AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF PAGES
NRC-04-98-045	1	

2. AMENDMENT/MODIFICATION NO	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO	5. PROJECT NO. (If applicable)
M006		RES-C02-327	

6. ISSUED BY CODE

U.S. Nuclear Regulatory Commission
Division of Contracts and Property Mgt.
Attn: T-7-I-2
Contract Management Branch
Washington DC 20555

7. ADMINISTERED BY (If other than Item 6) CODE

DUPLICATE ORIGINAL

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)

Purdue Research Foundation
Attn: Mr. Thomas B. Wright
Sponsored Program Administration
1069 Hovde Hall
West Lafayette IN 47907-1063

(X) 9A. AMENDMENT OF SOLICITATION NO.

9B. DATED (SEE ITEM 11)

10A. MODIFICATION OF CONTRACT/ORDER NO.
NRC-04-98-045

10B. DATED (SEE ITEM 13)
X 07-28-1998

CODE FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

___ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ___ is extended, ___ is not extended.
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
(a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

B&R No.: 26015110205; Job Code: W6698; BOC: 252A;
Appropriation No.: 31X0200.260; Amount Obligated: $135,975

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(A) A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation data, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER (Specify type of modification and authority) FAR Clause 52.217-9

X Option to Extend Term of the Contract (MAR 1989)

E. IMPORTANT: Contractor ___ is not, X is required to sign this document and return 2 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Please see the attached page.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
	Mary H. Mace Contracting Officer
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED
Douglas W. Sobel, Director University Contracting Group	JAN 0 2 2002
(Signature of person authorized to sign)	
16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
BY (Signature of Contracting Officer)	12/31

STANDARD FORM 30 (REV. 10-83)

TEMPLATE-ADM 001

ADM 02

This modification is approved pending (1) receipt of salary verification for Drs. Ishii and Revankar; a Q/A engineer or machine shop specialist; and an instrumentation (instrument) specialist; and (2) clarification of Section VII, Deliverables, item nos. 8 and 9 as discussed with Triva Appleton on 12/27/01. The purposes of this modification are to (1) exercise Option Year No. 4, in accordance with Section I.3, Option to Extend the Term of the Contract, thereby extending the period of performance through December 31, 2002; (2) revise Section B.3, Consideration and Obligation–Cost Reimbursement, to reflect a downward adjustment in the estimated cost for Option Year No. 4; (3) increase the contract ceiling by $129,975 from $986,744 to $1,116,719; (4) increase the obligated amount by $129,975 from $986,744 to $1,116,719; and (5) change the Statement of Work in accordance with the contractor's technical proposal dated December 20, 2001 and the enclosed two (2) pages. Accordingly, the following changes are hereby made:

1. Section B.3, CONSIDERATION AND OBLIGATION–COST REIMBURSEMENT (JUN 1988), paragraphs (a) and (d) are deleted in their entirety and replaced with the following:

   "(a) The total estimated cost of this contract is $1,116,719, which includes the basic contract ($303,072); Option Year No. 1 ($242,000); Option Year No. 2 ($191,800); Option Year No. 3 ($249,872) and Option Year No. 4 ($129,975)."

   "(d) The amount obligated by the Government with respect to this contract is $1,116,719. It is estimated that the amount obligated will cover performance through December 31, 2002."

2. See the attached 2-paged Statement of Work describing the effort to be performed during Option Year No. 4 as the 6 subtasks of Task 4.

3. Section F.8, DURATION OF CONTRACT PERIOD (MAR 1987) ALTERNATE 2 (1987) is revised to read as follows:

   "This contract shall commence on July 28, 1998 and will expire on December 31, 2002. "

A summary of obligations for this contract, from award through the date of this action, is provided below:

Total FY98 Obligation Amount	$303,072
Total FY99 Obligation Amount	$242,000
Total FY00 Obligation Amount	$191,800
Total FY01 Obligation Amount	$249,872
Total FY02 Obligation Amount:	$129,975
Cumulative Total of NRC Obligations	$1,116,719

This modification obligates $129,975 of FY02 funds.

All other terms and conditions of the contract remain unchanged.

STATEMENT OF WORK

MODIFICATION 6 TO NRC-0498045 (RES-W6698)
PUMA INTEGRAL TEST FACILITY

Task 4 Option Year 4 - PERFORM AND ANALYZE SEPARATE-EFFECTS TESTS

The contractor will perform a series of BWR flow instability tests. The objectives of these tests are to:

(i) Obtain experimental data on BWR RPV instability with a range of inlet loss coefficients, system inventories, reactor powers, and reactor pressures.
(ii) Obtain experimental data on BWR RPV flow instability with power feedback.
(iii) Evaluate the TRAC-M code using the obtained data and identify TRAC-M model deficiencies. This task involves preparation of an input model of the PUMA facility in either TRAC-B or TRAC-M format.

WORK REQUIREMENTS:

The contract shall perform and analyze separate-effects tests to provide BWR flow instability data with power feedback inside the reactor pressure vessel (RPV). These data will be used to assess the ability of the TRAC-M code to simulate two phase hydraulic instability, which involves preparation of a input model of PUMA (TRAC-M or TRAC-B format), running the code, and assessing the code performance. The contractor shall perform experiments for typical BWRs at full power, start-up, shut down, and other situations where instabilities are likely to occur. To accomplish the objectives, six separate subtasks must be completed.

Subtask 1. Scaling

Since the PUMA facility was originally scaled from the SBWR design, the contractor shall perform a scaling study to ensure the data obtained from experiments are prototypic of a typical BWR plant. If the analysis proves that scaling distortions exist with respect to a typical BWR, then these distortions shall be explained and the test conditions set to minimize them. In particular, since PUMA is designed for low pressure condition, the scaling analysis must address pressure scaling.

Subtask 2. Analytical Modeling of the BWR RPV Instability

A two-phase flow analytical model shall be developed to predict the RPV instability before the experiments start. The stability boundary shall be studied parametrically for a range of core inlet loss coefficients, reactor powers, and reactor pressures.

Subtask 3. PUMA Core Modifications

PUMA core inlet shall be modified to allow measurable and adjustable loss coefficients. The adjustable inlet allows parametric studies with a range of inlet losses. Proper instrument modifications shall be made to ensure the best void-fraction feedback measurement for the void-power feedback instability experiment.

Subtask 4. Parametric Flow Instability Experiment

A test matrix shall be developed for experimental study of flow instability with a range of inlet loss coefficients, the system inventories, reactor powers, and reactor pressures. The test matrix shall clearly state the operational conditions which instabilities will occur and identify the data that must be measured to characterize the instability type. The text matrix proposed by the contractor shall be approved by NRC before the experiments are initiated. In each parametric study, the instability type should be identified (Ledinegg, flow pattern transition, pressure drop, multiple channel, density wave, etc . . .). The contractor shall ensure reasonable void measurements in the core region are taken. The measurements shall include void faction at various section of the reactor, downcomer flow, temperatures, and pressures at various locations and all critical data specified in the test matrix developed under Subtask 4.

Sublask 5. Power Feedback Instability Experiment

Normal BWR inlet loss coefficients shall be used during the experiments involving instability with power feedback. The heater power shall be controlled based on the reactor kinetics calculation, where the void feedback and fuel conduction time lag are included. The contractor shall ensure suitable void-fraction feedback measurement for the void-power feedback instability experiment. The measurements shall include void faction at various section of the reactor, downcomer flow, temperatures, and pressures at various locations and all critical data specified in the test matrix developed under Subtask 4.

Subtask 6 - TRAC-M Assessment

The contractor shall prepare an input model of PUMA(either in TRAC-B or TRAC-M input format), run the computer code, compare the code results to the data, drawing conclusions concerning code performance and reasons for any discrepancies.

REPORTING REQUIREMENTS AND DELIVERABLES

The contractor will prepare a final report to summarize and analyze the test data. The report should include: (1) a state-of-art survey of all the BWR instability data available in the open literature, (2) a description of the PUMA components and instrumentation involved in the tests, (3) scaling methods used for the experiment planning, (4) detailed figures showing the exact location of each instrument, (5) measurement uncertainty of each instrument, (6) test conditions such as power, pressure, temperature, void fraction, and mass flow rate, (7) comparison between the PUMA data and code results of relevant parameters that are responsible for driving the particular instability mode, and a clear description of the instability mechanism, (8) conclusions and recommendations for model improvement, (9) the report shall be in both text and electronic format (pdf if possible), the experimental data shall be in NRC Databank format, and the computer code input deck shall be in electronic format.

PERIOD OF PERFORMANCE

Task 4 shall be completed by December 31, 2002.