

A. 51-20334
N/KI-20335

Selection Statement
for
Formal Methods for Life Critical Systems

On September 9, 1994, I met with the Source Evaluation Committee (SEC) appointed to evaluate proposals for Formal Methods for Life Critical Systems. The Committee presented the procurement history, the evaluation procedures, and the results of the evaluation of the proposals submitted.

PROCUREMENT OBJECTIVE

The objective of this procurement is to provide research in the development of practical life-critical system verification methods and demonstrations. NASA Langley Research Center has been developing techniques for the design and validation of flight critical systems for over two decades. Although much progress has been made in developing methods which can accommodate physical failures, the design flaw remains a serious problem. Formal methods offer the most scientifically-defensible means to removing design flaws from the digital systems used in aerospace vehicles. The major goal of this effort will be to make formal methods practical for use on life-critical systems developed in the United States, and to orchestrate the transfer of this technology to industry through use of carefully designed demonstration projects. This effort will build on the recent advances in formal methods to extend/enhance existing formal methods for life-critical system design problems.

The request for proposals reserved the right to make multiple awards. The resulting contract(s) will be term contract(s). The term for issuance of task assignments will be sixty (60) months. Each contract will include a total of 35,000 productive research hours, inclusive of options. The primary place of performance will be the Contractor's facility.

Seventy-five (75) firms received the RFP which was released on May 16, 1994. The following firms submitted proposals by the specified date and time of June 30, 1994 at 4:00 P.M.

- Computational Logic, Inc.
- Odyssey Research Associates, Inc.
- SRI International

EVALUATION PROCEDURES

A Source Evaluation Committee was appointed to conduct the evaluation of proposals received in response to the solicitation. Prior to the release of the RFP, a detailed Evaluation Plan was developed by the Evaluation Committee and

approved by the Selection Official. The RFP contained four (4) representative task assignments to give the offeror greater visibility into the type of tasks that may be assigned in the course of the contract and to allow NASA to use the responses for evaluation purposes. In addition to the sample tasks, the RFP contained eighteen (18) capabilities that were used to evaluate the offeror's formal verification system.

The evaluation plan included a numerical and adjective scoring system for the Mission Suitability subfactors. The plan also stipulated that the Committee would evaluate, but not score, Cost, Relevant Experience/Past Performance, and Other Considerations. Further, the plan provided for the assignment of an adjective rating to the latter two (2) factors.

The evaluation factors/subfactors and the relative importance of each as set forth in the evaluation plan/RFP are summarized below:

Factor 1 Mission Suitability

Subfactor 1 - Understanding the Requirement	25%
Subfactor 2 - Technical Approach	40%
Subfactor 3 - Personnel Qualifications	20%
Subfactor 4 - Management Plan	15%

Factor 2 Cost

Factor 3 Relevant Experience and Past Performance

Factor 4 Other Considerations

Subfactor 1 - Financial Condition and Capabilities
Subfactor 2 - Contract Terms and Conditions
Subfactor 3 - Small Business/Small Disadvantaged Business Subcontracting Plan

The RFP and the Evaluation Plan stated that the numerical weights assigned to subfactors under Mission Suitability are indicative of the relative importance of those evaluation areas and that the weights will be utilized by the Selection Official as a guide. The RFP further stated that in the selection of a contractor(s) for negotiation leading to contract award, Mission Suitability, Cost, and Relevant Experience and Past Performance would be of essentially equal importance. Other considerations would be of less importance than each of the other three factors.

The SEC evaluated the proposals in accordance with the approved Evaluation Plan. Initially, each member individually reviewed the proposals to determine if any should be rejected as patently unacceptable. There were none considered patently

unacceptable. The SEC, with the concurrence of the Contracting Officer, elected to proceed with the Alternate (Streamlined) Evaluation Procedure, as set forth in the Plan.

Each Committee member evaluated in detail the technical proposals and individually developed strengths and weaknesses for the four (4) Mission Suitability subfactors. In addition, consultants were used to evaluate certain designated subfactors. The Committee held discussions to arrive at a consensus set of strong and weak points for each of the Mission Suitability subfactors.

The Committee members reviewed each business proposal to evaluate the factors of Cost, Relevant Experience and Past Performance, and Other Considerations. Proposed costs were reviewed and discussed with the Committee's Cost and Pricing Analyst. In addition, the business proposals were reviewed to determine any impact on the Committee's Mission Suitability evaluation. Preliminary probable costs were developed for each firm. The Committee formulated any questions where appropriate for each of the offerors.

Written discussions were held with and BAFO's requested from all offerors. Answers to questions and BAFO's were received and evaluated. The evaluation was finalized by assigning a consensus adjective rating to Mission Suitability. This was derived by converting the adjective rating to numerical scores for each Mission Suitability subfactor and weighing these scores by the weights set forth in the RFP and Evaluation Plan. A probable cost was developed for each offeror. The factors of Relevant Experience and Past Performance and Other Considerations were also assigned adjective rating but not scored.

EVALUATION FINDINGS

Set forth below in order of ranking is a summary of the Mission Suitability findings for the three (3) offerors.

SRI International

The proposal submitted by SRI received an overall Mission Suitability rating of Excellent. In the area of Understanding the Requirement, the proposal contained many major strengths. SRI demonstrated a thorough understanding of verification methodology, aircraft system design, all aspects of system and subsystem verification, and fault tolerance and real-time theory. In regards to technical approach, SRI's proposal reflected strengths in all tasks areas and only one minor weakness. For example, SRI's technical strengths include an excellent understanding of the issues associated with authenticated Byzantine agreement and clock synchronization and extensive capabilities to perform formal verification. The personnel proposed reflected a highly qualified research team with knowledge in all required disciplines. SRI proposed a strong management plan.

Odyssey Research Associates, Inc.

The proposal submitted by Odyssey received an overall Mission Suitability rating of Very Good. The proposal reflected several strengths and weaknesses in the area of Understanding the Requirement. ORA demonstrated an understanding of the industry climate, system and subsystem verification, and a variety of different formal method tools and approaches. However, ORA failed to demonstrate an understanding of the requirements for certifying aircraft electronic systems and lacked discussion of aircraft system design and fault tolerance and real-time theory. With regard to technical approach the proposal reflects several strengths and only one weakness. These strengths include; a unique capability to conduct formal verification of implementations, a thorough understanding of extending the verification system to support object-oriented programming, and a good approach to fault tolerant clock synchronization. However, ORA's proposal lacked adequate discussion of the level of effort required to complete each task. The personnel proposed reflected a highly qualified team with knowledge in most of the required disciplines. A sound management plan was proposed.

Computational Logic, Inc.

The proposal submitted by CLI received an overall Mission Suitability rating of Fair. In the area of Understanding the Requirement, there was one strength and several major weaknesses. Although CLI's proposal demonstrated an understanding of system and subsystem verification techniques, they failed to demonstrate an understanding of the requirements for certifying aircraft electronic systems and lacked discussions of recent work in fault tolerance and real-time system analysis. With regard to the technical approach, there were several strengths and many major weaknesses. CLI's technical strengths include a carefully engineered theorem prover with a strong emphasis on soundness and well designed and useful modularization features provided in the verification system. However, CLI's proposal did not address recent and important work in generalizing clock synchronization to cover transient faults. Their approach to extending the verification system is inadequate and the stated capability of ACL2 to handle higher order logic constructions is extremely limited. The personnel proposed lacked experience in most of the required disciplines. CLI's proposed a poor management plan.

COST

The Committee's cost evaluations were based on the costs and fixed fee proposed by each offeror for the total level of effort including option(s). The SEC evaluated the validity of the proposed costs in terms of the offeror's understanding of the requirement and cost realism. In addition, a probable cost was developed. The ranking (low to high) for proposed and probable costs, including fixed fee is listed below.

SRI International
Odyssey Research Associates, Inc.
Computational Logic, Inc

RELEVANT EXPERIENCE AND PAST PERFORMANCE

In evaluation of the Relevant Experience and Past Performance, the Committee assigned an adjective rating of Excellent to SRI International which had highly relevant experience and excellent past performance. Odyssey Research Associates and Computational Logic were assigned a rating of Very Good. Each have relevant experience and very good past performance.

OTHER CONSIDERATIONS


For this factor, an adjective rating of Very Good was assigned to all three proposers. For all of the offerors, the financial condition was found to be adequate for contract performance. The terms and conditions were accepted by each of the offerors. Since Computational Logic and Odyssey Research Associates are small businesses, a subcontract plan was not required. SRI submitted an adequate subcontract plan.

SELECTION DECISION

After an assessment of the final evaluation findings, I have concluded that the SEC performed its duties in accordance with the policies and procedures set forth in NASA regulations. Further, I conclude that the Committee's evaluation was objective and fair.

I have reviewed the need for multiple awards with respect to programmatic need. Based on this review of the Center's projected forthcoming requirements for formal methods for life critical systems, two awards are appropriate. Consequently, SRI International and Odyssey Research Associates are selected for final negotiations leading to contract award for this research.

In making this decision, I have considered Mission Suitability, Cost, Relevant Experience and Past Performance to be of essentially equal importance. Other Considerations was of less importance than each of the other three factors.


James Y. Taylor
Contracting Officer

9-22-94