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AWARD/CONTRACT

Page 1 of 1

1. THIS CONTRACT IS A RAISED ORDER UNDER OPAS TO PERFORM THE FOLLOWING RATING:

2. CONTRACT NO. NRC-04-97-039 3. EFFECTIVE DATE 4-24-97 4. REQUISITION PROJECT # PS-RES-96-071

5. ISSUED BY Code: U.S. Nuclear Regulatory Commission, Div. of Contracts & Property Mgmt., Contract Mgmt. Br. #1, M/ST712, Washington, D.C. 20555 6. ADMINISTERED BY Code: If other than Item 5 U.S. Nuclear Regulatory Commission, Div. of Contracts & Property Mgmt., Contract Mgmt. Br. #1, M/ST712, Washington, D.C. 20555

7. NAME AND ADDRESS OF CONTRACTOR: Sciencetech, Inc., 11140 Rockville Pike, Suite 500, Rockville, Maryland 20852 8. DELIVERY: [] FOB ORIGIN [X] OTHER (See below) 9. DISCOUNT FOR PROMPT PAYMENT: N/A Principal Investigator Technical Contact: Dr. Daniel Prelewicz, Telephone No: (301) 468-6425

10. SUBMIT INVOICES 4 copies unless otherwise specified TO THE ADDRESS SHOWN IN ITEM: 6

11. SHIP TO/MARK FOR CODE: U.S. Nuclear Regulatory Commission, ATTN: Tim Lee, M/S T 10E46, Office of Nuclear Regulatory Res., Washington, D.C. 20555 12. PAYMENT WILL BE MADE BY CODE: U.S. Nuclear Regulatory Commission, Division of Accounting & Finance, GOV/COM Accounting Sect., T9E2, Washington, D.C. 20555

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION [] 10 U.S.C. 2304(c) [] [] 41 U.S.C. 253(c) []

14. ACCOUNTING AND APPROPRIATION DATA SEE ATTACHED PAGE

15A. ITEM NO. 15B. SUPPLIES/SERVICES 15C. QUANTITY 15D. UNIT 15E. UNIT PRICE 15F. AMOUNT

The NRC hereby accepts the contractor's technical proposal dated October 15, 1996, and as revised on February 5, 1997, and March 21, 1997 which are hereby incorporated by reference and made a part of this cost-plus-fixed-fee contract.

15G. TOTAL AMOUNT OF CONTRACT 3,041,947.00

EXCEPTION TO STANDARD FORM SF26 REV. 4-85 Prescribed by GSA FAR 48 CFR 53.214 a

060002



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Handwritten signature and date: 4/10/97

RES C97-052

| A MUNICIPALITY | B BAR NUMBER | C EASEMENT NO. | D SECTION | E APPROPRIATION NO. | RES ID NO. |
|-------------------|-----------------|-------------------|--------------|------------------------|-------------|
| 014-000-00 | 76060800100 | FR852 | 250A | 31X0200.760 | RES-C97-052 |
| 014-000-00 | 76060800100 | FR853 | 250A | 31X0200.760 | RES-C97-053 |
| 014-000-00 | 76060800100 | FR854 | 250A | 31X0200.760 | RES-C97-054 |
| 014-000-00 | 76060800100 | FR855 | 250A | 31X0200.760 | RES-C97-055 |
| 014-000-00 | 76060800100 | FR856 | 250A | 31X0200.760 | RES-C97-056 |
| 014-000-00 | 76060800100 | FR857 | 250A | 31X0200.760 | RES-C97-057 |
| 014-000-00 | 76060800100 | FR858 | 250A | 31X0200.760 | RES-C97-058 |
| 014-000-00 | 76060800100 | FR859 | 250A | 31X0200.760 | RES-C97-059 |
| 014-000-00 | 76060800100 | FR860 | 250A | 31X0200.760 | RES-C97-060 |
| 014-000-00 | 76060800100 | FR861 | 250A | 31X0200.760 | RES-C97-061 |
| 014-000-00 | 76060800100 | FR862 | 250A | 31X0200.760 | RES-C97-062 |
| 014-000-00 | 76060800100 | FR863 | 250A | 31X0200.760 | RES-C97-063 |

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DESCRIPTION

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CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 2 copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (Attachments are listed herein.)

18. AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number _____, including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

19A. NAME AND TITLE OF SIGNER
(Type or print)
Douglas A. Knight
Manager of Contracts and Administration

20A. NAME OF CONTRACTING OFFICER

Mary H. Mace

19B. NAME OF CONTRACTOR
by SCIENTECH, Inc.
(Signature of person authorized to sign)

20B. UNITED STATES OF AMERICA
by Mary H. Mace
(Signature of Contracting Officer)

19C. DATE SIGNED
April 23, 1997

20C. DATE SIGNED
4-23-97

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PART I - THE SCHEDULE**SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS****B.1 PROJECT TITLE**

The title of this project is as follows:

RELAP5 Thermal-Hydraulic Code Maintenance

[End of Clause]

B.2 BRIEF DESCRIPTION OF WORK (MAR 1987)

The contractor shall provide the personnel, facilities, and equipment required to provide code configuration control, correction of code error, code improvements, developmental assessment, documentation updates, and user support to NRC, its contractors, and CAMP members for the RELAP5/MOD3 codes.

[End of Clause]

B.3 CONSIDERATION AND OBLIGATION--COST PLUS FIXED FEE (JUN 1998) ALTERNATE I (JUN 1991)

- (a) The total estimated cost to the Government for full performance of the base year is \$947,847.28, of which the sum of \$883,243.54 represents the estimated reimbursable costs, the amount of \$61,827.05 represents the fixed fee, and the amount of \$2,776.60 represents the facilities capital cost of money.
- (b) Should the Government exercise Optional Task 5, in the base year, the estimated cost for this effort is \$619,568.68, of which the sum of \$577,375.70, represents the estimated reimbursable costs, the amount of \$40,416.30 represents the fixed fee, and the amount of \$1,776.68 represents the facilities capital cost of money.
- (c) The Government reserves the right to exercise the following options at the total estimated cost indicated below:

| | | |
|-----------------|---------------------|--------------|
| Option Year 1 - | Reimbursable Costs: | \$783,668.96 |
| | Fixed Fee: | \$ 54,856.83 |
| | FCCM: | \$ 2,127.62 |
| | Est. Cost Recovery: | \$ 85,000.00 |
| | Total Est. Cost: | \$755,653.41 |

| | | |
|-------------------|---------------------|--------------|
| Optional Task 5 - | Reimbursable Costs: | \$591,641.45 |
|-------------------|---------------------|--------------|

B.3 (Continued)

| | | |
|-------------------|---------------------|--------------|
| (Opt. Yr. 1) | Fixed Fee: | \$ 41,414.90 |
| | FCCM: | \$ 1,556.59 |
| | Est. Cost Recovery: | \$ 0.00 |
| | Total Est. Cost: | \$634,612.94 |
| Option Year 2 - | Reimbursable Costs: | \$810,467.47 |
| | Fixed Fee: | \$ 56,732.72 |
| | FCCM: | \$ 1,794.46 |
| | Est. Cost Recovery: | \$ 85,000.00 |
| | Total Est. Cost: | \$783,994.65 |
| Optional Task 5 - | Reimbursable Costs: | \$606,131.90 |
| (Opt. Yr. 2) | Fixed Fee: | \$ 42,429.23 |
| | FCCM: | \$ 1,315.96 |
| | Est. Cost Recovery: | \$ 0.00 |
| | Total Est. Cost: | \$649,877.09 |
| Option Year 3 - | Reimbursable Costs: | \$818,615.55 |
| | Fixed Fee: | \$ 57,303.00 |
| | FCCM: | \$ 1,817.59 |
| | Est. Cost Recovery: | \$ 85,000.00 |
| | Total Est. Cost: | \$792,736.23 |
| Optional Task 5 - | Reimbursable Costs: | \$621,102.62 |
| (Opt. Yr. 3) | Fixed Fee: | \$ 43,477.18 |
| | FCCM: | \$ 1,348.53 |
| | Est. Cost Recovery: | \$ 0.00 |
| | Total Est. Cost: | \$665,928.33 |
| Option Year 4 - | Reimbursable Costs: | \$846,569.22 |
| | Fixed Fee: | \$ 59,259.85 |
| | FCCM: | \$ 1,876.45 |
| | Est. Cost Recovery: | \$ 85,000.00 |
| | Total Est. Cost: | \$822,705.52 |
| Optional Task 5 - | Reimbursable Costs: | \$636,669.81 |
| (Opt. Yr. 4) | Fixed Fee: | \$ 44,566.89 |
| | FCCM: | \$ 1,382.31 |
| | Est. Cost Recovery: | \$ 0.00 |
| | Total Est. Cost: | \$682,619.01 |

- (d) There shall be no adjustment in the amount of the Contractor's fixed fee by reason of differences between any estimate of cost of performance of the work under this contract and the actual cost for performance of that work.
- (e) The amount currently obligated with respect to this contract is \$451,922.24.
- (f) It is estimated that the amount currently allotted will cover performance for six months from the effective date.

B.3 (Continued)

[End of Clause]

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT**C.1 STATEMENT OF WORK****C.1.1 BACKGROUND**

The Division of Systems Technology, Office of Nuclear Regulatory Research (RES), is developing the RELAP5 thermal-hydraulic code for use in reactor safety analyses for improving the safety of nuclear power plants throughout the world.

The RELAP5/MOD3 code in conjunction with a nuclear plant analyzer (NPA), PYGI (a program to create an input deck from a restart or plot file), and an INEL modified version of xmgr5 (a graphics plotting package) is being used for performing analysis of transients in operating reactors, analyses to support resolution of generic issues, evaluation of emergency operating procedures and accident management strategies, confirmation of licensee's analyses, testing of fidelity on NRC simulators, training exercises for NRC staff, and supporting analyses for the certification of the AP600 advanced PWR design.

The RELAP5/MOD3 is a one-dimensional best estimate thermal-hydraulic code that is primarily used for small-break loss-of-coolant accidents (SBLOCA) and other transients. It is the NRC's primary analysis tool for thermal-hydraulic safety studies and probabilistic risk assessments of operating and advanced light water reactor designs. The NPA, and xmgr5 are supporting graphics packages that are used with RELAP5.

The RELAP5, and NPA codes are being used by other international organizations performing reactor safety studies. The use of these codes by several users provide numerous calculations and assessments needed to validate and make the codes. The NRC also benefits from this exchange by receiving code assessments and cash contributions from these organizations to defray some of the costs associated with the code development and conducting two international workshops to discuss issues related to these codes.

The availability of these codes to agencies of foreign governments through the International Code Applications and Maintenance Program (CAMP), will continue to support the agency's interest in cooperation which improves the safety of nuclear plants throughout the world.

The codes are currently provided to U.S. users for a nominal fee which covers shipping and handling, and code debugging. If U.S. users require assistance in using the code, such assistance will be offered on a cost-recovery basis. Both domestic users and CAMP

C.1 (Continued)

members continue to assess the codes against reactor operational and experimental data. As a result of these comparisons and through use of the code for plant safety assessment, many changes to the codes are suggested each year. When sufficient changes have been made to the codes, they are frozen for a suitable period and released, thus providing the users with an unchanging code which can be assessed.

The RELAP5 in conjunction with a NPA is being developed and maintained by INEL for the NRC.

In implementing this contract, an appropriate period of overlap (6 months) will be provided with the existing organization maintaining the RELAP5 code so as to facilitate a smooth transition and ensure all user needs are met during this period.

C.1.2 OBJECTIVE

The objective of this contract is to provide code configuration control, correction of code error, code improvements, developmental assessment, documentation updates and user support to NRC, its contractors, and CAMP members for the RELAP5/MOD3 code. The contractor shall provide the personnel, facilities, and equipment required to accomplish these objectives. Tasks to accomplish this objective shall be apportioned into four broad Task Areas with Subtasks delineated for each Task Area as appropriate, and one optional task. The first task requires the contractor to provide a single point of contact to assist code users. The second task requires the contractor to perform code maintenance and upgrades on the RELAP5 codes. The third task requires the contractor to apportion his costs for services to domestic code users on a cost recovery basis only. The fourth task area requires the contractor to prepare a cost estimate for the implementation of a plan to develop a new code which would combine the capabilities of several NRC thermal-hydraulic and neutronics codes into a single code, and finally the optional task requires the contractor to implement the plan discussed in task 4.

Technical and Other Special Qualifications Required

This project requires computer programmers who have experience and knowledge of the RELAP5/MOD3, NPA, xmqr5 codes (hereinafter referred to as the codes), and analysts who have experience and knowledge of thermal-hydraulic and reactor physics principles, numerical methods, and modeling which are applicable to transient and accident analyses of both operating and advanced PWRs and BWRs. In addition, computer capability to perform code development, validation, and assessment are required to meet the needs of the assigned staff and to release new code versions as agreed. Finally, there must also be diversity in the computer

C.1 (Continued)

code(s) capability to match systems used by most of the code users (i.e., SUN, IBM, DEC workstations).

C.1.3 SCOPE:**TASK AREA 1:**

Provide a single point of contact for satisfying the code users requests for documentation, code versions or updates, modeling changes, improved code user convenience, assistance and diagnosis of user difficulties with the codes, corrections of coding "bugs", and updating of code documentation. During the execution of code improvements, adequate measures shall be taken to ensure the integrity of the code(s) through software quality control procedures. Updated codes shall ensure backward compatibility with plant input decks that were developed for old versions of the code e.g., provide "translators" to modify the input decks.

Subtasks:

1. Maintain configuration control, and a tape library of code versions, including ancillary data files and plotting routines. Restrict READ/WRITE access to supervised employees.
2. Distribute code versions to NRC approved users in a form compatible with the user's computer system (Workstation), and in "user friendly" installation packages. The NRC will provide a list of all the approved users.
3. Provide telephone assistance during regular business hours, e.g. 8:00 a.m. to 5:00 p.m., local time, Monday through Friday, to users to diagnose their difficulties with the code.
4. Maintain separate files of user trouble reports and user change requests for each code. On a quarterly basis, the contractor shall provide to the NRC Project Officer a proposed prioritization schedule, and estimated staff effort to meet these requests.
5. On a monthly basis, the contractor shall meet with the NRC Project Officer. The location of the meetings shall alternate each month between NRC Headquarters in Rockville, MD, and the contractor's site. The meetings shall be for one or two days, to discuss the progress of the contract and any other technical details.
6. On a quarterly basis, publish a newsletter to all the code users that will share users' experiences, not otherwise reported, and advise them of code updates, documentation

C.1 (Continued)

changes, workshops and other items of interest to the users.

7. On a yearly basis, the contractor shall provide one training workshop for 20-25 novice and advanced users of the codes. The location of the workshop shall be alternated each year between the U.S. and Europe. The costs for the first year will be reimbursed by the NRC and every course thereafter will be on a cost recovery basis.

TASK AREA 2:

Perform code maintenance and upgrades for each code with strict adherence to ANSI standards* so as to assure code portability, code accuracy by quality assurance testing, documentation of code improvements, and code integrity by traceability procedures. The work is to be performed in a Quality Assurance (QA) environment.

Subtasks:

1. Perform engineering analyses of user-reported errors and document those analyses, the safety significance of the problem and their priority. Based on a priority assigned by and the NRC Project Officer, correct errors found by code users, by giving highest priority to those of great safety significance and low cost, and low priority to those of small safety significance. If error corrections require significant resources (more than one staff month) to correct, the contractor shall provide to the NRC Project Officer a written evaluation and proceed with error correction only after written approval from the NRC Project Officer. Conduct all code configuration controls according to applicable IEEE quality assurance standards* or comparable standards. Copies of these standards will be provided upon request. Define QA for error corrections and code improvements and submit a report describing these procedures (see Section F).
2. Code improvements and improvements in user convenience features shall be required throughout the contract period. However, these cannot be defined in advance, but deficiencies will be identified by NRC, its contractors, CAMP members or other users. As directed by the NRC Project Officer, these shall be evaluated to determine their importance and estimated cost to improve and implement, but shall be implemented only upon written approval of the NRC Project Officer.
3. Code improvements which take advantage of advances in computer capabilities, and new experimental and assessment results shall be evaluated and recommendations made to NRC concerning their implementation, including schedule and cost.

C.1 (Continued)

4. Maintain and improve a formal process for developmentally assessing the codes against new experimental data and/or when modifications are made to the codes. The process shall be structured and automated to the extent practical and shall contain assessment cases sufficient to test and verify the code capabilities and the impact of code changes.
5. Prior to release of new versions of the code, the contractor shall developmentally assess, using a wide range of test cases, with particular attention to cases which test the acceptability of model changes made since the last released version that is, through comprehensive developmental assessment assure that error corrections/improvements in one area do not degrade the code's performance in other areas. This assessment shall be documented with an evaluation of each assessment case as well as a comparison of standard assessment cases for the current and prior versions of the code. The developmental assessment comparisons shall be automated to ensure that each new version of the code has gone through all previous development assessments. The assessment data base shall be expanded with applicable test cases as appropriate.
6. Existing code manuals shall be maintained and updated when improvements or error corrections are made and concurrent with the release of a new version of the code. The manuals shall be maintained in an electronic format as well as submitted to the NRC Project Officer for publication as NUREG/CR reports.

*ANS 7-432, IEEE 1012-1986, NUREG/BR-0167, and ANSI/ANS 10.3

TASK AREA 3:

The contractor shall provide CAMP support, National, and International Interactions to all code users under this Task Area. The NRC will provide a list of all current code users which will be divided into two groups: Group 1 will include users working on NRC programs and international users who are CAMP members, and Group 2 users shall include all other users. All efforts performed on behalf of the Group 2 users shall be performed on a cost recovery basis only. User support shall include assistance with diagnosis of code problems, code distribution, engineering analyses, code changes, documentation and testing, and meetings (i.e., 2 CAMP meetings per year for 2 people, 3 days, in the U.S. or Europe).

Subtasks:

C.1 (Continued)

1. Provide members with user support required by the CAMP agreements, e.g., by providing the latest version of the codes and documentation, answering user questions and concerns, and distribute the quarterly newsletter.
2. Participate in and make presentations at CAMP semi-annual meetings, and prepare CAMP and Technical Program Committee (TPC) meeting minutes.
3. On a cost recovery basis, provide CAMP members support not specifically covered by numerous international agreements, e.g., workshops, training, etc. It is understood that the rates shall be the same as charged to the Government.
4. Evaluate CAMP member assessment reports (submitted as in-kind contributions under terms of the CAMP agreement) and submit them to the NRC Project Officer for publication as NUREG-1A reports.
5. Prepare Annual Summary Reports of Independent Assessments performed by CAMP participants for each of the codes.
6. Maintain cognizance of national and international developments in the area of thermal-hydraulic codes/experiments so as to be able to propose modeling improvements to RELAP5 and additions to its developmental assessment test matrix to ensure it retains a state-of-the-art thermal-hydraulic analysis capability.

TASK AREA 4:

The NRC is currently studying the feasibility of consolidating several thermal-hydraulic codes that embody the same characteristics and address specific safety issues into one code. To that end, the NRC assembled a group of experts (e.g., in thermal hydraulics, numerical methods, and computer technology) to assess the capability of existing codes and the attributes that must be included in a future code to fulfil the needs defined below. A plan will be available to the NRC in December 1996, and will then be provided to the contractor. The contractor shall develop the cost to implement the plan and recommend the best means of achieving that end to better match today's and future needs. The specific needs are that the code must not involve reactor design information that is proprietary and must be capable of performing accident and transient analyses for operating reactors as well as advanced reactors. The code shall be easy to modify by the NRC staff to incorporate new models. The code shall include point, 1-D (dimension) and 3-D reactor kinetics to address different stability problems encountered in BWRs. The code shall also have compatible 1-D, 2-D, 3-D, two-phase fluid dynamic

C.1 (Continued)

packages suited to address the components and geometries of interest and significant issues that pose a challenge to current codes, e.g., two-phase level tracking, thermal stratification. The code(s) shall use numeric solution schemes, programming language, and graphical user interface that achieve the best trade-off between code readability, maintainability, ease of use, robustness, (i.e., the ability to successfully run a transient to its conclusion without user intervention), speed and accuracy. The code data base shall be structured to exploit modern computer technology/architectures (e.g., parallel processing), as well as take advantage of developments in two-phase fluid dynamics. Every effort shall be made to make the new code backwardly compatible with the input decks developed for the present codes.

TASK AREA 5 (OPTIONAL):

Should the NRC exercise this task, the contractor shall be required to develop an improved computer code. This may require additional talent and expertise than that needed for maintaining existing codes. At the NRC's discretion, and subject to the contractor assembling a talented team that is capable of developing innovative numerical schemes to solve complex multiphase fluid dynamic and neutronic problems associated with modeling of nuclear reactor accidents, the contractor shall implement the plan, developed under Task Area 4, develop a thermal-hydraulic systems code(s) that would be applicable to all current light water reactor designs as well as the advanced passive LWRs.

NOTE: For estimation purposes, if the optional task is exercised this will be done within the base year of the contract. In addition, if exercised, this task shall be performed in conjunction with tasks 1-4 above.

C.2 GOVERNMENT PURCHASED EQUIPMENT/PROPERTY

The contractor may purchase, upon the NRC Project Officers approval, 5-7 high performance workstations (see Attachment 3 for specifications), and/or upgrade or replace existing computer hardware as needed during the period of the contract to assure that the codes properly utilize state-of-the-art workstation capabilities and to maintain compatibility with the workstations used by NRC, its contractors, and CAMP members (i.e., UNIX). Identification of upgrade and/or replacement hardware shall be presented to the NRC Project Officer and purchases made only after prior written approval of the NRC Project Officer.

In accordance with the contractor's cost proposal and NRC's estimate the following is the estimated amount to be spent on equipment purchased by the contractor: