

**PROJECT TASK STATEMENT**

**BETWEEN**

**Sandia Corporation**

**AND**

**British East India Company**

**a corporation of the United Kingdom  
having a principal office in London, United Kingdom  
(hereinafter "Participant")**

**Geothermal Dynamics**

This Project Task Statement (PTS) is under the authority and subject to all terms and conditions of Cooperative Research and Development Agreement (CRADA) No. SC##/####.##.##.

**A. PURPOSE**

Sandia National Laboratories (Sandia) and the British East India Company (BEIC) are collaborating on this PTS to apply advanced thermal diagnostics in high pressure environments to determine path ways for analytics in geothermal sciences. More specifically the ability to ascertain heat transfusion through the substrata surfaces of the earth's mantle has unique wave length characteristics that are difficult to capture using traditional methodologies. Sandia and BEIC seek to augment existing analytics and develop new ones to better understand the underlying science behind geothermal radiation.

**Reasons for Cooperation**

See Appendix A, Statement of Work, to CRADA SC##/####.##.##.

The current analytic models are not sufficient to advance available technology beyond a proof of concept stage. The conflicting wavelengths of heat transfer in the earth's mantle cannot be accurately isolated in order to better understand placement of geothermal hot spots. If geothermal hot spots are clearly identifiable, the naturally occurring heat of earth can be harnessed to generate steam which can then be used as a utility scale energy source that can help combat influxes in the carbon cycle.

**B. SCOPE**

**Duration of Project**

The period of performance of this project is 18 months.

**Technical Objectives**

- Identify and isolate heat variability at various substrata levels.
- Measure the level of heat output in high pressure environments.
- Measure the effect that different materials hardening techniques will have on drilling capabilities.

**Phases of the Project**

N/A

**Tasks and Division of Responsibilities**

Task No.	Task Title	Duration (months)	Responsible Parties
1	Mantle Analysis	01-06	Sandia/BEIC
2	Heat Sensitivity Measurement	06-12	Sandia/BEIC
3	Application of Modeling Tools	12-17	Sandia/BEIC
4	Prepare Final Report	17-18	Sandia/BEIC

**Task Descriptions****Task 1: Mantle Analysis**

Discussion. The geology of the earth's mantle necessitates unique analysis to produce a data set that can be used for finding the optimal areas for drilling. The substrata compaction creates varying densities and the collaboration under this PTS will seek to exploit weaknesses in various substrata levels. Downhole drilling techniques utilizing the hardened hammer approach will allow for a compilation of empirical data that can be aggregated to demonstrate that there are indeed superior areas of drilling. Certain software developed through algorithmic testing will be used to speed the process of drilling as well as augment any issues with accuracy. High pressure environments will be analyzed using the cutting edge capability sets of both Parties and will be useful in ascertaining drill depth; as there are issues with hardening of the hammer bits at certain temperatures, both Parties will work together to ensure that optimization is achieved.

Deliverables. A jointly produced (Sandia and BEIC) empirical dataset will be generated and used to identify the optimal areas for drilling.

**Task 2: Heat Sensitivity Measurement**

Discussion. The conductivity of certain materials in the earth's mantle will be analyzed to observe the effect of entropic heat transfer. The geothermal subsurface creates unique pockets of closed sub-systems where the laws of thermodynamics dictate a predictable pattern of heat transfer; these sub-systems will be analyzed infrared detection. The Parties will work to refine the ability to measure heat and sift through any variance that is caused by the spherical nature of the earth's core and heat irradiating therefrom. Measurements will be taken at varying depth and strata composition levels to ensure that a wide array of data is collected and that any analysis will have the desired empirical effect.

Deliverables. A jointly produced (Sandia and BEIC) empirical dataset that will allow analysis of heat conductivity in the earth's mantle.

**Task 3: Application of Modeling Tools**

Discussion. The data collected from Task 1 & Task 2 will be amalgamated to form an independent study on the optimal areas in which to place geothermal production plants. High performance computing will be utilized to generate proposed optimal locations and the integrity of the data will be ensured by pre-determined algorithms that capture the accurate manner in which such data should be computed and analyzed.

Deliverable. A memo summarizing findings will be produced.

**Task 4: Prepare Final Report**

Discussion. Upon completion or termination of this PTS, a final report will be developed by Sandia and BEIC, which will include the following information: (1)A final abstract; (2)technical results/accomplishments; (3)a list of PTS-generated Intellectual Property (Subject Inventions, Copyrights, Mask Works, and/or Trademarks); (4)a description of benefits to the DOE/NNSA; (5)a description of benefits to the PTS Participant/s, industry, consumers/taxpayers, and/or U.S. economy.

Deliverable. Final report.

**Location of "Next Use"**

The location of delivery and "next use" for the deliverables developed under this PTS effort: the Island of Helena.

**C. ESTIMATED COST (All Money in \$K)**

This table shows estimated costs for this PTS only.

	<b>PY1</b>	<b>PY2</b>	<b>Total</b>
<b>GOVERNMENT</b>			
DOE/NNSA Contribution	\$250.00	\$250.00	\$500.00
Other Federal Funds	\$ .00	\$ .00	
Paid 0.0% DOE Fed Admin Chg	\$ .00	\$ .00	
Total Other Federal Funds	\$ .00	\$ .00	
<b>Total Government</b>	\$ .00	\$ .00	
<b>SANDIA CORPORATION</b>			
Total Sandia Corp. Funds	\$250.00	\$250.00	\$500.00
<b>PARTICIPANT</b>			
Funds-In Contribution	\$582.52	\$582.52	\$1,165.04
Paid 3.0% Fed Admin Chg	\$17.48	\$17.48	\$34.96
Total Participant Funds	\$600.00	\$600.00	\$1,200
In-Kind Contribution	\$500.00	\$500.00	\$1,000
<b>Total Participant</b>	\$1,100.00	\$1,100.00	\$2,200.00
<b>Total CRADA Value</b>	\$1,350.00	\$1,350.00	\$2,700

**D. TECHNICAL CONTACTS**

**For Sandia:**

Principal Investigator Name  
Org. XXXXX/ MS XXXX  
Phone: (XXX) XXX-XXXX  
Fax: (XXX) XXX-XXXX  
email: MYNAME@sandia.gov

**For Participant:**

Participant Name  
Phone: (XXX) XXX-XXXX  
Fax: (XXX) XXX-XXXX  
email: XXXXX@XXXX.com

**E. FUNDING AND COSTS**

The Participant's estimated contribution is \$2,200,000, which includes \$1,000,000 in-kind, \$1,165,040 funds-in, and \$34,960 for the Federal administrative charge. The total estimated value of this PTS is \$2,700,000.

Payment Terms

- (1) Upon receipt of Sandia's invoice, the Participant shall pay Sandia the total amount of \$1,200,000 to cover the entire project and period of the program. Sandia shall not begin work under the PTS until the agreement is executed and the funds are received.

- (2) Upon completion of the work or termination of this CRADA and/or PTS, Sandia shall refund any funds-in account balance to the Participant.
- (3) All costs incurred by Sandia under this PTS and payable by the Participant shall be computed in accordance with Sandia's standard accounting practices.
- (4) The total reimbursements made by the Participant to Sandia under this PTS shall not exceed \$1,200,000 without a written amendment to this PTS executed by both Parties.

The Parties agree that amounts due from Participant for work at Sandia under this PTS are the singular property of DOE/NNSA from the outset. Sandia shall receive payments from Participant solely as custodian for DOE/NNSA. Sandia will deposit all Participant proceeds into the U.S. Treasury account for DOE/NNSA.

Checks must be identified with the PTS or invoice number, should be made payable to "Sandia Corporation", and mailed as follows:

- If to be sent by overnight courier such as Federal Express, address the overnight mail envelope to: Sandia National Laboratories, 1515 Eubank SE, Mail Stop 1387, Albuquerque, NM, 87123.
- If to be mailed by U.S. mail, address envelope to: Sandia National Laboratories, P.O. Box 5520, Albuquerque, NM, 87185-5520.

Automated Clearing House (ACH) payments should be directed to: Sandia National Laboratories, ABA No. 107002312, Account No. 156402023089. Participant shall be responsible for payment of all fees associated with ACH.

For information on paying by credit card, contact Sharon A. Chino at Sandia National Laboratories, (505) 844-2236.

**F. PERSONAL PROPERTY**

None

**G. LOANED/BORROWED PROPERTY**

**1. LOANED PROPERTY**

None

**2. BORROWED PROPERTY**

As part of this PTS, Participant will lend to Sandia the Participant's property described below:

Description of Borrowed Property:

Item	Qty	Description	Identification	Unit Cost	Ext. Cost*
1	1	Oscilloscope	BEIC#1234	\$50,000	\$50,000.00
TOTAL VALUE OF BORROWED PROPERTY					\$50,000.00

\*Extended cost equals quantity times unit cost.

Sandia's Location of Borrowed Property: 7011 East Ave, Bldg. 906, Room 106, Livermore, CA 94550.

In no event shall Sandia be liable in excess of \$21,540.00, including liability for negligence.

Sandia assumes the risk of and shall be responsible for any loss or damage to the property specified in this PTS. Exception shall be made for reasonable wear and tear and loss or damage for any cause beyond its control. Sandia shall not be liable for more than the actual value of the property nor for more than the cost to repair or replace same with materials of like kind and quality, whichever is lower in cost. In no event shall Sandia be liable in excess of \$50,000.00, including liability for negligence.

Sandia agrees to return the property upon completion of the PTS, or otherwise make disposition as mutually agreed upon.

Property to be returned to the Participant shall be shipped to the address shown in Article XXVII.B.2. of the CRADA, "F.O.B. Participant's facility."

#### **H. BACKGROUND INTELLECTUAL PROPERTY**

Section H provides each Party the opportunity, as a matter of goodwill but not legal obligation, to declare its interests in Intellectual Property that has been created in the "background", i.e., before or outside this PTS. The purpose is to forestall disputes over what is and what is not Generated Information.

Each Party may use another Party's Background Intellectual Property identified in Section H of this PTS solely in performance of research and development under the PTS. This PTS does not grant or promise to grant to a Party any option, grant, or license to commercialize, or otherwise use another Party's Background Intellectual Property. Licensing of Background Intellectual Property, if agreed to by the Parties, shall be the subject of separate licensing agreements between the Parties.

Each Party has used reasonable efforts to list all relevant Background Intellectual Property, but Intellectual Property may exist that is not identified. No Party shall be liable to another Party because of any failure to list Background Intellectual Property.

Sandia elects to declare an interest in the following Background Intellectual Property:

SD# #####

SD# #####

SCR# ####

BEIC elects to declare an interest in the following Background Intellectual Property:

None

**I. APPROVAL**

**For Sandia:**

BY \_\_\_\_\_  
Peter R. Atherton

TITLE Senior Manager, Industry Partnerships

DATE \_\_\_\_\_

**For Participant:**

BY \_\_\_\_\_

TITLE

DATE \_\_\_\_\_

FICTITIONAL SAMPLE