such relevant and material information as the Secretary or his designee may require, that such foreign patent rights have tended substantially to lessen competition or to result in undue market concentration in any section of the United States in any line of commerce to which the technology relates; or

(B) Unless the recipient of such rights demonstrates to the satisfaction of the Secretary or his designee at such hearing that the recipient has taken effective steps, or within a reasonable time thereafter is expected to take such steps, necessary to accomplish substantial utilization of the invention.

D. Filing of Patent Applications.

(1) With respect to each Subject Invention in which the Participant or the inventor requests foreign patent rights in accordance with subparagraph C.(4) of this clause, a request may also be made for the right to file and prosecute the U.S. application on behalf of the U.S. Government. If such request is granted, the Participant or inventor shall file a domestic patent application on the invention within six (6) months after the request for foreign patent rights is granted, or such longer period of time as may be approved by the Patent Counsel for good cause shown in writing by the requester. With respect to the invention, the requester shall promptly notify the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) of any decision not to file an application.

(2) For each Subject Invention on which a domestic patent application is filed by the Participant or inventor, the Participant or inventor shall:

21. PATENT RIGHTS - LONG FORM (Cont'd)

(i) Within two (2) months after the filing or within two (2) months after submission of the invention disclosure if the patent application previously has been filed, deliver to the Patent Counsel a copy of the application as filed including the filing date and serial number;

(ii) Within six (6) months after filing the application or within six (6) months after submitting the invention disclosure if the application has been filed previously, deliver to the Patent Counsel a duly executed and approved assignment to the Government, on a form specified by the Government;

(iii) Provide the Patent Counsel with the original patent grant promptly after a patent is issued on the application; and

(iv) Not less than thirty (30) days before the expiration of the response period for any action required by the Patent and Trademark Office, notify the Patent Counsel of any decision not to continue prosecution of the application.

(3) With respect to each Subject Invention in which the Participant or inventor has requested foreign patent rights, the Participant or inventor shall file a patent application on the invention in each foreign country in which such request is granted in accordance with applicable statutes and regulations and within one of the following periods:

(i) Eight (8) months from the date of filing a corresponding United States application, or if such an application is not filed, six (6) months from the date the request was granted;

(ii) Six (6) months from the date a license is granted by the Commissioner of Patents and Trademarks to file the foreign patent application where such filing has been prohibited by security reasons; or

(iii) Such longer periods as may be approved by the Patent Counsel for good cause shown in writing by the Participant or inventor.

(4) Subject to the license specified in subparagraphs C.(1), (2) and (3) of this clause, the Participant or inventor agrees to convey to the Government, upon request, the entire right, title, and interest in any foreign country in which the Participant or inventor fails to have a patent application filed in accordance with subparagraph D.(3)

21. PATENT RIGHTS - LONG FORM (Cont'd)

of this clause, or decides not to continue prosecution or to pay any maintenance fees covering the invention. To avoid forfeiture of the patent application or patent the Participant or inventor shall, not less than sixty (60) days before the expiration period for any action required by any Patent Office, notify the Patent Counsel of such failure or decision, and deliver to the Patent Counsel the executed instruments necessary for the conveyance specified in this paragraph.

E. Invention Identification, Disclosures, and Reports.

(1) The Participant shall establish and maintain active and effective procedures to ensure that Subject Inventions are promptly identified and timely disclosed. These procedures shall include the maintenance of laboratory notebooks or equivalent records and any other records that are reasonably necessary to document the conception and/or the first actual reduction to practice of Subject Inventions, and records which show that the procedures for identifying and disclosing the inventions are followed. Upon request, the Participant shall furnish the Contracting Officer a description of these procedures so that he may evaluate and determine their effectiveness.

(2) The Participant shall furnish the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) on a DOE-approved form:

(i) A written report containing full and complete technical information concerning each Subject Invention within six (6) months after conception or first actual reduction to practice whichever occurs first in the course of or under this Agreement, but in any event prior to any on sale, public use or public disclosure of such invention known to the Participant. The report shall identify the Agreement and inventor and shall be sufficiently complete in technical detail and appropriately illustrated by sketch or diagram to convey to one skilled in the art to which the invention pertains a clear understanding of the nature, purpose, operation, and to the extent known, the physical, chemical, biological, or electrical characteristics of the invention. The report should also include any request for foreign patent rights under subparagraph C.(4) of this clause and any request to file a domestic patent application under subparagraph D.(1) of this clause. However, such requests shall be made within the period set forth in subparagraph B.(2) of this clause. When an invention is reported under this subparagraph E.(2)(i), it shall be presumed to have been made in the manner specified in Section 9(a)(1) and (2) of 42 U.S.C. 5908 unless the Participant contends it was not so made in accordance with subparagraph G.(2)(ii) of this clause.

(ii) Upon request, but not more than annually, interim reports on a DOE-approved form listing Subject Inventions and subcontracts awarded containing a Patent Rights article for that period and certifying that:

21. PATENT RIGHTS - LONG FORM (Cont'd)

(A) The Participant's procedures for identifying and disclosing Subject Inventions as required by this paragraph E. have been followed throughout the reporting period;

(B) All Subject Inventions have been disclosed or that there are no such inventions; and

(C) All subcontracts containing a Patent Rights clause have been reported or that no such subcontracts have been awarded.

(iii) A final report on a DOE-approved form within three (3) months after completion of the Agreement work listing all Subject Inventions and all subcontracts awarded containing a Patent Rights clause and certifying that:

(A) All Subject Inventions have been disclosed or that there were no such inventions; and

(B) All subcontracts containing a Patent Rights article have been reported or that no such subcontracts have been awarded.

(3) The Participant shall obtain patent agreements to effectuate the provisions of this clause from all persons in its employ who perform any part of the work under this Agreement except nontechnical personnel, such as clerical employees and manual laborers.

(4) The Participant agrees that the Government may duplicate and disclose Subject Invention disclosures and all other reports and papers furnished or required to be furnished pursuant to this clause. If the Participant is to file a foreign patent application on a Subject Invention, the Government agrees, upon written request, to use its best efforts to withhold publication of such invention disclosures until the expiration of the time period specified in subparagraph D.(1) of this clause, but in no event shall the Government or its employees be liable for any publication thereof.

F. Publication. It is recognized that during the course of the work under this Agreement, the Participant or its employees may from time to time desire to release or publish information regarding scientific or technical developments conceived or first actually reduced to practice in the course of or under this Agreement. In order that public disclosure of such information will not adversely affect the patent interests of DOE or the Participant, patent approval for release or publication shall be secured from Patent Counsel prior to any such release or publication.

G. Forfeiture of Rights in Unreported Subject Inventions.

(1) The Participant shall forfeit to the Government, at the request of the Secretary or his designee, all rights in any

21. PATENT RIGHTS - LONG FORM (Cont'd)

Subject Invention which the Participant fails to report to Patent Counsel (with notification by Patent Counsel to the Contracting Officer) within six (6) months after the time the Participant:

(i) Files or causes to be filed a United States or foreign patent application thereon; or

(ii) Submits the final report required by subparagraph E.(2)(iii) of this clause, whichever is later.

(2) However, the Participant shall not forfeit rights in a Subject Invention if, within the time specified in (1)(i) or (1)(ii) of this paragraph G., the Participant:

(i) Prepares a written decision based upon a review of the record that the invention was neither conceived nor first actually reduced to practice in the course of or under the Agreement and delivers the same to Patent Counsel (with notification by Patent Counsel to the Contracting Officer); or

(ii) Contending that the invention is not a Subject Invention the Participant nevertheless discloses the invention and all facts pertinent to this contention to the Patent Counsel (with notification by Patent Counsel to the Contracting Officer); or

(iii) Establishes that the failure to disclose did not result from the Participant's fault or negligence.

(3) Pending written assignment of the patent applications and patents on a Subject Invention determined by the Secretary or his designee to be forfeited (such determination to be a final decision under the "Disputes" clause of this Agreement), the Participant shall be deemed to hold the invention and the patent applications and patents pertaining thereto in trust for the Government. The forfeiture provision of this paragraph G. shall be in addition to and shall not supersede other rights and remedies which the Government may have with respect to Subject Inventions.

H. Examination of Records Relating to Inventions.

(1) The Contracting Officer or his authorized representative, until the expiration of three (3) years after final payment under this Agreement, shall have the right to examine any books (including laboratory notebooks), records, documents, and other supporting data

21. PATENT RIGHTS - LONG FORM (Cont'd)

of the Participant which the Contracting Officer or his authorized representative reasonably deems pertinent to the discovery or identification of Subject Inventions or to determine compliance with the requirements of this clause.

(2) The Contracting Officer or his authorized representative shall have the right to examine all books (including laboratory notebooks), records and documents of the Participant relating to the conception of first actual reduction to practice of inventions in the same field of technology as the work under this Agreement to determine whether any such inventions are Subject Inventions, if the Participant refuses or fails to:

(i) Establish the procedures of subparagraph E.(1) of this clause; or

(ii) Maintain and follow such procedures; or

(iii) Correct or eliminate any material deficiency in the procedures within thirty (30) days after the Contracting Officer notifies the Participant of such a deficiency.

I. Withholding of Payment (Not Applicable to Subcontracts).

(1) Any time before final payment of the amount of this Agreement, the Contracting Officer may, if he deems such action warranted, withhold payment until a reserve not exceeding \$50,000 or 5 percent of the amount of this Agreement, whichever is less, shall have been set aside if in his opinion the Participant fails to:

(i) Establish, maintain and follow effective procedures for identifying and disclosing Subject Inventions pursuant to subparagraph E.(1) of this clause; or

(ii) Disclose any Subject Invention pursuant to subparagraph E.(2)(i) of this clause; or

(iii) Deliver the interim reports pursuant to subparagraph E.(2)(ii) of this clause; or

(iv) Provide the information regarding subcontracts pursuant to subparagraph J.(5) of this clause; or

(v) Convey to the Government in a DOE-approved form the title and/or rights of the Government in each Subject Invention as required by this clause.

21. PATENT RIGHTS - LONG FORM (Cont'd)

(2) The reserve or balance shall be withheld until the Contracting Officer has determined that the Participant has rectified whatever deficiencies exist and has delivered all reports, disclosures, and other information required by the clause.

(3) Final payment under this Agreement shall not be made by the Contracting Officer before the Participant delivers to Patent Counsel all disclosures of Subject Inventions and other information required by subparagraph E.(2)(i) of this clause, the final report required by subparagraph E.(2)(iii) of this clause, and Patent Counsel has issued a patent clearance certification to the Contracting Officer.

(4) The Contracting Officer may, in his discretion, decrease or increase the sums withheld up to the maximum authorized above. If the Participant is a nonprofit organization, the maximum amount that may be withheld under this paragraph shall not exceed \$50,000 or 1 percent of the amount of this Agreement, whichever is less. No amount shall be withheld under this paragraph while the amount specified by this paragraph is being withheld under other provisions of the Agreement. The withholding of any amount or subsequent payment thereof shall not be construed as a waiver of any rights accruing to the Government under this Agreement.

J. Subcontracts.

(1) For the purpose of this paragraph the term "Participant" means the party awarding a subcontract and the term "subcontractor" means the party being awarded a subcontract, regardless of tier.

(2) Unless otherwise authorized or directed by the Contracting Officer, the Participant shall include the Patent Rights clause of 41 CFR 9-9.107-5(a) or 41 CFR 9-9.107-6 as appropriate, modified to identify the parties in any subcontract hereunder having as a purpose the conduct of research, development, or demonstration work. In the event of refusal by a subcontractor to accept this clause, or if in the opinion of the Participant this clause is inconsistent with DOE's patent policies, the Participant:

(i) Shall promptly submit written notice to the Contracting Officer setting forth reasons for the subcontractor's refusal and other pertinent information which may expedite disposition of the matter; and

(ii) Shall not proceed with the subcontract without the written authorization of the Contracting Officer.

21. PATENT RIGHTS - LONG FORM (Cont'd)

(3) Except as may be otherwise provided in this clause, the Participant shall not, in any subcontract or by using a subcontract as consideration therefor, acquire any rights in its subcontractor's Subject Invention for the Participant's own use (as distinguished from such rights as may be required solely to fulfill the Participant's Agreement obligations to the Government in the performance of this Agreement).

(4) All invention disclosures, reports, instruments, and other information required to be furnished by the subcontractor to DOE, under the provisions of a Patent Rights clause in any subcontract hereunder may, in the discretion of the Contracting Officer, be furnished to the Participant for transmission to DOE.

(5) The Participant shall promptly notify the Contracting Officer in writing upon the award of any subcontract containing a Patent Rights clause by identifying the subcontractor, the work to be performed under the subcontract, and the dates of award, and estimated completion. Upon the request of the Contracting Officer the Participant shall furnish him a copy of the subcontract.

(6) The Participant shall identify all Subject Inventions of the subcontractor of which it acquires knowledge in the performance of this Agreement and shall notify the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) promptly upon the identification of the inventions.

(7) It is understood that the Government is a third party beneficiary of any subcontract clause granting rights to the Government in Subject Inventions, and the Participant hereby assigns to the Government all rights that the Participant would have to enforce the subcontractor's obligations for the benefit of the Government with respect to Subject Inventions. The Participant shall not be obligated to enforce the agreements of any subcontractor hereunder relating to the obligations of the subcontractor to the Government regarding Subject Inventions.

K. Background Patents.

(1) "Background Patent" means a domestic patent covering an invention or discovery which is not a Subject Invention and which is owned or controlled by the Participant at any time through the completion of this Agreement:

21. PATENT RIGHTS - LONG FORM (Cont'd)

(i) Which the Participant, but not the Government, has the right to license to others without obligation to pay royalties thereon; and

(ii) Infringement of which cannot reasonably be avoided upon the practice of any specific process, method, machine, manufacture or composition of matter (including relatively minor modifications thereof) which is a subject of the research, development, or demonstration work performed under this Agreement.

(2) The Participant agrees to and does hereby grant to the Government a royalty-free, nonexclusive, license under any Background Patent for purposes of practicing a subject of this Agreement by or for the Government in research, development, and demonstration work only.

(3) The Participant also agrees that upon written application by DOE, it will grant to responsible parties for purposes of practicing a subject of this Agreement, nonexclusive licenses under any Background Patent on terms that are reasonable under the circumstances. If, however, the Participant believes that exclusive or partially exclusive rights are necessary to achieve expeditious commercial development or utilization, then a request may be made to DOE for DOE approval of such licensing by the Participant.

(4) Notwithstanding the foregoing subparagraph K.(3), the Participant shall not be obligated to license any Background Patent if the Participant demonstrates to the satisfaction of the Secretary or his designee that:

(i) A competitive alternative to the subject matter covered by said Background Patent is commercially available or readily introducible from one or more other sources; or

(ii) The Participant or its licensees are supplying the subject matter covered by said Background Patent in sufficient quantity and at reasonable prices to satisfy market needs, or have taken effective steps or within a reasonable time are expected to take effective steps to so supply the subject matter.

L. Atomic Energy.

(1) No claim for pecuniary award or compensation under the provisions of the Atomic Energy Act of 1954, as amended, shall be

21. PATENT RIGHTS - LONG FORM (Cont'd)

asserted by the Participant or its employees with respect to any invention or discovery made or conceived in the course of or under this Agreement.

(2) Except as otherwise authorized in writing by the Contracting Officer, the Participant will obtain patent agreements to effectuate the provisions of subparagraph L.(1) of this clause from all persons who perform any part of the work under this Agreement, except nontechnical personnel, such as clerical employees and manual laborers.

M. Limitation of Rights. Nothing contained in this Patent Rights clause shall be deemed to give the Government any rights with respect to any invention other than a Subject Invention except as set forth in the Patent Rights article of this Agreement with respect to Background Patents and the Facilities License.

22. FLOOD INSURANCE

The Participant shall comply with the flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973, Public Law 93-234, 87 Stat. 975, approved December 31, 1976, Section 102(a) requires, on and after March 2, 1975, the Purchase of flood insurance in communities where such insurance is available as a condition for the receipt of any Federal financial assistance for construction or acquisition purposes for use in any area that has been identified by the Secretary of the Department of Housing and Urban Development as an area having special flood hazards and provisions prescribed by the Federal Insurance Administration in 24 CFR Chapter X, Subchapter B., will be complied with.

23. UTILIZATION OF LABOR SURPLUS AREA CONCERNS

(The following clause is applicable if this Agreement exceeds \$10,000.00)

A. It is the policy of the Government to award contracts to labor surplus area concerns that agree to perform substantially in labor surplus areas, where this can be done consistent with the efficient performance of the Agreement and at prices no higher than are obtainable elsewhere. The Participant agrees to use its best efforts to place its subcontracts in accordance with this policy.

B. In complying with paragraph A. of this clause and with paragraph B. of the clause of this Agreement entitled "Utilization of Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals," the Participant in placing its subcontracts shall observe the following order of preference: (1) Small business concerns that are labor surplus area concerns, (2) other small business concerns, and (3) other labor surplus area concerns.

23. UTILIZATION OF LABOR SURPLUS AREA CONCERNS (Cont'd)

C. (1) The term "labor surplus area" means a geographical area identified by the Department of Labor as an area of concentrated unemployment or underemployment or an area of labor surplus.

(2) The term "labor surplus area concern" means a concern that together with its first-tier subcontractors will perform substantially in labor surplus areas.

(3) The term "perform substantially in a labor surplus area" means that the costs incurred on account of manufacturing, production, or appropriate services in labor surplus areas exceed 50 percent of the Agreement price.

24. LABOR SURPLUS AREA SUBCONTRACTING PROGRAM

A. The Participant agrees to establish and conduct a program which will encourage labor surplus area concerns to compete for subcontracts within their capabilities. In this connection, the Participant shall:

(1) Designate a liaison officer who will (a) maintain liaison with duly authorized representatives of the Government on labor surplus area matters, (b) supervise compliance with the "Utilization of Labor Surplus Area Concerns" clause and (c) administer the Contractor's Labor Surplus Area Subcontracting Program;

(2) Provide adequate and timely consideration of the potentialities of labor surplus area concerns in all "make-or-buy" decisions;

(3) Assure that labor surplus area concerns will have an equitable opportunity to compete for subcontracts, particularly by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation of labor surplus area concerns;

(4) Maintain records showing the procedures which have been adopted to comply with the policies set forth in this clause and report subcontract awards (see 41 CFR 1-16.804-5 regarding use of Optional Form 61). Records maintained pursuant to this clause will be kept available for review by the Government until the expiration of one (1) year after the award of this contract, or for such longer period as may be required by any other clause of this contract or by applicable law or regulations; and

(5) Include the "Utilization of Labor Surplus Area Concerns" clause in subcontracts which offer substantial labor surplus area subcontracting opportunities.

B. (1) The term "labor surplus area" means a geographical area identified by the Department of Labor as an area of concentrated unemployment or underemployment or an area of labor surplus.

24. LABOR SURPLUS AREA SUBCONTRACTING PROGRAM (Cont'd)

(2) The term "concern located in a labor surplus area" means a labor surplus area concern.

(3) The term "labor surplus area concern" means a concern that, together with its first-tier subcontractors, will perform substantially in labor surplus areas.

(4) The term "perform substantially in labor surplus areas" means that the costs incurred on account of manufacturing, production, or appropriate services in labor surplus areas exceed 50 percent of the contract price.

C. The Participant further agrees to insert, in any subcontract hereunder which may exceed \$500,000.00 and which contains the "Utilization of Labor Surplus Area Concerns" clause, provisions which shall conform substantially to the language of this clause, including this paragraph C., and to notify the Contracting Officer of the names of such subcontractors.

25. DISPUTES

A. Except as otherwise provided in this Agreement, any dispute concerning a question of fact arising under this Agreement which is not disposed of by Agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail, or otherwise furnish a copy thereof to the Participant. The decision of the Contracting Officer shall be final and conclusive unless within 60 days from date of receipt of such copy, the Participant mails, or delivers a written notice of appeal to the Department of Energy Financial Assistance Appeals Board in accordance with 10 CFR Part 1024 (See Rule 1). The decision of the Department of Energy Financial Assistance Appeals Board shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessary to imply bad faith, or not supported by substantial evidence. In connection with any appeal proceeding under this clause, the Participant shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Participant shall proceed diligently with the performance of the Agreement and in accordance with the Contracting Officer's decision.

B. This "Disputes Clause" does not preclude consideration of law questions in connection with decisions provided for in paragraph A. above; provided, that nothing in this Agreement shall be construed as making final the decision of any administrative official, representative, or board, based on a question of law.

26. BUY AMERICAN ACT

A. In acquiring end products, the Buy American Act (41 U.S. Code 10a-10d) provides that the Government give preference to domestic source end products. For the purpose of this clause:

(1) "Components" means those articles, materials, and supplies which are directly incorporated in the end products;

(2) "End products" means those articles, materials, and supplies which are to be acquired under this contract for public use; and

(3) "A domestic source end product" means (i) an unmanufactured end product which has been mined or produced in the United States, and (ii) an end product manufactured in the United States if the cost of the components thereof which are mined, produced, or manufactured in the United States exceeds 50 percent of the costs of all its components. For the purpose of this subparagraph A.(3)(ii), components of foreign origin of the same type or kind as the products referred to in subparagraphs B.(2) or (3) of this clause shall be treated as components mined, produced, or manufactured in the United States.

B. The Participant agrees to give preference in all purchases under this Cooperative Agreement to domestic source end products.

27. UTILIZATION OF SMALL BUSINESS CONCERNS AND SMALL BUSINESS CONCERNS OWNED AND CONTROLLED BY SOCIALLY AND ECONOMICALLY DISADVANTAGED INDIVIDUALS

A. It is the policy of the United States and the Department of Energy that small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals shall have the maximum practicable opportunity to participate in the performance of contracts let by DOE.

B. The Participant hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with the efficient performance of this Agreement. The Participant further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the Department of Energy as may be necessary to determine the extent of the Participant's compliance with this clause.

C. (1) As used in this Agreement, the term "small business concern" shall mean a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

(2) The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern:

(i) Which is at least 51 per centum owned by one or more socially and economically disadvantaged individuals;

27. UTILIZATION OF SMALL BUSINESS CONCERNS AND SMALL BUSINESS CONCERNS OWNED AND CONTROLLED BY SOCIALLY AND ECONOMICALLY DISADVANTAGED INDIVIDUALS (Cont'd)

or in the case of any publicly-owned business at least 51 per centum of the stock of which is owned by one or more socially and economically disadvantaged individuals; and

(ii) Whose management and daily business operations are controlled by one or more of such individuals.

The Participant shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, and other minorities, or any other individual found to be disadvantaged by the Small Business Administration pursuant to Section 8(a) of the Small Business Act.

D. Subcontractors shall provide a notarized statement to the Participant certifying their status as either a small business concern or a small business concern owned and controlled by socially and economically disadvantaged individuals.

28. UTILIZATION OF WOMEN-OWNED BUSINESS CONCERNS

A. It is the policy of the United States Government that women-owned businesses shall have the maximum practicable opportunity to participate in the performance of contracts awarded by any Federal agency.

B. The Participant agrees to use its best efforts to carry out this policy in the award of subcontracts to the fullest extent consistent with the efficient performance of this Agreement. As used in this Agreement, a "woman-owned business" concern means a business that is at least 51% owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management. "Women" mean all women business owners.

APPENDIX B

PROJECT TASKS, SCHEDULE BACKGROUND, AND REPORTING REQUIREMENTS

The following is a description of the work to be performed under the cooperative agreement, keyed to the milestone table of the proposal (P. 31-32). The work to be performed under this agreement will be accomplished in five tasks: Preparation, Field Work, Data Reduction, and Interpretation Final Report, and Technology Transfer Plan.

Task 1. The preparation task has two major phases: (1) Computer Software Interfacing and (2) Instrument Calibration and Installation. The first phase involves the development of a computer processing system to handle the DR100 cassette data, prepare phase, amplitude, and wave form data for further processing, and then compute preliminary locations, magnitudes, and spectra. The second phase involves the preparation of the recording equipment for field deployment, including precision calibration of recorder response for later use in the spectral analysis of the data. This task also includes the final recording site selection and installation of the recording equipment in the field. During this first phase, shot point locations will be selected and arrangements for drilling the shot holes will be finalized.

Task 2. Field work will be conducted to include the actual microearthquake recording in the field area for three months and setting off of the calibration shots. The main phase of this task will be maintaining the recording systems in the field including the daily time and recorder gain calibrations required to maintain recording accuracy. The other phase will be shot hole drilling and loading, and the precise timing of the calibration shots.

Task 3. Data reduction will occur nearly simultaneously with the field work. Data cassettes from the field will be brought to Sacramento on a weekly basis for preliminary data analysis. The computer processing system developed in phase one will be used to pick phase and amplitude data, compute preliminary locations, magnitudes, and first motion plots, and process seismograms for preliminary P&S waves spectra. These data will be used to check on the quality and progress of the field recording.

Task 4. Data interpretation and preparation of the final report. Final locations of earthquakes within the study area will be determined using Master event techniques and the calibration shots. Detailed spectral analysis will be conducted for moment, corner-frequency, and high frequency attenuation. The resulting data will be interpreted for anomalous crustal properties indicative of a geothermal system by examining magnitude-moment, recurrence (b-value), attenuation (Q), stress drop, and velocity parameters. Graphs, maps, and cross-sections demonstrating spectral, phase and amplitude anomalies will be provided at a common scale. Existing geologic and geophysical information will be added in order to aid in the interpretation. A final report encompassing results and interpretations will be produced and will include an evaluation of the use of the microearthquake technique in geothermal exploration. Other required reports, as outlined in DOE CR 537, will be developed during the contract period.

Task 5. Technology transfer to the scientific community will be accomplished by presenting results of this work to at least one Geoscience Conference, and by the publication of results in National scientific journals.

REPORTING REQUIREMENTS CHECKLIST

PURPOSE

A checklist to identify and communicate additional reporting requirements which are not otherwise set forth in the General Purpose clauses of DOE contracts and agreements. It will be included as part of the contract or agreement. This form will be completed for each proposed contract or agreement and can be modified as required in Special Instructions to adapt it to a specific situation.

INSTRUCTIONS

Item 1 - Enter the title as indicated in the Procurement Request, Interagency Agreement, or initiating memorandum.

Item 2 - Enter the identification number of the Procurement Request or Interagency Agreement, the date of the memorandum, and contract number after award.

Item 3 - Check spaces to indicate plans and reports required. For each reporting requirement checked, indicate frequency of delivery in column provided using one of the frequency codes shown.

3.A.1 Management Plan - The contractor's plan to manage the effort described in the statement of work or similar document. It will contain management methodologies, control systems, and procedures he will use. Includes milestones and other planning schedules, organizational identification and descriptions, and special and critical plans, such as test plans, plans for handling of Government owned property. Work breakdown structures, key personnel identification, and methods for monitoring progress toward objectives may be required.

3.A.2 Milestone Schedule and Status Report - The contractor's milestone schedule for all work breakdown structure items, line items, or deliverables specified in the contract. Updated periodically (usually monthly) with status, progress toward completion, and percent completion of each line item and of the total contract.

3.A.3 Cost Plan - A baseline plan for incurring costs on a contract or agreement to measure progress in terms of cost; update and forecast contract fund requirements; plan funding changes; and develop fund requirements and budget estimates.

3.A.4 Manpower Plan - A baseline plan to allocate manpower to each reporting category identified in the contract or agreement.

3.A.5 Contract Management Summary Report - A single-page graphic presentation of integrated cost, major milestones, and manpower for rapid visual analysis and trend forecasting.

3.A.6 Project Status Report - A periodic report to communicate to DOE management an assessment of contract status, to explain variances and problems, and to discuss any other areas of concern or achievements.

3.A.7 Cost Management Report - A periodic report of the status of costs compared to the Cost Plan. Data is used to: report actual and projected accrued costs; evaluate performance against plan; identify actual and potential problem areas; construct cost experience for projects and budgeting efforts; and, to verify the reasonableness of contractors' invoices.

3.A.8 Manpower Management Report - A periodic report of the status of actual and projected manpower expenditure against the Manpower Plan. Data is used to evaluate performance against plan; identify actual and potential problem areas; and to construct manpower experience for projections and planning efforts.

3.A.9 Conference Record - Documentation of the contractor's understanding of significant decisions, direction or redirection or required actions resulting from any meeting with DOE representatives.

3.A.10 Hot Line Report - A hardcopy report by the fastest means available, (TWX, etc) documenting critical problems, emergency situations, and important technical breakthroughs.

3.B.1 Notice of Energy R&D Project - A formatted, two-page report to provide information on unclassified DOE R&D projects for dissemination to the scientific, technical, and industrial communities and to the public. Also provides information to the Smithsonian Scientific Information Exchange.

3.B.2 Technical Progress Report - A formal, structured technical report, submitted periodically to communicate project results for dissemination to Government agencies, the scientific, technical and industrial communities and the public.

3.B.3 Topical Report - A special technical report prepared when a project has reached a point at which a major milestone or a significant phase has been completed, when unexpected results have been achieved, when it is logical to summarize results achieved, or when a new scientific or technological finding is deemed to warrant prompt publication.

3.B.4 Final Technical Report - Technical Progress Report reporting final results of DOE supported R&D and scientific projects.

3.C PMS/Mini-PMS

1) Cost Performance Report (PMS Application)

Format 1 - Reports current period and cumulative budget, actual costs and earned value data by work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

Format 2 - Reports current period and cumulative budget, actual costs, and earned value data by contractor functional elements.

Format 3 - Provides periodic updating to the established performance measurement baseline. Incorporates authorized contract changes and internal re-planning into the performance measurement baseline.

Format 5 - Provides a narrative analysis of contract variances.

2) Cost/Schedule Report (Mini-PMS Application) - Periodic, usually monthly, report of cumulative budget, actual costs and earned value by summary work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

3) System Description (PMS Application) - Contractor's description of the management control system to be used in performing contract work. Must address all elements of the PMS criteria.

4) Summary System Description (Mini-PMS Application) - Contractor's summarized description of the management control system to be used in performing contract work.

5) WBS Dictionary - Lists and defines work breakdown structure. For more detailed instructions see PMS Manual.

Frequency Codes - Each code must have an identified time period (i.e., As Required - 5 days after event occurrence). These time periods are suggested in the solicitation and negotiated at contract award.

Item 4 - Identify any special reporting requirements not indicated in Item 3 and/or qualifiers to those selected. (Use additional sheets as necessary.)

Item 5 - Check appropriate blocks.

Report Distribution List - A comprehensive informative listing of reports by frequency of submission, addresses and number of copies for each addressee.

Reporting Categories (level of detail) - An identification by WBS level of task elements for which reporting will be required by DOE.

Item 6 - Signature of person or persons preparing the checklist and the date prepared. Preparation is by person or persons responsible for preparation of Procurement Request or Statement of Work.

Item 7 - Signature of the person reviewing the checklist and date reviewed.



ID F-129 (Rev. 08-79)
 Ref. DOE 13302
 (use with DOE CR-537)

U.S. DEPARTMENT OF ENERGY
 IDAHO OPERATIONS OFFICE
REPORT DISTRIBUTION LIST

Contract No.	Report Distribution List														
	Milestone Schedule & Status Management Plan	Contract Management & Status Report	Cost Plan	Manpower Summary Report	Project Status Report	Cost Management Report	Manpower Management Report	Notice of Energy RD&D Project (SSIE)	Conference Record	Hot Line Report	Technical Progress Report	Final Technical Report	Cost/Schedule Status Report	Summary System Description	WBS Dictionary
DE-FC07-80ID12144															
Addressees	Number of Report Copies														
M. A. Widmayer, Program Manager Resource Definition Branch U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, ID 83401	2							1	1	1			1	1	5
C. Bufe U. S. Department of Energy Division of Geothermal Energy MS 3344 Federal Building 12th and Penn, N. W. Washington, D. C. 20461	1							1	1	1			1	1	5
Dennis Nielson University of Utah Research Institute 420 Chepita Way, Suite 120 Salt Lake City, UT 84108	1							1	1	1			1	1	1
Special Instructions															

UNIFORM DOE CONTRACTOR SCIENTIFIC, TECHNICAL AND ENGINEERING REPORT NUMBERING SYSTEM

Effective with the implementation of the Procurement/Contract numbering system as shown in the example below, the following guidelines are established for identifying scientific and technical reports (progress, interim, final topical, etc.) conference papers, proceedings, theses, and translations.

1. All DOE contractors now applying uniquely identifying codes and systems approved by TIC are to continue using such codes and systems.
2. DOE Field Office codes such as ALO, IDO, COO, HCP, NVO, ORO, RLO, SAN, and SRO; and program codes such as FE, DSE, etc., are no longer approved for use by contractors.
3. Contractors having no approved unique codes are to number information products as shown below. All contractors in this category should create unique report numbers by (a) identifying the report with a DOE code, (b) selecting the final seven characters from the applicable contract number (two alphabetic and five numerals), and (c) adding suffix numbers sequentially for each report generated under the contract. For new contracts, the sequential number should begin with 1. For existing contracts the established sequence should continue. Slash marks and hyphens should be applied as shown in the examples.

Examples: Report numbers generated from contract number DE-AC03-79ET01834.M001:

DOE/ET/01834-1; DOE/ET/01834-2; DOE/ET/01834-3; etc.

Note: It is essential that both the final five-digit numeral and the two preceding alphabetical characters be extracted from the contract number as shown. The modification number, if any, normally shown as M001, etc., following the basic five-digit number is NOT used in the report number.

4. Reports issued in more than one binding, or reissued as revisions or later editions, are to be identified by adding the following additional suffixes to the basic number: Rev. - Revision; Vol. - Volume; Pt. - part; Add. - Addenda; Ed. - Edition, etc.

Examples: DOE/ET-01834-1 Rev.
DOE/ET/01834-1 Rev. 2

DOE/ET-01834-1 Pt. 1
DOE/ET/01834-1 Pt. 2

It is intended that report numbers be structured exactly as specified in the examples insofar as possible. If modification to this basic format is essential, it is to be approved through normal channels before being used.

Proposal Copy # 4 of 5

Submitted to the Department of Energy
Idaho Operations Office

Solicitation for Cooperative Agreement Proposals
SCAP No. DE-SC07-80ID12144

MICROEARTHQUAKE SURVEY AND ANALYSIS

California Division of Mines and Geology
1416 Ninth St., Room 1341
Sacramento, Calif. 95814

Detailed Microearthquake Investigation of Casa Diablo, Long Valley KGRA, CA.

Funding Requested from DOE: \$100,000.

Total Project Cost: \$148,922.

Proposed Duration (in weeks): 65.

Proposed starting date: January 1, 1981.

Name of Principal Investigators: Chris H. Cramer, Associate Seismologist
Donald J. Stierman, Assistant Research
Geophysicist

Telephone (with area code): (916) 322-9312

Approval

Jack Dye
Jack Dye

Assistant Director

8/5/80
Date

James F. Davis
James F. Davis

State Geologist

8/7/80

Chris H. Cramer
Chris H. Cramer

Associate Seismologist

8/4/80

Abstract

We propose to conduct a state-of-the-art microearthquake survey of the Long Valley known geothermal area for the purpose of obtaining high-quality digital data required to evaluate microearthquake analysis as a tool in geothermal exploration. The digital data collected from three months of monitoring will be computer processed for locations, source parameters, velocity structure, attenuation, and focal mechanisms. Three calibration shots will provide velocity structure and station delay information needed for precision hypocenter determinations. Interpretation of the results will focus on delineating variations in subsurface properties that might define the geothermal system. Also the relationship of the earthquake activity to the geothermal area will be examined. We propose the Long Valley, CA, geothermal area as the best target for this study because 1) geologic and geophysical background data have already been obtained from previous geophysical surveys, including a refraction survey in the Caldera, 2) seismic activity has been high in and around the geothermal area in Long Valley since June, 1979, including a series of magnitude six events in May, 1980, 3) the geothermal system is the more common hot water dominated system unlike the rarer vapor dominated system at The Geysers, and 4) the geothermal system is still in its natural state (unexploited) although some exploratory drilling has been conducted.

Table of Contents

	Page
Abstract	i
Table of Contents	ii
Statement of Work	1
Technical Requirements	3
Technical Description	3
Feasibility	8
Cost-Effectiveness	13
Technical References	15
Qualifications and Capabilities	17
Personnel Capabilities.....	17
Company Capabilities.....	27
Project Management Plan	29
Management Approach	29
Schedule.....	31
Technology Transfer Plan.....	33
Business/Cost Requirements.....	34
Organization Information.....	34
Cost Sharing.....	34
Project Pricing Proposal.....	35
Project Budget by Task.....	39
Other Contracts.....	43
Other Required Forms.....	47
Agreement Terms and Conditions.....	52
Appendices.....	53

Statement of Work

We propose to improve the data quality, precision, and effectiveness of microearthquake monitoring as a tool in geothermal exploration. State-of-the-art digital recording plus computer processing to obtain spectral parameters as well as arrival time and amplitude information will provide improved data quality for determining microearthquake parameters such as location, movement, magnitude, and stress drop and additional information on crustal properties such as velocity structure and anisotropy, attenuation of seismic P and S-waves and Poissons ratio. The results of such a state-of-the-art microearthquake survey of the Casa Diablo area of the Long Valley Known Geothermal Resource Area will be interpreted for anomalous properties indicating the extent of the geothermal resource and relationship of observed seismicity to hydrothermal activity. An evaluation will also be made of the usefulness of this microearthquake monitoring technique in geothermal exploration.

Improvement of the microearthquake monitoring technique will be accomplished by using a dense array (spacing ≤ 4 km) of digital event recorders with 3 component recording at 200 samples/sec/channel in monitoring the proposed geothermal system (Casa Diablo, Long Valley KGRA). Much higher quality data can be recorded both for location and spectral studies by employing digital instrumentation as compared to previous analog systems and station densities (spacing ≥ 5 km) commonly used in monitoring seismicity in geothermal areas. In order to speed data processing and increase data reliability, computer assisted processing will be employed. An integrated data processing system based on interactive graphics will be developed so as to rapidly and accurately process the digital event recorder data for P&S phases, amplitude, and spectral parameters.

The resulting data will be interpreted for anomalous crustal properties indicative of a geothermal system by examining magnitude-moment, recurrence (b-value), attenuation (Q), stress drop, and velocity in relation to surrounding regional values. Graphs, maps and cross-sections demonstrating spectral, phase and amplitude anomalies will be provided at a common scale. Existing geologic and geophysical information will be added in order to aid in the interpretation. A final report encompassing results and interpretations will be produced and all digital data can be made available for future DOE studies.

Technical Requirements

Technical Description:

Previous problems with the use of microearthquake monitoring as a geothermal exploration tool center on 1) inaccuracy in hypocenters in areas of complex or unknown velocity distribution, 2) poorly constrained fault plane solutions, 3) limited dynamic range and band width of recorded data for estimating source parameters and attenuation, and 4) statistically inadequate data for determining the slope of magnitude-frequency relation (b-value) in both the geothermal and surrounding regions. Improvement in the microearthquake monitoring technique for geothermal exploration can be accomplished by a detailed microearthquake survey of a small geothermal target using dense (≤ 4 km) station spacing, digital event recording of 3-component data, and calibration shots as master events to improve relative locations among events. In order to evaluate the value of this improvement in microearthquake monitoring technique, a test is proposed for Casa Diablo, Long Valley KGRA involving 3 months of field recording.

The most important aspect of this evaluation is data quality as no effective evaluation can be made without high quality data. It is proposed to use 12-bit digital event recorder systems (Sprengnether DR-100 with 3-component, 2Hz seismometers) with proper signal conditioning (anti-aliasing filters) at high sample rates (200 samples/sec). Individual stations will be time and amplitude calibrated daily in order to maintain accuracy. Nine to ten stations with 4 km or less spacing will be placed in the Casa Diablo target area (figure 1).

Another important factor in quality control is the availability of timely data processing to check on data quality so as to make important adjustments to recorders and in station distribution to insure a usable data set for

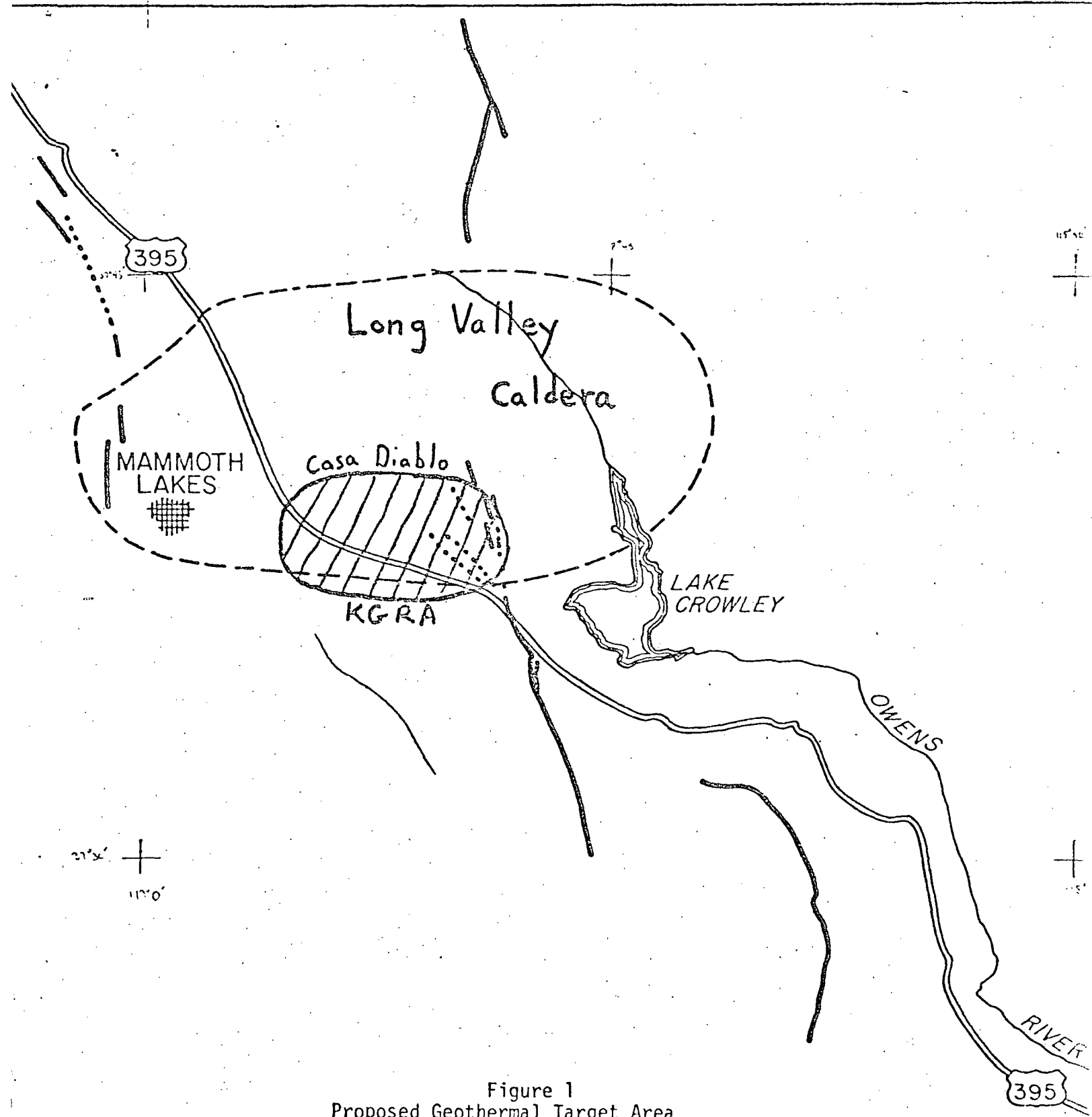


Figure 1
Proposed Geothermal Target Area

later interpretation. This requires timely computer assisted processing during the recording stage of the project. Computer assisted processing will also be required to process the digital data for locations and spectra and archive it for future use. It is proposed to use a minicomputer system (Data General Eclipse S250) with interactive graphics (Tektronix 4014-1 and software) in the data processing. A processing system will be developed prior to the field recording phase that will 1) handle the digital data from the cassette playback unit, 2) allow operator interaction for picking phase and amplitude data, 3) compute locations, magnitudes, and first motion plots, and 4) process seismograms for P&S wave spectra. This system will be put together from existing computer programs.

Three calibration shots will be set off and used 1) as masters for improving relative and absolute microearthquake locations, and 2) as a check on the velocity structure of Hill (1976). From past CDMG experience in volcanic-geothermal terrain near Mt. Shasta, it is proposed to use 1000 lb. shots in 60m (200 ft.) bore holes to overcome attenuation effects and significantly increase the chances of complete recording by the local array.

The data base after processing will include each event's origin time, location, standard errors of location, magnitude (ML after Bakun and Lindh, 1977), moment, source dimension, and stress drop (spectral parameters based on Brune's theory, 1970, 1971). Individual P&S spectra, determined from windowed data via Fast Fourier Transform techniques, will be analyzed for moment, corner frequency and high frequency roll off, and interpreted for attenuation (Q). Individual digital seismograms will be archived on magnetic tape for future distribution and use.

Problems may arise in determining moment from body wave spectra for shallow ($h < 5\text{km}$) microearthquakes at nearby stations. The separation of P&S may be insufficient at some stations or multiple events (closely spaced in time) may prevent analysis of some data. Care must be taken to insure validity of data being interpreted under the seismic moment theory being applied. Thus a statistical criteria will be developed to ensure reliable determination of seismic moment. Further, the effect of radiation pattern as described by Lee and Teng (1973) and P&S waves on individual spectra and seismic moment determinations will be investigated and, if need be, removed. All spectra will be corrected for instrumental response.

This data base will be used in an examination for anomalous features associated with the target geothermal area. Magnitude-moment and recurrence (b-value) relations will be compared with regional values. Maps and cross-sections will be prepared from the data base showing microearthquake distributions, velocity structure, variations in Q, and changes in stress drop. Zones of hydrothermal alteration, locations of existing exploration wells, and other relevant geologic and geophysical information will also be displayed at a common scale. Focal mechanisms will be compared with regional mechanisms and with the tectonics of the area. An interpretation of the resulting crustal information with respect to properties of interest in geothermal exploration will be synthesized. A presentation of all data gathered and examined plus a critical analysis of the microearthquake tool in defining the extent of a geothermal reservoir will be included in a final report.

The work proposed above will be accomplished in a 15-month program outlined in Table I (see Schedule in Project Management Plan section). It is divided into four stages: Preparation, Field Work, Data Reduction, and Interpretation. As indicated, data reduction will occur nearly concurrently with data collection.

Technical limitations to the application of the proposed approach include 1) a limited field season in the proposed study area, 2) results limited by distribution of microearthquake activity, and 3) limited recording capacity of event recorder cassette tapes at high sample rates (10 minutes of actual record time per tape). These limitations can be overcome by judicious planning of the program: 1) field work planned for appropriate season (summer), 2) timely processing of data to check on microearthquake distribution and appropriate adjustments in station locations in order to increase number of sample paths through geothermal target, and 3) adjusting of event recorder trigger parameters and gains to "tune" the array to record only larger events expected and not to trigger on many small events if activity is high.

Feasibility:

Microearthquake monitoring has been conducted in geothermal areas in the past (e.g. Steeples and Pit, 1976; Walter and Weaver, 1980). Recently Majer and McEvilly (1979) and Peppin and Bufe (1980) have applied digital event recording on a limited basis to The Geysers, CA, vapor dominated system with promising results, particularly in the area of defining regional variations in attenuation, recurrence (b-value), and spectral parameters. The high sample rates and more extensive digital recording proposed in this study should extend the usefulness of the microearthquake monitoring technique by providing more and higher quality data on subsurface properties for evaluation.

The Long Valley's potential as a geothermal resource area was investigated extensively by the U.S. Geological Survey in the early 1970's. The results of that investigation, which supported the existence of a high temperature geothermal resource near Casa Diablo, were published as a series of papers in 1976 (for example, see Muffler and Williams, 1976; Bailey et al., 1976; Hill, 1976; Lachenbrach et al., 1976a, 1976b; Hoover et al., 1976; Stanley et al., 1976; Steeples and Pit, 1976; and Steeples and Iyer, 1976). These studies also provide an existing data base for use in evaluating the results from a detailed microearthquake investigation of the Casa Diablo area.

Long Valley KGRA has other important advantages as a target area for testing the proposed improvements in the microearthquake technique as a geothermal exploration tool. 1) Earthquake activity exists in and around the Casa Diablo area of Long Valley. Steeples and Pit (1976) located some earthquakes between Casa Diablo and Whitmore Hot Springs and near the southern boundary faults of the Caldera. Starting in June, 1979, earthquake activity

in the Casa Diablo area has increased markedly and continues even after the May, 1980, M6 sequence in the same area (figures 2 & 3). CDMG has been investigating this activity already (Cramer and Topozada, 1980) and have investigated focal mechanisms in the region (see figure 4) [See Appendix I concerning permission to conduct the proposed microearthquake survey].

2) Casa Diablo is known to be a hot water dominated system (Lachenbruch et al., 1976a, 1976b). It is important to test the microearthquake technique proposed at a hot water system because that type geothermal system is more prevalent than vapor dominated systems such as at The Geysers, CA. 3) The geothermal system at Long Valley is still near its natural state (unexploited). An unexploited geothermal system would provide a more critical test of the microearthquake technique than an exploited geothermal system such as the one in Imperial Valley or at The Geysers. 4) Cultural noise levels are low at Long Valley especially when compared with the Imperial Valley. 5) Previous seismic data suggest the existence of attenuation and spectral anomalies associated with the Long Valley geothermal system (Hill, 1976, p. 751-2). And 6) existing regional coverage can be used to augment local first-motion studies [see figure 4]. Many regional stations are recorded in Sacramento by the California Department of Water Resources. CDMG has access to that data.

The cost of using the proposed high station density microearthquake monitoring technique based on digital event recording and computer assisted processing is comparable to existing analog recording and record digitizing approaches. The price of digital event recording systems are comparable and probably less expensive than recording equipment for other existing recording techniques (except non-digitizable analog recording). Computer processing of data is required with any existing recording technique. The proposed

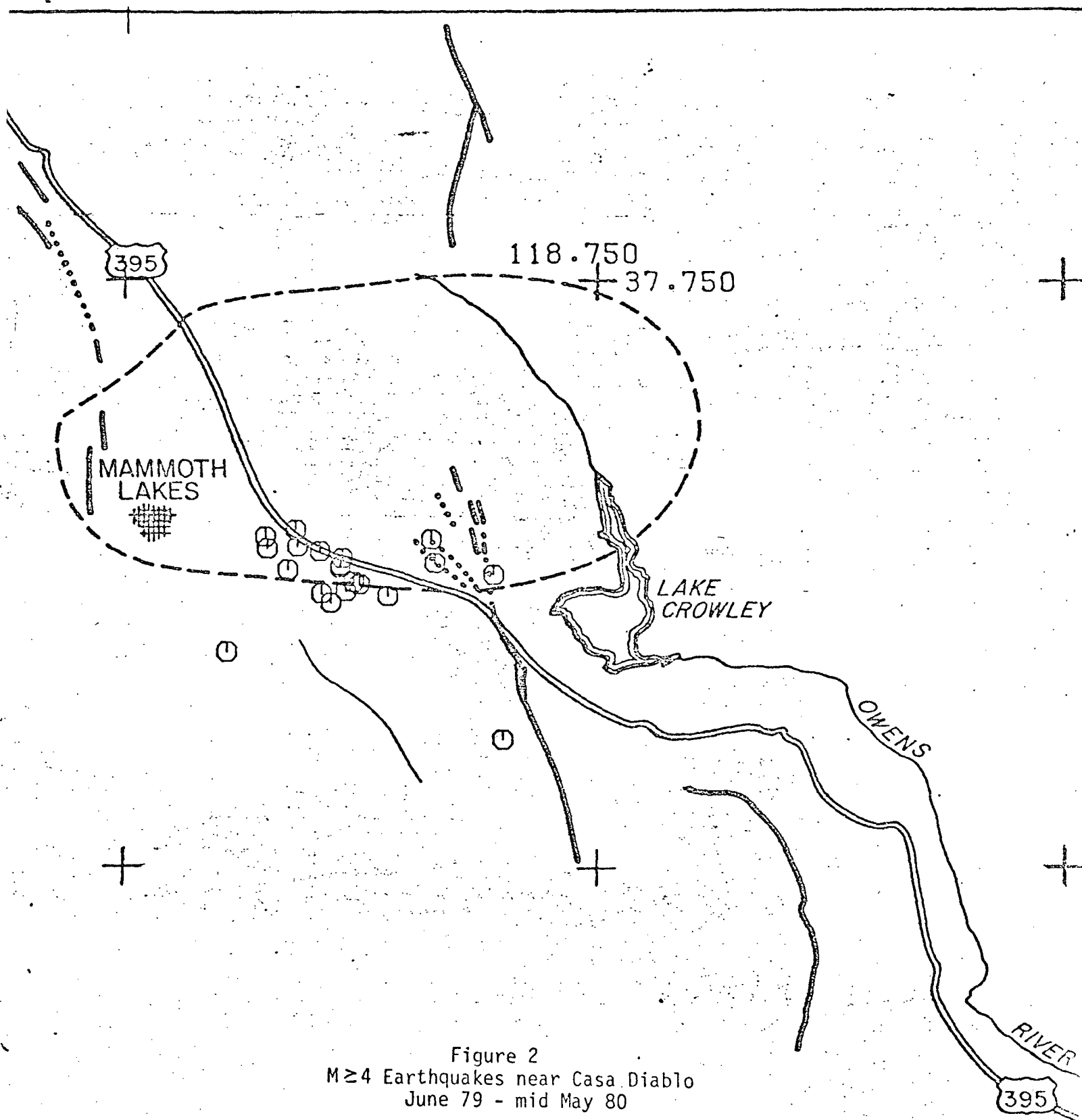


Figure 2
 M ≥ 4 Earthquakes near Casa Diablo
 June 79 - mid May 80

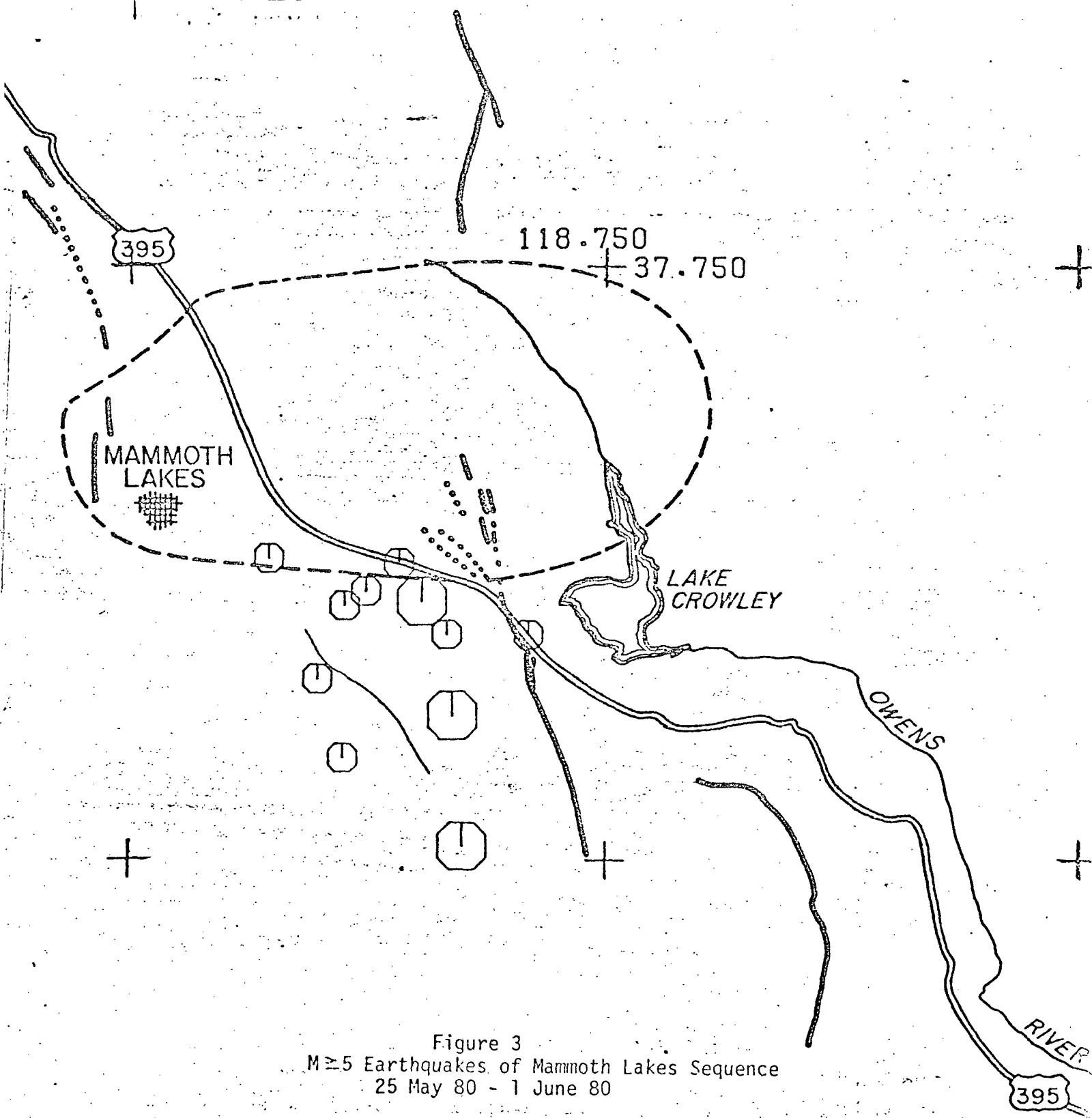
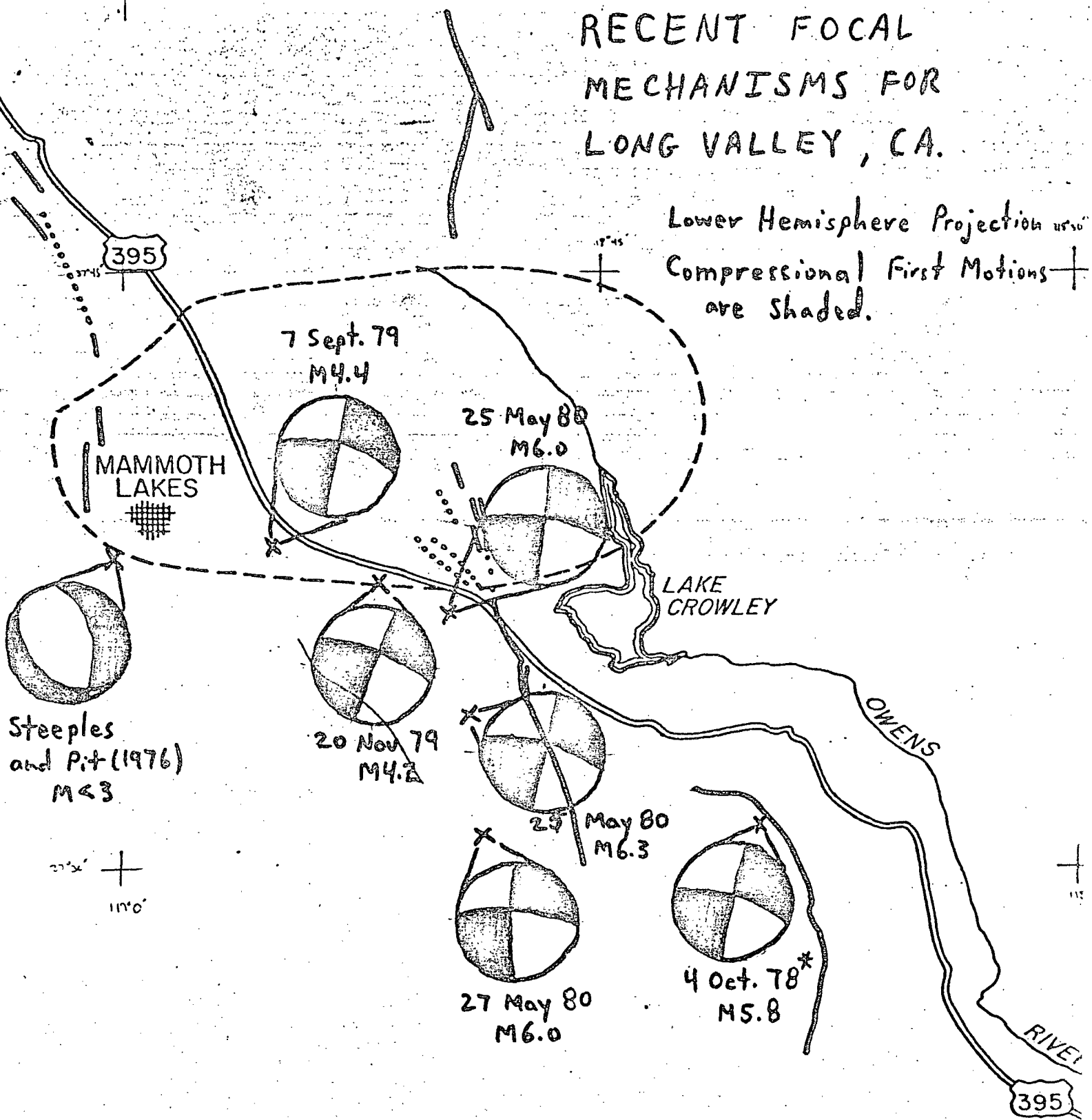


Figure 3
 $M \geq 5$ Earthquakes of Mammoth Lakes Sequence
 25 May 80 - 1 June 80

Figure 4

RECENT FOCAL MECHANISMS FOR LONG VALLEY, CA.

Lower Hemisphere Projection used
Compressional First Motions are Shaded.



* Focal mechanism from G.S. Fuis (1979, oral communication)

recording approach has the advantage in terms of timely processing of data so as to effect the course of the data gathering in the field and the ability to gather more usable data and differing kinds of information on crustal properties for the same cost.

Finally the cost of using other seismic techniques (refraction and reflection) to obtain similar information in geothermal exploration is higher than or comparable to the cost of applying the proposed microearthquake monitoring technique. Detailed refraction profiling across the geothermal target is at least as expensive as microearthquake monitoring in operational costs. Refraction studies have the advantage of detailing P-velocity structure, but the proposed microearthquake monitoring can provide additional information on other crustal properties because of better penetration (deeper crustal sources), the addition of S-wave data, the investigation of spectral parameters, and the delineation of seismicity parameters (locations, recurrence, etc.). The microearthquake method provides more for the same cost than detailed refraction studies. The other technique that could be applied is reflection profiling which is at least an order of magnitude more expensive, depending on data quality desired and crustal properties for which the reflection data is being processed and interpreted. Also, reflection seismics are not sensitive to vertical or steeply dipping structural features that carry geothermal fluids.

Cost-Effectiveness:

As mentioned in the preceding section on feasibility, the proposed use of digital event recorders and computer assisted processing has cost-effective advantages in detailed exploration of geothermal resources. One is that

higher quality data, that can provide more information on crustal properties, can be gathered and interpreted via the proposed technique than with more conventional microearthquake surveys for about the same cost. The potential increased information obtainable from high quality data and increased spectral parameter resolution is best illustrated by the results of Majer and McEvilly (1979) for The Geysers, California. Another cost-effective advantage is the ability to "tune" and adjust the array because of timely computer assisted processing of data records while the field program is going on. This allows changes in the station locations in order to take advantage of seismicity patterns in optimizing sampling of the crust of the targeted geothermal system. This would save the cost of redoing parts of the field experiment later at considerably more cost and provides assurances of data quality and usable results not previously available in microearthquake surveys.

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Qualifications and Capabilities

Personnel Capabilities:

The following are the key personnel involved with the project:

Dr. Chris H. Cramer, Seismologist CDMG, Co-P.I.
(5 man-months)

Dr. Donald J. Stierman, Assistant Professor of Geophysics UCR,
Co.-P.I. (2 man-months)

Dr. Tien-Chang Lee, Associate Professor of Geophysics UCR
(2 man-months)

Dr. Chris H. Cramer will have responsibility for directing the field program and processing and interpreting the data for hypocentral locations of microearthquakes detected. Dr. Cramer will also direct the compilation of available geologic and geophysical data for the study area. Dr. Donald J. Stierman will have the responsibility of directing the UCR contribution, under contract to the Division of Mines and Geology. Dr. Stierman will be involved in interpreting the results in terms of crustal properties of interest in geothermal exploration. Dr. Tien-Chang Lee will be involved with interpreting the data and determining the spectral parameters. Drs. Cramer and Stierman will have the responsibility of integrating the results and preparing a final report.

PERSONNEL QUALIFICATIONS

Chris H. Cramer

Education:

B. S. in Physics and Mathematics, University of Puget Sound
Tacoma, Washington, 1969.

M. S. in Geophysics, Stanford University, 1973.

Ph.D. in Seismology, Stanford University, 1976.

Society Memberships:

Seismological Society of America

American Geophysical Union

Society of Exploration Geophysicists

Experience:

May 1966 - May 1969

Worked summers and part time during school year working on gravity and geodetic projects at University of Puget Sound.

September 1969-September 1971

Service in U. S. Army.

September 1972 - June 1973

Teaching assistant for Geophysics Department at Stanford University.

June 1973 - July 1976

Worked on student appointment (part time, full summers) at U. S. Geological Survey, Menlo Park on 3 different projects during this period:

- (a) Marine geophysical study of Beaufort and Chukchi Seas--compilation and interpretation of magnetic data (June 1973-July 1975).
- (b) Relocation and interpretation of small earthquakes on the Calaveras fault near Hollister, California looking for time and spatial P-velocity variations (July 1974-August 1975). Also ran a small portable seismograph array to monitor an earthquake swarm southeast of Hollister California (August 1974)
- (c) Interpretation of regional and teleseismic P-wave travel-time residuals for precursory time variations (Ph.D. Thesis). (August 1975 - July 1976).

Experience (cont.)

August 1976 - Present

Associate Seismologist for California Division of Mines and Geology, conducting microearthquake studies in California. Conducted studies of activity near Auburn in western Sierra Nevada foothills and along the Cucamonga fault along the southeastern San Gabriel Mountains. Also conducted aftershock studies of 1978 Ukiah earthquake, 1978 Stephens Pass swarm (east of Mt. Shasta), and 1979-80 Mammoth Lakes sequence.

Publications:

- C.H. Cramer, 1968, A time lapse presentation of the earthquakes of Washington State 1952 - 1967, Transactions, American Geophysical Union, 49, p. 715.
- C.H. Cramer, 1970, Viscosity of the Atlantic Ocean Bottom, Science, 167, p. 1123-1124.
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- C.H. Cramer and R.L. Kovach, 1974, A search for teleseismic travel-time anomalies along the San Andreas fault zone, Geophysical Research Letters, 1, p. 90-92.
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- C.H. Cramer, 1980, Stephens Pass, California, Earthquake Swarm of August-November, 1978: Time and Spatial History (abstract), Earthquake Notes 50, 5.
- C.H. Cramer and T.R. Topozada, 1980, Preliminary locations and focal mechanisms for the May, 1980, Mammoth Lakes M6 earthquake sequence, California Division of Mines and Geology, Special Report , in press.

BIOGRAPHICAL SKETCH

(Give the following information for all professional personnel listed on page 2, beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

NAME: Donald J. Stierman Assistant Professor of Geophysics	SOCIAL SECURITY NO.: 483-56-3135	BIRTHDATE: (Mo., Day, Yr.) October 27, 1947
TITLE		
PLACE OF BIRTH (City, State, Country) Dubuque, Iowa, U.S.A.	PRESENT NATIONALITY: (If Non-U.S. Citizen, indicate kind of visa and expiration date.) U.S. Citizen	

EDUCATION: (Begin with baccalaureate and include postdoctoral)

INSTITUTION AND LOCATION	DEGREE	YEAR	SCIENTIFIC FIELD
State University of New York, Brockport, New York	B.S.	1969	Physics
Stanford University, Stanford, California	M.S.	1974	Geophysics
Stanford University, Stanford, California	Ph.D.	1977	Geophysics

HONORS:

MAJOR RESEARCH INTEREST: Geophysical studies of tectonically active structures; physical properties of rocks in situ	ROLE IN PROPOSED PROJECT: Principal Investigator
---	--

RESEARCH AND/OR PROFESSIONAL EXPERIENCE: (Starting with present position, list professional background and employment.)

- 1977 - present Assistant Professor of Geophysics, Department of Earth Sciences, University of California, Riverside, California.
- 1974 - 1975 Geophysicist, U.S. Geological Survey, Menlo Park, California (part-time).
- 1973 - 1977 Teaching and research assistant, Department of Geophysics, Stanford University (part-time).
- 1969 - 1972 Physics Instructor, Escuela Superior del Profesorado "Francisco Morazan", Tegucigalpa, Honduras.

Publications:

- 1973 Cooper, M. R.; R. L. Kovach, C. H. Cramer and D. J. Stierman, Some aspects of strain release and seismic slip in central California: in Proceedings Conf. on Tectonic Problems San Andreas Fault System: R. L. Kovach, A. Nur, eds. Stanford University Publications.
- 1976 Boore, David M. and D. J. Stierman, Source parameters of the Point Mugu, California earthquake of 21 February, 1973: Bull. Seis. Soc. Am., 66, 385-404.
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Geology, 32, 14-17.

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Stierman, Donald J., Earthquake sounds and animal cues: Some
field observations: Bull. Seis. Soc. Am. (in press).

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Citizen of U.S.A.; born in Taiwan, 1943; male; married; two children.

EDUCATION: Ph.D. University of Southern California, 1973.
M.S. University of Idaho, 1969.
B.S. National Taiwan University, 1965.

PROFESSIONAL POSITIONS:

1974-present Lecturer (1974-1975), Assistant Professor (1975-1979),
Associate Professor (1979), Department of Earth Sciences,
University of California, Riverside, California.
1974-1975 Post-doctoral scholar, Department of Geology and Geo-
physics, Woods Hole Oceanographic Institution, Woods
Hole, Massachusetts.
1965-1966 ROTC, Army, Republic of China.

PROFESSIONAL AFFILIATIONS: American Geophysical Union, Society of Exploration
Geophysicists.

PROFESSIONAL LICENSES: Registered geologist and geophysicist, State of California.

TEACHING EXPERIENCE
(1974 to present):

Introductory geophysics, oceanography, earthquake seis-
mology, geophysical data processing, terrestrial heat
flow, electrical exploration.

RESEARCH EXPERIENCE
(1973 to present):

Actively involved in the theoretical, experimental, and
observational research;
Heat flow -- measurements in the ocean (basin, ridge,
continental margin), lake, and continent;
theoretical investigation of terrestrial
heat transfer; development of finite ele-
ment method.

RESEARCH EXPERIENCE
(continued):

- Electrical exploration -- development of telluric method in geothermal exploration; use of DC resistivity in groundwater exploration.
- Magnetics -- marine magnetic survey; interpretation of aeromagnetic data; monitoring of magnetic field for earthquake prediction.
- Seismology -- seismic reflection; theoretical investigation of wave propagation and radiation pattern; microearthquake activities in the geothermal area; study of aftershock sequence.

PUBLICATIONS

Terrestrial Heat Flow

- T-C. Lee and T. L. Henyey, Heat-flow refraction across dissimilar media: Geophysical Journal of the Royal Astronomical Society, 39, 319-333, 1974.
- T-C. Lee and R. P. Von Herzen, Heat flow near the south Atlantic triple junction, 55°S, 0°E: Geophysical Research Letters, 2, 201-204, 1975.
- T-C. Lee, Focusing and defocusing of heat flow by a buried sphere: Geophysical Journal of the Royal Astronomical Society, 43, 635-641, 1975.
- T-C. Lee and T. L. Henyey, Heat flow through the southern California borderland: Journal of Geophysical Research, 80, 3733-3743, 1975.
- T. L. Henyey and T-C. Lee, Heat flow in Lake Tahoe, California-Nevada, and the Sierra Nevada-Basin and Range transition: Geological Society of America Bulletin, 87, 1179-1187, 1976.
- T-C. Lee, On shallow-hole temperature measurements--a test study in the Salton Sea geothermal field: Geophysics, 42, 572-583, 1977.
- D. L. Williams, T-C. Lee, K. Green, R. P. Von Herzen, and M. Hobart, A geothermal study of the Mid-Atlantic Ridge near 37°N: Geological Society of America Bulletin, 88, 531-540, 1977.
- T-C. Lee and R. P. Von Herzen, A composite trans-Atlantic heat-flow profile between 20°S and 35°S: Earth and Planetary Science Letters, 35, 123-133, 1977.
- T-C. Lee and L. H. Cohen, Onshore and offshore measurements of temperature gradients in the Salton Sea geothermal area, California, Geophysics, 44, 206-215, 1979.
- T-C. Lee, Erosion, uplift, exponential heat source distribution and transient heat flux, Journal of Geophysical Research, 84, 585-590, 1979.

PUBLICATIONS

Terrestrial Heat Flow (continued)

T-C. Lee, A. J. Rudman and A. Sjoeren, Application of finite element analysis to terrestrial heat flow, Indiana Geological Survey Occasional Paper -- Geophysical Computer Program, 7, 53 p., 1980.

Seismology

T-C. Lee and T. L. Teng, Radiation patterns of P and SV waves in a multi-layered medium: Bulletin Seismological Society of America, 63, 529-547, 1973.

B. Gilpin and T-C. Lee, A microearthquake study in the Salton Sea geothermal area, California: Bulletin Seismological Society of America, 68, 441-450, 1978

D. J. Stierman, T-C. Lee, S. O. Zappe and D. Seamount, Aftershocks of the Homestead Valley earthquakes of March 15, 1979: California Geology, January, 1980, 14-17, 1980.

Miscellaneous

T-C. Lee, Telluric anomalies caused by shallow structures, ellipsoidal approximations: Geophysics, 42, 97-102, 1977.

T-C. Lee, Speculation on the source beds of oil and gas in Taiwan from the geothermal viewpoints: Acta Oceanographica Taiwanica, National Taiwan University, 8, 172-177, 1978.

S. Biehler and T-C. Lee, Resource assessment in Geothermal Energy and Regional Development, edited by S. Edmunds and A. Rose, Praeger Publishers, New York, 57-74, 1979.

Manuscripts submitted

T-C. Lee, Geomagnetic reference field

R. S. Lu, J. J. Pan and T-C. Lee, Heat flow in the southwestern Okinawa Trough

Manuscripts in preparation (available in the format of technical reports)

M. Kam and T-C. Lee, Curie isotherm in the Imperial Valley, California

T-C. Lee, Heat flow anomaly across the San Jacinto fault in southern California

Technical Reports and Abstracts

Not listed

Company Capabilities;

CDMG is the state geological survey for California. It has professional staff and equipment already devoted to microearthquake monitoring projects and geothermal investigations. The Division has been involved with micro-earthquake monitoring projects since 1976 (e.g. Cramer et al, 1977; Topozada and Cramer, 1978; Cramer and Harrington, 1979; Cramer, 1980 - see publications of C.H. Cramer). CDMG facilities and equipment available under this proposal are 8-DR100 recording systems (three component), 2-DP100 playback units plus analog oscillograph chart recorders, 2-TS400 portable clocks, portable oscilloscopes and WWV radios for interstation timing, State IBM 370/168 computer facility, Eclipse S-250 minicomputer with interactive graphics (Tektronix) and incremental plotter (Heuston), and field vehicles.

The Division has also been active in geothermal investigations under contract from DOE (see Other Contracts under Business/Cost Requirements section).

In addition, the Division has made contractual agreements for shot hole drilling and powder in past seismological investigations.

CDMG has also contracted work from the University of California, Riverside (UCR) in the past (e.g. Stierman, 1980a). UCR Institute of Geophysics and Planetary Physics has professional staff with experience in interpretation of seismic data for crustal properties and in geophysical investigations of geothermal areas (Dr. Stierman and Dr. Lee - see personnel qualifications, also Stierman, 1980b). UCR facilities and equipment available

under this proposal are 1-DR100 three component system, 6-8 additional DR100 systems on short term loan (3-months) from Lawrence Livermore Laboratory, DP-100 playback/microprocessor system for obtaining IBM compatible tapes (Appendix II), University's IBM and PRIME computer systems, and refraction shot controller for detonating and timing calibration shots.

References

- Cramer, C.H., 1980, Stephens Pass, California, Earthquake swarm of August-November, 1978: Time and spatial history (abstract), Earthquake Note 50, 5.
- Cramer, C.H., and Harrington, J.M., 1979, Seismicity and tectonics of the eastern San Gabriel Mountains area, San Bernardino and Los Angeles Counties, California, in D.M. Morton, editor, Geology of the Transverse Ranges, U.S. Geological Survey Professional Paper, in press.
- Cramer, C.H., Sherburne, R.W., Topozada, T.R., and Parke, D.L., 1977, A microearthquake survey of the Rocklin-Penryn pluton in the Sierra Nevada foothills west of Auburn, California, California Division of Mines and Geology, Open-File Report 77-11SAC, 29 p.
- Stierman, D.J., 1980a, The Homestead Valley Earthquake sequence, Final Report to California Division of Mines and Geology under Contract #5-0004.
- Stierman, D.J., 1980b, In-situ Studies of seismic wave velocities and attenuation in basement rocks in Southern California, NSF grant (funded).
- Topozada, T.R., and Cramer, C.H., 1978, Ukiah earthquake, 25 March 1978: Seismicity possibly induced by Lake Mendocino, California Geology 31, 275-281.

Project Management Plan

Management Approach:

The project will be performed in the seismology section of the California Division of Mines and Geology, Department of Conservation, at the Sacramento District Office. Dr. Chris H. Cramer will be the Division seismologist in charge of the project. Drs. Stierman and Lee of University of California, Riverside, will be working under subcontract directly with the seismology section. An organization chart is shown in figure 5.

Figure 5

Project Organization Chart

Director, Department of Conservation



Chief and State Geologist, CDMG



Chief Deputy State Geologist, CDMG



District Geologist, Sacramento



Manager, Seismology Section

Co-Principal Investigator: Chris H. Cramer

Sub-Contract Staff: Co-Principal Investigator: Donald J. Stierman

Tien-Chang Lee

Support Staff

Schedule:

Table I shows project proposed work schedule and staff allocations:

		Table I - Proposal Work Schedule														
Project Month		1	2	3	4	5	6	7*	8*	9*	10	11	12	13	14	15
<u>Preparation</u>																
A. Computer Software Interfacing		-----														
i) DP programmer (4 man-mo.)																
ii) Seismologist, Dr. Cramer (2 man-mo.)																
B. Instrument Calibration and Installation		-----														
i) Electronic Technician (1 man-mo.)																
ii) Seismologist, Dr. Cramer (2 man-weeks)																
<u>Field Work</u>																
A. Recording		-----														
i) Field Student Assistants (6 man-mo.)																
ii) Elect. Technician (1 man-mo.)																
iii) Seismologist, Dr. Cramer (2 man-weeks)																
iv) Dr. Stierman (1 man-week)																
v) Dr. Lee (1 man-week)																
B. Calibration Shots		-----														
i) † 1 Drill Crew (1 crew-week)																
ii) † Loader / Shooter (1 man-week)																
iii) Seismologist, Dr. Cramer (1 man-week)																

Table I - Proposal Work Schedule

Project Month	1	2	3	4	5	6	7*	8*	9*	10	11	12	13	14	15
---------------	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----

Data Reduction

- i) Student Assistants
(3 man-mo.)
- ii) Seismologist, Dr. Cramer
(3 man-weeks)

Interpretation and Final Report

- i) Seismologist, Dr. Cramer
(2 man-mo.)
- ii) Dr. Stierman
(1 3/4 man-mo.)
- iii) Dr. Lee
(1 3/4 man-mo.)
- iv) Student Assistant at CDMG
(3 man-mo.)
- v) Student Assist. at UCR
(2 man-mo.)
- vi) Secretary-Typist
(1 man-mo.)
- vii) Draftsman
(1 man-mo.)
- viii) Secretary - UCR
(1 man-mo.)

Footnotes to Table I:

* These project months must be during the summer because winter weather conditions make access impossible.

† Personnel contracted along with drilling rig and explosives.

Technology Transfer Plan:

The technology developed under this proposal should be fairly easy to transfer to other potential users. Digital event recorders with 200 samples/sec/channel for 3 channels have become standard production items from equipment manufacturers. The results, interpretations, and evaluations will be available in report form. Digital data collected during the proposed study will be available on magnetic tape for further study. The proposed computer processing system will be composed of standard routines and programs written in FORTRAN and use standard Tektronics graphic display routines. Copies of the developed system can be made available on magnetic tape. CDMG is a public agency so that all work done under this proposal will remain in the public domain.

Business/Cost Requirements

Organization Information:

The California Division of Mines and Geology has an authorized budget of \$6,711,986 for Fiscal Year 1980-81. The budget elements from which the proposed study would be funded are "Land Use Geology and Seismology", with authorized funds of \$3,581,516, and "Mineral Resource Conservation", with authorized funds of \$974,219.

The California Division of Mines and Geology is the State Geological Survey of California. It is administered by the California Department of Conservation, which in turn, is a part of the State Resources Agency.

The Division has been in continuous operation since 1880, and has active programs in basic geology, geologic hazards, and mineral resources. The total staff size is 124 individuals, of which 81 are earth scientists, including 6 seismologists.

Cost Sharing:

The California Division of Mines and Geology's contribution will be the use of its 8-DR100 digital event recorders and ancillary equipment and a cost share of \$40,876. This cost share is subdivided into a guaranteed cost share of \$15,000 and an optional cost share of \$25,876. The University of California, Riverside's contribution will be the use of its single DR-100 digital event recorder and a cost share of \$8,046. DOE's cost share will be \$100,000. The monetary costs are summarized in the following table.

Table II - Cost Sharing

Dept. of Energy		\$ 100,000
CDMG Cost Share	a) guaranteed	15,000
	b) optional	25,876
UCR Cost Share		8,046
		<u> </u>
	Project Total Cost:	\$ 148,922

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget
Approval No. 29-R0184

This form is for use when (i) submission of cost or pricing data (see FPR 1-3.807-3) is required and (ii) substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO.
1

NO. OF PAGES
4

NAME OF OFFEROR California Division of Mines and Geology		SUPPLIES AND/OR SERVICES TO BE FURNISHED 8 recording systems (DR100) and ancillary equipment	
HOME OFFICE ADDRESS 1416 Ninth Street, Rm. 1341 Sacramento, CA 95814			
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED Sacramento District		TOTAL AMOUNT OF PROPOSAL \$ 148,922	GOV'T SOLICITATION NO. DE-SC07-80ID12144

DETAIL DESCRIPTION OF COST ELEMENTS

1. DIRECT MATERIAL (Itemize on Exhibit A)				EST COST (\$)	TOTAL EST COST'	REFER-ENCE'
N/A						
a. PURCHASED PARTS						
b. SUBCONTRACTED ITEMS						
c. OTHER— (1) RAW MATERIAL						
(2) YOUR STANDARD COMMERCIAL ITEMS						
(3) INTERDIVISIONAL TRANSFERS (At other than cost)						
TOTAL DIRECT MATERIAL						
2. MATERIAL OVERHEAD' (Rate % of base =)						
3. DIRECT LABOR (Specify)	ESTIMATED HOURS	RATE/HOUR	EST COST (\$)			
a) Assoc. Seismologist, Chris Cramer	1056	21.85	\$23,074			
b) Prec. Electronic Technician	352	18.98	6,681			
c) D.P. Programmer	600	35.40	21,240			
d) Student Assistants	2464	6.29	15,499			
e) Office Assistant II (Secretary)	176	9.15	1,610			
f) Geotechnical Draftsman	176	14.35	2,560			
TOTAL DIRECT LABOR					\$70,630	
4. LABOR OVERHEAD (Specify Department or Cost Center)	O.H. RATE	X BASE =	EST COST (\$)			
N/A - included in 3						
TOTAL LABOR OVERHEAD						
5. SPECIAL TESTING (Including field work at Government installations)				EST COST (\$)		
N/A						
TOTAL SPECIAL TESTING						
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)	N/A					
7. TRAVEL (If direct charge) (Give details on attached Schedule)	Exhibit A			EST COST (\$)		
a. TRANSPORTATION				\$ 2,600		
b. PER DIEM OR SUBSISTENCE				\$ 6,900		
TOTAL TRAVEL					\$ 9,500	
8. CONSULTANTS (Identify—purpose—rate)				EST COST (\$)		
a) Univ. Of California Riverside, Institute of Geophysics and Planetary Physics (See Supplementary Form 60)				\$21,513		
b) Calibration shot contract work (drilling, explosives, etc.) (See Exhibit A)				\$12,500		
TOTAL CONSULTANTS					\$34,013	
9. OTHER DIRECT COSTS (Itemize on Exhibit A)					\$ 6,500	
TOTAL DIRECT COST AND OVERHEAD					\$120,643	
10. GENERAL AND ADMINISTRATIVE EXPENSE (Rate 23.44% of cost element Nos. 10)					\$28,279	
12. ROYALTIES'						
TOTAL ESTIMATED COST					\$148,922	
14. FEE OR PROFIT						
TOTAL ESTIMATED COST AND FEE OR PROFIT					\$148,922	

This proposal is submitted for use in connection with and in response to (Describe RFP, etc.)

SCAP # DE-SC07-80ID12144

and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE Jack Dye, Assistant Director	SIGNATURE <i>Jack Dye</i>
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NAME OF FIRM Department of Conservation, Division of Mines and Geology	DATE OF SUBMISSION August 5, 1980
---	--------------------------------------

EXHIBIT A—SUPPORTING SCHEDULE (Specify. If more space is needed, use reverse)

COST EL NO.	ITEM DESCRIPTION (See footnote 5)	EST COST (\$)
7a	20 RT Sacramento/Mammoth (500 mi RT) (1 site selection; 1 installation; 13 weekly data tape transfers ; 4 equipment maintenance and repair; 1 calibration shot) 10,000 miles @ \$.13/mi	\$1,300
	100 daily station maintenance trips in Mammoth area (100 mi trip) 10,000 miles @ \$.13/mi	\$1,300
	TOTAL	\$ 2,600
7b	Per Diem 150 days @ \$46/day	\$ 6,900
9	Computer time (Eclipse S-250, IBM 370/167) 5 CPU-hrs @ \$1000/CPU-hr	\$5,000
	300 Cassettes Digital Recording Tape (type R300NH) @ \$5.00 ea.	\$1,500
	TOTAL	\$ 6,500
8b	Drill Crew with drill (contracted) - 1 crew week (3 holes each 200' deep)	\$7,500
	Loader/Shooter and Explosives (contracted) (3000 lbs explosives)	\$5,000
	TOTAL	\$ 12,500

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

YES NO (If yes, identify below.)

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL	TELEPHONE NUMBER/EXTENSION
---	----------------------------

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

YES NO (If yes, identify on reverse or separate page)

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

YES NO (If yes, identify.): ADVANCE PAYMENTS PROGRESS PAYMENTS OR GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT (Or, do you have any independently financed (IRGID) projects) FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

YES NO (If yes, identify.):

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

YES NO (If no, explain on reverse or separate page)

See Reverse for Instructions and Footnotes

OPTIONAL FORM 60 (10-71)

Supplement for University of California, Riverside costs

CONTRACT PRICING PROPOSAL (RESEARCH AND DEVELOPMENT)				Office of Management and Budget Approval No. 29-RO184	
This form is for use when (i) submission of cost or pricing data (see FPR 1-3.807-3) is required and (ii) substitution for the Optional Form 39 is authorized by the contracting officer.				PAGE NO. 3	NO. OF PAGES 4
NAME OF OFFEROR		SUPPLIES AND/OR SERVICES TO BE FURNISHED			
HOME OFFICE ADDRESS		One recording system (DR100)			
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED		TOTAL AMOUNT OF PROPOSAL		GOV'T SOLICITATION NO.	
Univ. Of California, Riverside		\$			
DETAIL DESCRIPTION OF COST ELEMENTS					
1. DIRECT MATERIAL (Itemize on Exhibit A)		EST COST (\$)		TOTAL EST COST*	
N/A					
a. PURCHASED PARTS					
b. SUBCONTRACTED ITEMS					
c. OTHER—(1) RAW MATERIAL					
(2) YOUR STANDARD COMMERCIAL ITEMS					
(3) INTERDIVISIONAL TRANSFERS (At other than cost)					
TOTAL DIRECT MATERIAL					
2. MATERIAL OVERHEAD* (Rate % X \$ base =)					
3. DIRECT LABOR (Specify)		ESTIMATED HOURS	RATE/HOUR	EST COST (\$)	
Assistant Res. Geophysicist II, Donald J. Stierman		2 mo.	\$2369/mo	\$4,738	
Associate Res. Geophysicist I, Tien-Chang Lee		2 mo.	\$2997/mo	\$5,994	
Secretary II, step 5		1 mo.	\$1367/mo	\$1,367	
TOTAL DIRECT LABOR					\$12,099
4. LABOR OVERHEAD (Specify Department or Cost Center)*		O.H. RATE	X BASE =	EST COST (\$)	
Faculty summer salaries		8.06%	\$5,366	\$ 433	
Faculty academic year salaries		25%	\$5,366	\$1395	
Staff salaries		25%	\$1,367	\$ 342	
TOTAL LABOR OVERHEAD					\$ 2,170
5. SPECIAL TESTING (Including field work at Government installations)				EST COST (\$)	
N/A					
TOTAL SPECIAL TESTING					
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)		N/A			
7. TRAVEL (If direct charge) (Give details on attached Schedule)		Exhibit A		EST COST (\$)	
a. TRANSPORTATION				\$ 521	
b. PER DIEM OR SUBSISTENCE				\$1,288	
TOTAL TRAVEL					\$ 1,809
8. CONSULTANTS (Identify—purpose—rate)		N/A		EST COST (\$)	
TOTAL CONSULTANTS					
9. OTHER DIRECT COSTS (Itemize on Exhibit A)					\$ 2,000
TOTAL DIRECT COST AND OVERHEAD					\$18,078
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate % of cost element Nos. 10)		19 %			3,435
12. ROYALTIES*					
TOTAL ESTIMATED COST					\$21,513
14. FEE OR PROFIT					
TOTAL ESTIMATED COST AND FEE OR PROFIT					\$21,513

Project Budget by Task:

The following is a breakdown of the estimated total budget by task as outlined in Table I:

Preparation:

A. Computer software interfacing

1) Seismologist, Chris Cramer - 352 hrs. @ \$21.85 hr.:	\$ 7,692
2) D.P. Programmer - 600 hrs. @ \$35.40 hr.:	\$21,240
3) Computer time (system development) (3 CPU-hr @ \$1000/CPU-hr.):	\$ 3,000
	<hr/>
Subtotal:	\$ 31,952
Administrative Overhead (23.44% on Subtotal):	\$ 7,485
	<hr/>
Task Total:	\$ 39,417

B. Instrument Calibration and Installation

1) Seismologist, Chris Cramer - 88 hrs. @ \$21.85 hr.:	\$ 1,923
2) Prec. Electronic Technician - 176 hrs. @ \$18.98 hr.:	\$ 3,340
3) Travel - 2 RT Sacramento/Mammoth (500 mi RT) (1 site selection/1 installation)	
a) Field Truck Expenses	
(1000 mi @ \$.13/mile)	\$130
b) Per Diem (15 days @ \$46/day)	\$690
	<hr/>
	\$820
	<hr/>
Subtotal:	\$ 6,083
Administrative Overhead (23.44% of Subtotal):	\$ 1,426
	<hr/>
	\$ 7,509

Field Work:

A. Recording

1) Field Student Assistants - 1056 hrs. @ \$6.29 hr.	\$ 6,642
2) Prec. Electronic Technician - 176 hrs. @ \$18.98 hr.	\$ 3,340
3) Seismologist, Chris Cramer - 88 hrs. @ \$21.85 hr.	\$ 1,923
4) UCR staff (Salaries include benefits)	
a) Assist. Res. Geophysicist II, Steirman $\frac{1}{4}$ mo. summer @ \$2,560/mo.	\$ 640
b) Assoc. Res. Geophysicist I, Lee $\frac{1}{4}$ mo. summer @ \$3,239/mo.	\$ 810
c) 19% UCR overhead on a and b	<u>\$ 276</u>
	\$ 1,726.
5) Supplies - 300 Cassettes Digital Recording Tape \$5 each	\$ 1,500
6) Travel and Field Expenses	
a) RT Sacramento/Mammoth (500 mi RT) (13 weekly data tape transfers; 4 equipment maintenance) 8,500 mi @ \$.13 mile	\$1,105
b) CDMG field truck expenses (Station maintenance) 10,000 mi @ \$.13/mile	\$1,300
c) CDMG per diem - 128 days @ \$46/day	\$5,888
d) UCR expenses	
i) 2 RT Riverside/Mammoth (700 mi RT) 14 days @ \$8/day and 1400 mi @ \$.135/mile + 19% UCR overhead	\$ 358
ii) 14 days per diem @ \$46/day + 19% UCR overhead	<u>\$ 766</u>
	\$ 9,417
	Subtotal: \$ 24,548
Administrative Overhead (23.44% of Subtotal):	<u>\$ 5,754</u>
	Task Total: \$ 30,302

B. Calibration Shots:

1) Seismologist, Chris Cramer - 44 hrs. @ \$21.85 hr.	\$ 962
2) Drill Crew with drill (contracted) - 1 crew-week (3 holes each 200' deep)	\$ 7,500
3) Loader/Shooter and Explosives (Contracted) (3000 lbs. of explosives)	\$ 5,000
4) Travel	
a) 1 RT Sacramento/Mammoth (500 mi RT) 500 mi @ \$.13/mile	\$ 65
b) Per Diem 7 days @ \$46/day	<u>\$322</u>
	<hr/> \$ 387
	Subtotal: \$ 13,849
Administrative Overhead (23.44% of Subtotal):	<u>3,246</u>
	<hr/> Task Total: \$ 17,095

Data Reduction:

1) Seismologist, Chris Cramer - 132 hrs. @ \$21.85 hr.	\$ 2,884
2) Student Assistant - 528 hrs. @ \$6.29 hr.	\$ 3,321
3) Computer time (1 CPU-hr. @ \$1000/CPU-hr)	<u>\$ 1,000</u>
	Subtotal: \$ 7,205
Administrative Overhead (23.44% of Subtotal):	<u>\$ 1,689</u>
	<hr/> Task Total: \$ 8,894

Interpretation and Final Report:

1) Seismologist, Chris Cramer - 352 hrs. @ \$21.85 hr.	\$ 7,692
2) Student Assistants - 880 hrs. @ \$6.29 hr.	\$ 5,536
3) Secretary-Typist, OAIL - 176 hrs. @ \$9.15 hr.	\$ 1,611
4) Draftsman - 176 hrs. @ \$14.34 hr.	\$ 2,524
5) UCR Staff (Subcontract) (Salaries include benefits)	
a) Assist. Res. Geophysicist II, Donald Stierman	
i) 3/4 mo. summer @ \$2,560 mo. :	\$ 1,920
ii) 1 mo. academic @ \$2,985 mo. :	<u>\$ 2,985</u>
	\$ 4,905
b) Assoc. Res. Geophysicist I, T-C. Lee	
i) 3/4 mo. summer @ \$3,239 mo.:	\$ 2,429
ii) 1 mo. academic @ \$3,776 mo.:	<u>\$ 3,776</u>
	\$ 6,205
c) Secretary II, step 5	
1 mo. @ \$1,709 mo.	\$ 1,709
d) Supplies and Expenses (Telephone, mail, secretarial supplies, scientific illustrations, xerox, photography, etc.)	\$ 1,000
e) Travel	
i) 2 RT Airfare Ontario/Sacramento \$ 220 (\$110 RT)	
ii) Per Diem - 14 days @ \$46/day	<u>\$ 644</u>
	\$ 864
f) UCR computer time (1 CPU-hr @ \$1,000/CPU-hr)	\$ 1,000
g) 19% UCR overhead on items a-f	<u>\$ 2,980</u>
	\$ 18,663
6) CDMG Computer time (1 CPU-hr @ \$1,000/CPU-hr)	<u>\$ 1,000</u>
	Subtotal: \$ 37,026
Administrative Overhead (23.44% of Subtotal):	<u>\$ 8,679</u>
	Task Total: \$ 45,705

Government contracts relevant, to Earthquake Hazard Reduction Investigation awarded to the California Division of Mines and Geology.

TITLE

SPONSORING AGENCY

GRANT OR CONTRACT NO.

COST

Fiscal Year 1978
 Geologic and geomorphic investigation of the San Gabriel fault zone, Los Angeles and Ventura Counties, California;

(U.S.C.S.) 14-08-0001-16600, \$ 25,000
 Mod. # 1

Fiscal Year 1978
 To compile a Time-Stratigraphic Framework of Marine Sediments of the contiguous Western United States, with application to Dating Fault movements and establishing Fault Capability.

(U.S.C.S.) 14-08-0001-G-180 \$ 20,000

Fiscal Year 1978,
 Faulting and Liquefaction as Potential Earthquake Hazards in Urban San Diego, California;

(U.S.C.S.) 14-08-0001-16728 \$ 05,000

Fiscal Year 1978
 Earthquake Hazards Geologic Mapping of the San Andreas Fault Zone, Los Angeles, California.

(U.S.C.S.) 14-08-0001-G-504 \$100,000

Fiscal Year 1978
 Earthquake hazards associated with faults in the Greater Los Angeles metropolitan area, Los Angeles County, California, including faults in the Santa Monica-Raymond Hill, Verdugo-Eagle Peak, and Benedict Canyon fault zones.

(U.S.C.S.) 14-08-0001-G-510 \$ 82,000

Fiscal Year 1973
 Classification and Mapping of Quaternary Sedimentary Deposits for purposes of Seismic Zonation, South Coastal Los Angeles Basin, Orange County, California.

(U.S.C.S.) 14-08-0001-G-511 \$ 60,000

Fiscal Year 1979
 Compilation of Pre-1900 California Earthquake History and Relocation of Selected Instrumentally Recorded Earthquakes.

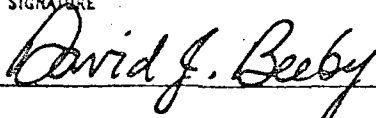
(U.S.C.S.) 14-08-0001-G-513 \$ 54,000

Contact:
 Bob Green
 (415)323-8111
 Ext. 2107

TITLE	SPONSORING AGENCY	GRANT OR CONTRACT NO.	COST
<u>Fiscal Year 1979</u> Faulting and Liquefaction as Potential Earthquake Hazards in Urban San Diego, California	(U.S.G.S.)	14-08-0001-17699	\$95,000
<u>Fiscal Year 1979</u> Earthquake Hazards Geologic Mapping of the San Andreas Fault Zone, Los Angeles, California	(U.S.G.S.)	14-08-0001-18244	\$50,000
<u>Fiscal Year 1979</u> Earthquake Hazards associated with faults in the greater Los Angeles Metropolitan area, Los Angeles County, California including faults in the Verdugo-Eagle Rock and Benedict Canyon Fault Zones.	(U.S.G.S.)	14-08-0001-18245	\$40,000
<u>Fiscal Year 1979</u> Classification and Mapping of Quaternary Sedimentary Deposits for purposes of Seismic Zonation, South Coastal Los Angeles Basin, Orange County, California.	(U.S.G.S.)	14-08-0001-18241	\$85,000
<u>Fiscal Year 1979</u> Preparation of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes.	(U.S.G.S.)	14-08-0001-18243	\$54,000
<u>Fiscal Year 1980</u> Earthquake Hazards and Tectonic History of the San Andreas Fault Zone, Los Angeles County, California	(U.S.G.S.)	14-08-0001-19193	\$35,000
<u>Fiscal Year 1980</u> Preparation of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes	(U.S.G.S.)	14-08-0001-19200	\$40,000
<u>Fiscal Year 1980</u> Classification and Mapping of Quaternary Sedimentary Deposits for Purposes of Seismic Zonation, South Coastal Los Angeles Basin, Orange County, California	(U.S.G.S.)	14-08-0001-19199	\$70,000

Contact:
Bob Green
(415) 323-8111
Ext. 2107

TITLE	SPONSORING AGENCY	GRANT OR CONTRACT NO.	COST
<u>Fiscal Year 1979</u>			
Quadrangle Assessment Drilling (Evaluate Geology and Uranium Favorability of the Sonora Pass Region, Alpine and Tuolumne Counties, California.)	(D.O.E.-BFEC) C.B. Inberg (303) 242-8621	Subcontract #80-397-G Project No. 20-78-2152 B/R No. CD-20-01-04-01	\$23,149
<u>Fiscal Year 1978-79</u>			
Surface Geologic (Evaluate Uranium Favorability in the TRONA Quadrangle, as part of the National Uranium Resource Evaluation [NURE].)	(D.O.E.-BFEC) C.B. Inberg (303) 242-8621	Subcontract #78-155-G Project No. 12-78-7088 B/R Code AG-01-01-01	Phase I \$23,020 Phase II 133,678 Phase III 27,303
<u>Fiscal 1978</u>			
An Inventory of Low and Moderate Temperature Geothermal Resources in California.	(D.O.E.) C.D. Inberg (303) 242-8621	EM-78-S-07-1739	\$111,453
<u>Fiscal 1979</u>			
Geothermal Assessment and Reservoir Definition in California.	(D.O.E.) Gerald Katz (415) 273-7943	DE-FG03-79ET27035	\$200,000

FEDERAL ASSISTANCE		2. APPLICANT'S APPLICATION	a. NUMBER	3. STATE APPLICATION IDENTIFIER	a. NUMBER
1. TYPE OF ACTION <input type="checkbox"/> PREAPPLICATION <input checked="" type="checkbox"/> APPLICATION (Mark appropriate box) <input type="checkbox"/> NOTIFICATION OF INTENT (Opt.) <input type="checkbox"/> REPORT OF FEDERAL ACTION		b. DATE Year-month-day 19 80 Aug. 1		b. DATE Year-month-day ASSIGNED 19	Number to follow.
4. LEGAL APPLICANT/RECIPIENT				5. FEDERAL EMPLOYER IDENTIFICATION NO.	
a. Applicant Name : Department of Conservation b. Organization Unit : Division of Mines and Geology c. Street/P.O. Box : 1416 Ninth Street, Room 1341 d. City : Sacramento e. County : Sacramento f. State : California g. ZIP Code: 95814 h. Contact Person (Name & telephone No.) : David Beeby (916) 445-0515				N/A	
7. TITLE AND DESCRIPTION OF APPLICANT'S PROJECT				6. PROGRAM (From Federal Catalog)	
Detailed Microearthquake Investigation of Casa Diablo, Long Valley KGRA, CA. The project is a detailed microearthquake survey of the above area to obtain high-quality digital data and to evaluate the technique as a tool in geothermal exploration.				a. NUMBER 811037 b. TITLE Geothermal - R & D	
				8. TYPE OF APPLICANT/RECIPIENT A-State H-Community Action Agency B-Interstate I-Higher Educational Institution C-Substate J-Indian Tribe D-Country K-Other (Specify): E-City F-School District G-Social Purpose District Enter appropriate letter <input type="checkbox"/> A	
10. AREA OF PROJECT IMPACT (Names of cities, counties, States, etc.)		11. ESTIMATED NUMBER OF PERSONS BENEFITING		9. TYPE OF ASSISTANCE	
Mono County, California		20,000,000		A-Basic Grant D-Insurance B-Supplemental Grant E-Other Enter appropriate letter(s) <input type="checkbox"/> A C-Loan	
13. PROPOSED FUNDING		14. CONGRESSIONAL DISTRICTS OF:		12. TYPE OF APPLICATION	
a. FEDERAL \$ 100,000.00	b. APPLICANT 48,922.00	a. APPLICANT 3	b. PROJECT 14	A-New C-Revision E-Augmentation B-Renewal D-Continuation Enter appropriate letter <input type="checkbox"/> A	
c. STATE .00	d. LOCAL .00	16. PROJECT START DATE Year-month-day 19 81, Jan 1		15. TYPE OF CHANGE (For 12c or 12e)	
e. OTHER .00	f. TOTAL \$ 148,922.00	17. PROJECT DURATION 15 Months		A-Increase Dollars F-Other (Specify): B-Decrease Dollars C-Increase Duration D-Decrease Duration E-Cancellation Enter appropriate letter(s) <input type="checkbox"/>	
18. ESTIMATED DATE TO BE SUBMITTED TO FEDERAL AGENCY 1980 Aug. 7				19. EXISTING FEDERAL IDENTIFICATION NUMBER N/A	
20. FEDERAL AGENCY TO RECEIVE REQUEST (Name, City, State, ZIP code) Department of Energy, Idaho Falls, Idaho, 83401				21. REMARKS ADDED <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
22. THE APPLICANT CERTIFIES THAT:		a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved. b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached: <input type="checkbox"/> None <input type="checkbox"/> Response attached			
		(1) State of CA, State Clearinghouse <input checked="" type="checkbox"/> <input type="checkbox"/> (2) <input type="checkbox"/> <input type="checkbox"/> (3) <input type="checkbox"/> <input type="checkbox"/>			
23. CERTIFYING REPRESENTATIVE		a. TYPED NAME AND TITLE		b. SIGNATURE	
		David J. Beeby Technical Planning Officer		 Year-month-day 19 80 Aug. 1	
24. AGENCY NAME				25. APPLICATION RECEIVED 19	
26. ORGANIZATIONAL UNIT		27. ADMINISTRATIVE OFFICE		28. FEDERAL APPLICATION IDENTIFICATION	
29. ADDRESS				30. FEDERAL GRANT IDENTIFICATION	
31. ACTION TAKEN		32. FUNDING		34. STARTING DATE 19	
<input type="checkbox"/> a. AWARDED <input type="checkbox"/> b. REJECTED <input type="checkbox"/> c. RETURNED FOR ADJUDICATION <input type="checkbox"/> d. DEFERRED <input type="checkbox"/> e. WITHDRAWN		a. FEDERAL \$.00 b. APPLICANT .00 c. STATE .00 d. LOCAL .00 e. OTHER .00 f. TOTAL \$.00		Year-month-day 35. CONTACT FOR ADDITIONAL INFORMATION (Name and telephone number)	
38. FEDERAL AGENCY A-95 ACTION		33. ACTION DATE 19		36. ENDING DATE 19	
a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.		b. FEDERAL AGENCY A-95 OFFICIAL (Name and telephone no.)			

SECTION I - APPLICANT/RECIPIENT DATA

SECTION II - CERTIFICATION

SECTION III - FEDERAL AGENCY ACTION

REPRESENTATIONS AND CERTIFICATIONS

[Instructions: Check or complete all appropriate boxes or blanks.]

The proposer makes the following representations and certifications:

1. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION

- (a) The bidder or offeror certifies that it is () is not (X) a small business concern as defined in accordance with Section 3 of the Small Business Act (15 U.S.C. 632).
- (b) The bidder or offeror certifies that it is a small business [as set forth in (a) above] and is () is not () owned and controlled by socially and economically disadvantaged individuals. Such a firm is defined as one -
 - (i) which is at least 51 per centum owned by one or more such individuals or, in the case of any publicly owned business, at least 51 per centum of the stock is owned by such individuals;
 - (ii) whose management and daily business operations are controlled by one or more such individuals; and
 - (iii) which certifies concerning said ownership and control in accordance with section (c) below.
- (c) The bidder or offeror certifies that it is () is not (X) a minority individual(s) in accordance with (c)(i) below or that it is () is not () socially and economically disadvantaged in accord with section (c)(ii) or (c)(iii). Socially and economically disadvantaged individuals are defined as:
 - (i) United States citizens who are Black Americans, Hispanic Americans, Native Americans, or other specified minorities;
 - (ii) any other individual found to be disadvantaged pursuant to section 8(a) of the Small Business Act (15 U.S.C. 637);
or
 - (iii) any other individual defined as socially, and economically disadvantaged, for purposes relating to other sections of the Small Business Act.

6. CERTIFICATION OF NONSEGREGATED FACILITIES

By the submission of this proposal, the offeror, applicant, or subcontractor certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. It certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. It further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATION OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semi-annually, or annually).

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER N/A

Each proposer shall furnish the following information by filling in the appropriate blocks:

- a. Is the proposer owned or controlled by a parent company as described below? () Yes () No. (For the purpose of this proposal, a parent company is defined as one which either owns or controls the activities and basic business policies of the proposer. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company

is able to formulate, determine or veto basic business policy decisions of the proposer, such other company is considered the parent company of the proposer. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.)

- b. If the answer to a. above is "Yes", proposer shall insert in the space below the name and main office address of the parent company.

Name of Parent Company: N/A

Main Office Address (No., Street, City, State and Zip Code)

N/A

- c. Proposer shall insert in the applicable space below, if it has no parent company, its own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941), or if it has a parent company, the E.I. No. of its parent company.

Employer Identification Number of Parent Company: N/A

8. CLEAN AIR AND WATER CERTIFICATION

(Applicable if the bid or offer exceeds \$100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.)

The bidder or offeror certifies as follows:

- (a) Any facility to be utilized in the performance of this proposed contract has (), has not (X), been listed on the Environmental Protection Agency List of Violating Facilities.
- (b) It will promptly notify the Contracting Officer, prior to award, of the receipt of any communication from the Director, Office of

Federal Activities, Environmental Protection Agency, indicating that any facility which it proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities.

(c) It will include substantially this certification, including this paragraph (c), in every nonexempt subcontract.

9. WOMAN-OWNED BUSINESS N/A

Concern is () is not () a woman-owned business.

A woman-owned business is a business which is, at least, 51 percent owned, controlled, and operated by a woman or women. Controlled is defined as exercising the power to make policy decisions. Operated is defined as actively involved in the day-to-day management.

For the purposes of this definition, businesses which are publicly owned, joint stock associations, and business trusts are exempted. Exempted businesses may voluntarily represent that they are, or are not, woman-owned if this information is available.

10. PERCENT OF FOREIGN CONTENT

The offeror/contractor will represent (as an estimate), immediately after the award of a contract, the percent of the foreign content of the item or service being procured expressed as a percent of the contract award price (accuracy within plus or minus 5 percent is acceptable).

Signed by

Jack Dye

Jack Dye
Assistant Director
(Title)

Note: No solicitation may be properly considered without this certification and no award may be made without it being executed.

Agreement Terms and Conditions

The California Division of Mines and Geology, State of California agrees in principal to accept, with one exception, all standard provisions listed in the sample Cooperative Agreement.

We request that Article III, Item C, be ammended to read as follows:

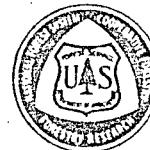
Participants Financial Support. All costs in excess of the one hundred thousand dollars (\$100,000) to be provided by DOE will be borne by the Participant. The amount of the excess will be borne as a guaranteed cost share of fifteen thousand dollars (\$15,000) and an optional cost share of twenty five thousand eight hundred seventy six dollars (\$25,876).

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

Inyo National Forest
Mammoth Ranger District
Mammoth Lakes, CA 93546

July 28, 1980
2720



State Of California
Division of Mines and Geology
Sacramento District Office
2815 "O" St.
Sacramento, CA 95816

Attn: Chris Cramer, Ph.D.
Associate Seismologist

Dear Dr. Cramer:

In your July 16, 1980 letter you have requested an indication of permission of the landowner to conduct passive microearthquake recording.

Let this letter serve as my preliminary approval to issue a special use permit to authorize this activity during the summer of 1981. My final decision to allow or disallow the project will be based on the findings of the required Environmental Analysis Report which will be completed upon the receipt of a formal request for a special use permit.

Generally, the period of time to reach a final decision is 60 days from receipt of the application.

If we can be of further assistance, feel free to contact my assistant, Dave Marlow, in this office (714)934-2505.

Sincerely,

RICHARD ADAMS
District Ranger

Appendix II

A LOW-COST DIGITAL DATA INTERFACE

Douglas S. Cavit (Institute of Geophysics and Planetary Physics, Univ. of California, Riverside, CA 92521)

More and more portable field geophysical instruments are using a digital format for the storage of information. This has brought about a great need for inexpensive ways of transferring large quantities of digital field data to larger mainframe computers for analysis. One way of achieving this, used extensively in past systems, is the custom designed interface consisting of discrete logic components. This is an effective technique but has some limitations. The user is locked into one particular format or type of digital data. The use of a microprocessor can solve this problem using software rather than hardware to achieve its purpose. Only minor software changes, rather than costly hardware modifications, are required to effect most interfaces. The decreasing cost and increasing capabilities of microprocessors makes this method of interfacing especially attractive.

My particular application is the interfacing of a Sprengnether DP-100 digital event recorder playback unit to a magnetic tape recorder compatible with an IBM 370 computer. The Sprengnether system is being used to study deep reflections, microearthquake spectra, and source mechanisms, all of which require further digital processing. However, the Sprengnether system has its own particular coding structure which was not directly compatible to the IBM. The DP-100 has a 12-bit rather than a more standard 16 or 8-bit pattern. By using an Intel SDK-85 microcomputer I am able to take the DP-100 coding, interpret it, change the format and rewrite it as two 8-bit bytes. The recorded data is then recorded on magnetic tape that is IBM standard.

This is but one application. Microprocessors can also pre-process some data, which can cut down significantly costly time on a large computer. This device has permitted us to gain the fullest use from our digital equipment at a minimal additional cost.