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SYSTEMS CONTROL, INC.

1801 PAGE MILL ROAD

PALO ALTO, CALIFORNIA 94304

TELEX: 348433

TELEPHONE (415)
494-1165

120-78-451
SCI Proposal MPL 78-562
May 25, 1977

United States Energy Research
and Development Administration
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attention: Mr. James B. Cotter
Chairman, Source Evaluation Panel

Subject: SCI Proposal MPL 78-562 entitled: "Geothermal Reservoir
Assessment Case Study"

Reference: Request for Proposal EY-R-08--007 dated March 25, 1977

Gentlemen:

Per the subject request for proposal, SCI is pleased to enclosed ten (10) copies of the technical and cost proposals. Also enclosed is one copy of our current annual report.

Our proposed effort is focused on the reservoir engineering studies portion of the RFP package. We have been in contact with a number of geothermal companies and are aware of ERDA's objectives for this study. Not knowing the nature of the data received from various geothermal exploration firms, we propose herein to perform the reservoir assistance studies on a time and material basis as quoted in our cost proposal. You will notice that our costs are quoted on rates per hour by labor category of various professionals. The specific tasks in our scope of work are given in the technical proposal.

In reponse to the minimum requirements for proposal response, we herein conform to the following two qualifications:

1. SCI has adequate financial resources or the ability to obtain such resources required to assure satisfactory performance of the contract.

May 25, 1977


2. SCI is willing to permit data offered to be disseminated to industry and the public at large.

The estimated cost per hour for labor category quoted is valid for ninety (90) days from the date of this letter.

Questions of a technical nature should be directed to Dr. Robert Schainker at (415) 494-1165. If I may be of assistance to you regarding contractual matters, please let me know.

Very truly yours,

SYSTEMS CONTROL, INC


Michael M. Larkin
Contracts Manager

Enclosures

6/E

SYSTEMS CONTROL, INC.

1801 PAGE MILL ROAD
PALO ALTO, CALIFORNIA 94304

TELEX: 348433

TELEPHONE (415)
494-1165

MPL 78-562

25 May 1977

TECHNICAL PROPOSAL

GEOHERMAL RESERVOIR ASSESSMENT CASE STUDY
RFP: EY-R-08-0007

Prepared For:

Energy Research and Development Administration
Nevada Operations Office
P.O. Box 14100/ 2753 S. Highland
Las Vegas, Nevada 89114

Attn: Mr. James B. Cotter

Prepared By:

R.W. Atherton
R.B. Schainker

1. INTRODUCTION AND DISCUSSION OF APPROACH

Systems Control, Inc. (SCI) is pleased to submit this proposal for reservoir assessment case studies to the Energy Research and Development Agency (ERDA). We are aware of ERDA's interest in encouraging the development of geothermal resources by reducing the costs and risks of exploration and reservoir assessment. This risk reduction will result in part from increasing the information on reservoir engineering and exploration available to the geothermal industry. To further the goal, ERDA wishes to document and publish case histories of reservoir assessment. Thus, a complete picture of studies reservoirs and an evaluation of methodologies for reservoir assessment will be developed and made available to the geothermal community.

Interest in this proposal is focused on the three known Geothermal Resource Areas (KGRAs) of Roosevelt Hot Springs, Cove Fort-Sulfurdale, and Thermo Hot Springs in the state of Utah. The basis of any reservoir assessment of these areas is specific data; consequently, we have contacted Union Oil, Phillips Petroleum, and Thermal Power in an attempt to develop a collaborative effort. Based on our communication with these firms, we understood that Thermal Power may be the only resposdee to the data portion of the RFP, and that they do not wish to provide to ERDA any interpretations of the data. (If asked however, they will answer any direct questions regarding the legibility, format and organization of the data.)

SCI's main interest in the RFP is precisely the area that others seem not to be interested in, namely, data interpretation with regards to reservoir assessment and evaluation of the component uncertainties associated with real field data. We believe we have performed notable studies

in these areas (see Section 2 and the reference section of this proposal), and herein offer to ERDA a list of potential tasks that could be performed on the data received via this RFP. Not knowing the exact type and magnitude of the data available, we propose in our cost proposal a Time-and-Materials (T&M) type of contract that ERDA can exercise for one or more of the tasks presented in Section 2.

The principal investigators for this program of research and development will be Dr. Robert W. Atherton and Dr. R.B. Schainker.

1.1 MINIMUM RFP QUALIFICATION CRITERIA

As a formal response to the minimum qualifications mentioned in the RFP (Page 2) for respondees, SCI herein conforms to the following:

- SCI has adequate financial resources and the ability to obtain such resources required to assure satisfactory performance of the contract. (The interested reader is referred to the SCI Financial Statement attached to the Cost Proposal.)
- SCI is willing to permit data, and/or interpretations of any data, resulting from this contract to be disseminated to industry and to the public at large without any restrictions.

2. SCOPE OF WORK

In this section we list possible tasks that can be initiated under a T&M contract for SCI to perform reservoir engineering and analysis on any relevant data. We invite ERDA to choose among these tasks as a basis for defining the specific nature of a work statement for SCI.

2.1 PRELIMINARY ASSESSMENT OF THE DATA

SCI will organize the available data; record its nature, quantity and quality; compare it to data from other KGRA's; and evaluate its usefulness for further studies.

2.2 STATISTICAL ANALYSIS OF DATA AND ERROR ANALYSIS

SCI will perform a preliminary statistical analysis of the geophysical and direct measurement data to identify trends and to analyze the variance and accuracy of the data. The study will identify sources of error and estimate error bounds on the data.

2.3 WELL-BORE MODELS

Using a well-bore model based on the equations of two-phase flow with heat transfer, SCI will analyze well-flow test data. This analysis will estimate the down-hole temperature and pressure, as well as temperature and pressure profiles in the well-bore. The transient behavior of the down-hole conditions will be investigated.

2.4 RESERVOIR MODELS

Using simplified and advanced models of hydrothermal flow, SCI will study and assess the reservoir. The modeling effort will incorporate

knowledge from geology covering the physical configuration and properties of the reservoir as well as temperature and flow data from well-tests. The results of the model will provide estimates of the reservoir temperature and flow properties as well as its evolution for various scenarios of development.

2.5 PARAMETER ESTIMATION

Using the methods and techniques of parameter estimation, SCI staff will obtain values of reservoir parameters such as porosity and permeability. The available methods include least squares, estimation maximum likelihood estimation, and Bayesian estimation.

2.6 RESERVOIR ENGINEERING AND ASSESSMENT

The principles of reservoir engineering and engineering judgement will be used to assess the value and status of the reservoir. This effort will include the information learned from previous work efforts and will result in a preliminary evaluation of the economic potential of the reservoir..

3. BACKGROUND AND EXPERIENCE

Systems Control, Inc. (SCI) is a consulting firm composed of engineers and scientists concerned with the complex planning, engineering, and management problems encountered in environmental, societal, utility industrial, and defense systems. Founded in 1968, Systems Control is today a growing, closely held company with strong financial backing. The company presently has over 300 employees, over 150 of whom are graduate engineers and scientists, including approximately 70 persons holding Ph.D. degrees.

SCI has been active in research and development for geothermal energy for the past three years.¹⁻⁵ Several projects have been completed, and the most notable is "The Analysis of Subsidence Associated With Geothermal Development,"* performed for NSF-RANN. Through the presentation of papers⁶⁻¹⁴ and attendance at technical meetings, SCI staff have kept constantly abreast of the state of the art in reservoir assessment and geothermal energy development.

The following individuals may be contacted concerning SCI's experience and capabilities in the geothermal area.

Dr. C.R. Nichols
Division of Geothermal Energy
Energy Research and Development
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545
(202) 376-4914

* The results of this study are available in a three volume report: Volume 1: Handbook; Volume 2: Research Report; Volume 3: Information Bank.

Dr. Ralph Perhac
Program Manager
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, California 94303
(415) 493-4800, ext. 436

Mr. T. Simkin
Lawrence Berkeley Laboratory
Building 90, Room 2135
Berkeley, California 94720
(415) 843-2740, ext. 6217

REFERENCES

1. Atherton, R.W., E.J. Finnemore, M.L. Gillam, et al., "The Analysis of Subsidence Associated With Geothermal Development," three volumes, Systems Control, Inc., Palo Alto, California. NTIS No. NSF/RA-760414/5/6, September 1976.
2. Schainker, R.B., M.L. Gillam and R.W.J. Lay, "Statistical Assessment of United States Known Hydrothermal Fields," Systems Control, Inc., (for EPRI), Palo Alto, California. SCI Project 7553, June 1976.
3. Finnemore, E.J., "Geothermal Subsidence Library Acquisition," Systems Control, Inc., (for LBL), Palo Alto, California. SCI project 6824, July 1976.
4. DeGance, A.E. and R.W. Atherton, "Chemical Engineering Aspects of Two-Phase Flow," Parts 1-8, Chemical Engineering, 1970-1971.
5. Atherton, R.W., "Reservoir Model for Rhyolitic Geothermal Sites," MPL 76-076, Systems Control, Inc., Palo Alto, California, January 1976.
6. Atherton, R.W., "The Use of General Sensitivity Theory to Analyze the Geothermal Reservoir Model's Sensitivity to the Permeability Functions," Geothermal Reservoir Engineering, P. Kruger, H.J. Ramey (eds.) SGP-TR-12, Stanford Geothermal Program, Stanford University, Stanford, California, 267, December 1975.
7. Finnemore, E.J. and R.W. Atherton, "A Critical Appraisal of Mathematical Models for Land Subsidence Simulation," Proceedings of the Conference on Environmental Modeling and Simulation, EPA 600/9-76-016, U.S. Environmental Protection Agency, Cincinnati, Ohio, 429-433, April 1976.
8. Finnemore, E.J. and M.L. Gillam, "Compaction Processes and Mathematical Models of Land Subsidence in Geothermal Areas, Second International Symposium on Land Subsidence (IAHS), Anaheim, California, December 1976.
9. Atherton, R.W., "Sensitivity Theory in Reservoir Models," lecture presented at Stanford Geothermal Program, Stanford University, Stanford, California, April 1976.
10. Finnemore, E.J., Systems Control's Subsidence Research Activities, Imperial County Project Coordination Council Meeting, El Centro, California, February 1976.

11. Finnemore, E.J., Estimating the Subsidence Potential of Geothermal Areas, presented at the Institute of Geophysics and Planetary Physics Topical Conference on Geothermal Resources of the Imperial Valley, California, Lake Arrowhead, California, 1976.
12. Finnemore, E.J., discussor, Imperial Valley Subsidence Detection Committee, El Centro, California, January 1976.
13. Atherton, R.W., "The Analysis of Subsidence Associated With Geothermal Development," Helioscience Institute Conference, Palm Springs, California, May 1977.
14. Finnemore, E.J., "Potential Land Subsidence at Geothermal Development Sites," Geothermal Energy Magazine, 35, May 1977.

ROBERT W. ATHERTON
Senior Research Engineer
B.S., M.S., Ph.D.

PROFESSIONAL EXPERTISE

- Mathematical Modeling of Energy Systems
- Mathematical Model Development of Chemical Processes
- Mathematical Models of Fluid Mechanics and Heat Transfer Processes
- Mathematical Modeling and Geothermal Reservoirs and Subsidence
- Photochemical Analysis of Ozone Models
- Stability Analysis of Nonlinear Differential Equations
- Sensitivity Analysis Methods for Identification of Model Parameter Uncertainties

MAJOR PROJECT ASSIGNMENTS

- Project Leader, Analysis of Subsidence Associated with Geothermal Development
- Project Leader, Design and Analysis for Multiphase Flow in Pipes and Porous Media
- Project Leader, Chemical Analysis Sensitivity Studies and Model Development Tasks for the Climatic Impact Assessment Program
- Computer Model Development on Batch Reactor and 1-d Models for Stratospheric Ozone
- Developed Design Methods and Computer Software for Two-Phase Flow Systems
- Developed Correlations and Computer Software for Thermodynamic Properties of Chemical Processes
- Developed General Theory for Statistical Sensitivity Analyses of Photochemical Reaction Sets

EMPLOYMENT RECORD

- Systems Control, Inc., 1973 - present
- Stanford University, Research Assistant, 1970-1973
- Brown and Root, Inc., Chemical Process Engineer, 1969-1970
- Hudson Engineering Corp. Chemical Analyst/Computer Scientist, 1968
- Gulf Oil Corp., Pipeline Scheduler, 1967

EDUCATION

- Rice University, B.A., Chemical Engineering and Mathematics, 1969;
M.Ch.E., Chemical Engineering, 1970
- Stanford University, Engineer, Chemical Engineering, 1972;
Ph.D., Chemical Engineering and Mathematics, 1974

PROFESSIONAL SOCIETIES AND AWARDS

- AIChE, A.A.A.S., SIAM, Sigma Xi, AGU
- Donald P. Eckman Award, 1976, for contributions to Automatic Control

ROBERT B. SCHAIKER, MANAGER
Environmental Systems Program
B.S., M.S., Ph.D.

PROFESSIONAL EXPERTISE

- Program Planning and Analysis of Environmental-Energy Policy Issues
- Statistical Decision Analysis Related to Quality Control and Government Regulations
- Socioeconomic Impact Analysis
- Statistical Sensitivity Analysis Techniques
- Cost-Benefit and Cost Effective Trade-off Analysis
- Technology Assessment Studies Related to Policy Decisions of Large Scale Systems

MAJOR PROJECT ASSIGNMENTS

- Manager, Environmental Systems Program, Systems Control, Inc.
- Supervisor, Technology Assessment of Fluorocarbon Releases and Potential Regulatory Alternatives
- Supervisor, Climatic Impact Assessment Program -Error Variance Analysis of SST Environmental Impact Statement
- Task Manager of Socioeconomic Impact Analysis for an EIS on Two Nuclear Power Plants, WNP4 and 5
- Principal Investigator, NSF Grant on Geothermal Environmental Effects with Special Emphasis on Subsidence
- Development of Atmospheric Monitoring Techniques to Identify Causation of Atmospheric Perturbations
- Development of Statistical Decision Theory Methods to Assess Industrial Contaminant Levels Under the Influence of Measurement Uncertainties
- Assessed the Statistical Uncertainties of Atmospheric Perturbations in Ozone and Temperature Caused by Stratospheric Vehicle Effluents
- Developed Methods of Aggregating Mathematical Models of Atmospheric Chemical Processes
- Developed Methods for Resource Allocation Analysis of Cost-Benefit Models
- Developed Probability Functions of Signal-to-Noise Ratios
- Developed Surveillance Design Tool to Maximize the Rejection of Clutter in a System Environmental Simulator

EMPLOYMENT RECORD

- Systems Control, Inc., Palo Alto, California, Senior Engineer and Program Manager, 1969 - present.
- Washington University, St. Louis, Missouri, Control Systems and Calculus, Lecturer - Summer and Night School, Research Assistant, 1965 - 1969.
- Litton Industries, Woodland Hills, California, Estimation and Control Theory Engineer, 1968.
- McDonnell Douglas, St. Louis, Missouri, Hybrid Computer Analyst, 1966.
- Naval Ordnance Laboratory, Corona, California, Automatic Controls Engineer, 1965.

EDUCATION

- Washington University, St. Louis, Missouri
B.S. Honors Engineering Science Program (Biology Minor), 1965
M.S. Systems Engineering, 1966
Ph.D. Applied Math - Control Systems Science, 1969

PROFESSIONAL SOCIETIES AND AWARDS

- Sigma Xi, Tau Beta Pi, Eta Kappa Nu, Pi Tau Sigma, and the Institute of Electrical and Electronic Engineers

SYSTEMS CONTROL, INC.

1801 PAGE MILL ROAD

PALO ALTO, CALIFORNIA 94304

GE

TELEX: 348433

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SCI Proposal MPL 78-562

COST PROPOSAL

GEOHERMAL RESERVOIR ASSESSMENT CASE STUDY

Prepared for:

United States Energy Research and
Development Administration
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attention: Mr. James B. Cotter
Chairman, Source Evaluation Panel

Prepared by:

Michael M. Larkin
Contracts Manager
(415) 494-11-5, extension 271

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 59 is authorized by the contracting officer.

PAGE NO.

NO. OF PAGES

NAME OF OFFEROR SYSTEMS CONTROL, INC.		SUPPLIES AND/OR SERVICES TO BE FURNISHED GEOHERMAL RESERVOIR ASSESSMENT CASE STUDY	
HOME OFFICE ADDRESS 1801 Page Mill Road Palo Alto, California 94304		SCI Proposal MPL 78-562	
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED Same		TOTAL AMOUNT OF PROPOSAL \$ T&M	GOV'T SOLICITATION NO. EY-R-08-0007

DETAIL DESCRIPTION OF COST ELEMENTS

1. DIRECT MATERIAL (Itemize on Exhibit A)		EST COST (\$)	TOTAL EST COST ¹	REFER- ENCE ²
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 ³ (Rate %X'S base =)				
3. DIRECT LABOR (Specify)		ESTIMATED HOURS	RATE/HOUR	EST COST (\$)
See Exhibit "A"				
Payroll Burden @ 29.5%				
TOTAL DIRECT LABOR				
4. LABOR OVERHEAD (Specify Department or Cost Center) ⁴		O.H. RATE	X BASE =	EST COST (\$)
Labor Overhead		67.5%		
TOTAL LABOR OVERHEAD				
5. SPECIAL TESTING (Including field work at Government installations)			EST COST (\$)	
TOTAL SPECIAL TESTING				
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)				
7. TRAVEL (If direct charge) (Give details on attached Schedule)			EST COST (\$)	
a. TRANSPORTATION				
b. PER DIEM OR SUBSISTENCE				
TOTAL TRAVEL				
8. CONSULTANTS (Identify—purpose—rate)			EST COST (\$)	
TOTAL CONSULTANTS				
9. OTHER DIRECT COSTS (Itemize on Exhibit A)				
TOTAL DIRECT COST AND OVERHEAD				
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate 23.8 % of cost element Nos. 10) ⁵				E
12. ROYALTIES ⁶				
TOTAL ESTIMATED COST				
14. FEE OR PROFIT				
TOTAL ESTIMATED COST AND FEE OR PROFIT				

INSTRUCTIONS TO OFFERORS

1. The purpose of this form is to provide a standard format by which the offeror submits to the Government a summary of incurred and estimated costs (and attached supporting information) suitable for detailed review and analysis. Prior to the award of a contract resulting from this proposal the offeror shall, under the conditions stated in FPR 1-3.807-3 be required to submit a Certificate of Current Cost or Pricing Data (See FPR 1-3.807-3(h) and 1-3.807-4).

2. In addition to the specific information required by this form, the offeror is expected, in good faith, to incorporate in and submit with this form any additional data, supporting schedules, or substantiation which are reasonably required for the conduct of an appropriate review and analysis in the light of the specific facts of this procurement. For effective negotiations, it is essential that there be a clear understanding of:

- a. The existing, verifiable data.
- b. The judgmental factors applied in projecting from known data to the estimate, and
- c. The contingencies used by the offeror in his proposed price.

In short, the offeror's estimating process itself needs to be disclosed.

3. When attachment of supporting cost or pricing data to this form is impracticable, the data will be described (with schedules as appropriate), and made available to the contracting officer or his representative upon request.

4. The formats for the "Cost Elements" and the "Proposed Contract Estimate" are not intended as rigid requirements. These may be presented in different format with the prior approval of the Contracting Officer if required for more effective and efficient presentation. In all other respects this form will be completed and submitted without change.

5. By submission of this proposal the offeror grants to the Contracting Officer, or his authorized representative, the right to examine, for the purpose of verifying the cost or pricing data submitted, those books, records, documents and other supporting data which will permit adequate evaluation of such cost or pricing data, along with the computations and projections used therein. This right may be exercised in connection with any negotiations prior to contract award.

FOOTNOTES

1. Enter in this column those necessary and reasonable costs which in the judgment of the offeror will properly be incurred in the efficient performance of the contract. When any of the costs in this column have already been incurred (e.g., on a letter contract or change order), describe them on an attached supporting schedule. Identify all sales and transfers between your plants, divisions, or organizations, under a common control, which are included at other than the lower of cost to the original transferee or current market price.

2. When space in addition to that available in Exhibit A is required, attach separate pages as necessary and identify in this "Reference" column the attachment in which the information supporting the specific cost element may be found. No standard format is prescribed; however, the cost or pricing data must be accurate, complete and current, and the judgment factors used in projecting from the data to the estimates must be stated in sufficient detail to enable the Contracting Officer to evaluate the proposal. For example, provide the basis used for pricing materials such as by vendor quotations, shop estimates, or invoice prices; the reason for use of overhead rates which depart significantly from experienced rates (reduced volume, a planned major re-arrangement, etc.); or justification for an increase in labor rates (anticipated wage and salary increases, etc.). Identify and explain any contingencies which are included in the proposed price, such as anticipated costs of rejects and defective work, or anticipated technical difficulties.

3. Indicate the rates used and provide an appropriate explanation. Where agreement has been reached with Government representatives on the use of forward pricing rates, describe the nature of the agreement. Provide the method of computation and application of your overhead expense, including cost breakdown and showing trends and budgetary data as necessary to provide a basis for evaluation of the reasonableness of proposed rates.

4. If the total cost entered here is in excess of \$250, provide on a separate page the following information on each separate item of royalty or license fee: name and address of licensor; date of license agreement; patent numbers, patent application serial numbers, or other basis on which the royalty is payable; brief description, including any part or model numbers of each contract item or component on which the royalty is payable; percentage or dollar rate of royalty per unit; unit price of contract item; number of units; and total dollar amount of royalties. In addition, if specifically requested by the contracting officer, a copy of the current license agreement and identification of applicable claims of specific patents shall be provided.

5. Provide a list of principal items within each category indicating known or anticipated source, quantity, unit price, competition obtained, and basis of establishing source and reasonableness of cost.

CONTINUATION OF EXHIBIT A—SUPPORTING SCHEDULE AND REPLIES TO QUESTIONS II AND V.

NARRATIVE EXPLANATION OF COST ELEMENTS

Systems Control, Inc. is under the cognizance of both the Defense Contract Administration Services Organization and the Defense Contract Audit Agency. Relevant cost data is available for Government verification at Systems Control, Inc.'s facility located at 1801 Page Mill Road, Palo Alto, California. This information is contained in accounting records and is substantiated by supportable data. The Systems Control, Inc. fiscal year is from March 1 through February 28.

In order to effect consistency in estimating and continuity of responsibility, this proposal is estimated in the same manner in which the program will be implemented and controlled. The tasks involved have been defined and estimated by the technical managers who, having performed these tasks or similar tasks previously, are best qualified to estimate and identify the resources necessary for the successful accomplishment of all tasks. The resources are defined in terms of hours by labor category; material parts; subcontract items; computer usage by hour; travel by number, duration, destination and purpose of trips; and other direct cost items.

The rates employed in this proposal have been used in previous proposals.

The Defense Contract Audit Agency renders informal approval for SCI proposal rates on a proposal by proposal basis.

A. Material and Subcontracts

A separate schedule for each proposed item is attached to this addendum.

B. Material Overhead

A material handling burden rate is applied to direct material items. This rate includes the expense of procurement and receiving direct material and subcontracted hardware and services.

C. Direct Labor

The estimated cost of direct labor by labor category is based on the planned man hours of participation of each employee listed below, times the employee's hourly rate as of the 5/2/77 payroll, plus a projected cost increase to allow for annual promotion/salary adjustment in accordance with company policy. The employee's hourly rate is determined by dividing the employee's annual salary by 2,080 hours. The planned man hours of participation of each employee and the man hour mix reflect the best judgment of the project manager and are based on prior experience with similar projects. The promotion/salary adjustment factor of 14.7 percent is based on an annualized eight percent increase, and is applied to each individual employee's hourly rate. The salary adjustment factor is predicated on a 3/30/79 mid-point for the proposed period of performance. A proposed man year of effort consists of 1,848 man hours.

Direct labor consists of the following employees:

Supervisor:	R. B. Schainker
Senior Engineer:	R. Lau J. Patmore J. Shepherd
Engineer:	R. Atherton D. Budenaers P. Grimsrud R. Patton
Programmer/Analyst:	M. Piccardo W. Winkler
Technical Aide:	L. McKell
Clerical:	Average

D. Fringe Benefits/Payroll Burden

This rate is based on projected allowable fringe benefits and payroll expenses applicable to employee compensation. The pool includes payroll tax (FICA, FUTA and SUI), workmen's compensation insurance, group insurance, vacation, holiday, excused absence and bonus pay.

E. Direct Labor Overhead and General & Administrative Burdens

The provisional overhead and G&A burden rates are based on projected allowable indirect expenses expected to be incurred during the proposed period of performance. The overhead rate is applied to the sum of direct labor and payroll burden expense. The G&A rate is applied to all elements of cost, other than material and subcontract value.

The following indirect rates were utilized in the preparation of this proposal:

	<u>FY '78</u>	<u>FY '79</u>
Material Overhead		
Fringe Benefits/Payroll Burden	29.5	29.5
Labor Overhead	67.5	67.5
General and Administrative	23.8	23.8

F. Basis for Travel

Travel requirements and the number of days required at each destination were estimated by the project manager based on his interpretation of the project requirements. Air fare expense is based on tourist fares as quoted in the "Official Airline Guide". Private automobile costs are reimbursed at 15¢ per mile. Auto rental at destination is estimated at the current average cost of \$30 per day.

Subsistence expenses incurred during travel that are adequately documented are paid by the company. Current actual experience is that the average per diem expense is \$38, except in certain cities where overnight accommodations are in great demand.

<u>Destination</u>	<u>Number of Days</u>	<u>Purpose of Trip</u>
--------------------	-----------------------	------------------------

N/A

G. Basis for Computer

The number of central processing unit hours of the UNIVAC 1108 (or equivalent) required to accomplish this program reflect the best judgment of the proposed project manager and are based on prior experience with similar programs. It is estimated that the following hours are required:

UNIVAC 1108 (or equivalent): 0 hours @ \$1,050/hour.

For terminal charges, only when using GFE Computer, SCI charges the standard rate of \$55.00 per hour, plus an eight percent administrative charge, and the average telephone cost of \$30.00 per hour.

Terminal Charge (\$55/hr x 1.08)	\$59.40
Telephone	30.00
Total per Hour	<u>\$89.40</u>

H. Basis for Report Production

Report production expense is based on competitive vendor quotations and the current average cost to the company for printing, collating and binding of deliverable technical reports. A technical report typically includes text, mathematical expression, tables, charts and graphs.

I. Basis for Consultant

Consultant expense is based on estimated cost for service and expense of the named consultant predicated on an agreed man day rate times the proposed man day(s) of participation plus reimbursable expenses. The agreed man day rate is in accordance with a consulting contract with the named consultant.

Proposed Consultant(s)

N/A