Letter and Attachment to following:

ESSCO
Old Powder Mill Road
Concord, MA 01742
Attn: Mr. A. Cohen, President

Marketing Manager
E-Systems
Commercial Division
P. O. Box 226031
Dallas, TX 75266

Harris Corporation
Government Communications Systems Division
P. O. Box 37
Melbourne, FL 32901
Attn: Mr. Richard Phelan, Antenna Group

Radiation Systems, Inc.
1501 Moran Road
Sterling, VA 22170
Attn: Mr. R. E. Thomas, President

Raytheon Company
141 Spring Street
Lexington, MA 02173
Attn: Mr. M. J. Arkin, Manager, Marketing Services

Rockwell International
Electronics Operations
Central Bid Registry
1200 N. Alma Road
Richardson, TX 75081
Attn: Mr. L. B. Marx, Manager, Contracts Bid Registry

GTE Communications Systems Division
77 A Street
Needham, MA 02194
Attn: Manager of Marketing

Satcom Technology, Inc.
Norcross, VA
Attn: Mr. David Speed, Vice President, Sales

May 21, 1981

Associated Universities, Inc., (AUI) operating the National Radio Astronomy Observatory (NRAO) under a contract with the National Science Foundation, an agency of the United States Government, is soliciting expressions of interest and prequalification information from firms who may have the personnel and facilities to design, manufacture and precisely measure radio telescope surface panels calling for extremely close tolerances. The surface panels the NRAO wishes to acquire are to be installed on the NRAO's 36-foot (millimeter wave) telescope located on Kitt Peak Mountain near Tucson, Arizona. It is anticipated that a Request for Proposal (RFP) will be issued to qualified firms interested in being considered for this work within the next 30 days.

Attached is a general outline and description of the work that will be called for in the proposed RFP, including a description of the size and shape of the telescope reflector surface, the surface characteristics, and a statement giving the allowable manufacturing tolerances for the panels, along with a method for calculating the accuracy of each individual panel. Where possible, we have stated our requirements for the panels as falling within an acceptable range or as minimum or maximum values. The reason for this is to give potential suppliers the greatest opportunity to use (or to adapt) their existing tooling, manufacturing processes and/or panel measuring devices and techniques to meet our requirements and thereby to minimize the overall cost of the panels. (Emphasis note: The individual panel manufacturing accuracy of 50 microns (0.050 mm or 0.002") RMS is an absolute upper limit and, while panels with an RMS value of less than 50 microns would be preferred, an RMS value in excess of 50 microns would be unacceptable.)

Some additional information of interest to potential suppliers:

1. Anticipated Contract Award Date: Late July, 1981.

2. Type of Contract: Firm Fixed Price (FFP).

3. Panel Delivery Date: Four months after contract award date--or sooner.

4. FOB Point: Vendor's Plant. (However, the vendor will be required to pack and crate the panels in non-returnable and resuable packing crates (as approved by AUI/NRAO) and to load the entire shipment on a truck, or trucks, provided by AUI/NRAO at the vendor's plant.

5. Budgetary Estimate for the Work: $160,000.

6. Payment: Upon completion of all the work (manufacturing, packing, and loading of all the panels) and its acceptance by AUI/NRAO at the vendor's plant.

If your firm is interested in being considered for this work, and you believe it is qualified to perform the work as outlined herein, please send us your reply along with any information you think would be helpful to us in assessing your qualifications (e.g., previous work of a similar nature, existing tooling, panel measuring techniques, etc.) to perform the work we require. We would appreciate receiving your response on or before June 1, 1981.

Sincerely yours,

J. Marymor
Contracts Manager

Attachment

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

General Outline and Description of the Work for a New Surface for the NRAO 36-foot Telescope

May 21, 1981

1. General

The National Radio Astronomy Observatory (NRAO) is planning to install a new surface on the 36-foot radio telescope situated at 6300 feet elevation on Kitt Peak, Arizona.

The outline of the plan to be followed is:

(a) NRAO issues a Request for Proposal (RFP) for the fabrication, measurement and supply of suitable surface plates.

(b) A supplier for the surface plates is selected.

(c) NRAO will then design and build a suitable back-up structure (BUS) to carry the surface.

(d) NRAO will pre-assemble the entire BUS and surface. The measuring and setting of the surface on the BUS will be the responsibility of NRAO. After pre-assembly and test the BUS and surface will be re-erected by NRAO on the telescope. The final alignment and test of the telescope will be done by NRAO.

This plan has been adopted since it allows the supplier of the surface some freedom in the actual surface specifications. It is the hope of NRAO that by allowing existing tooling and fabrication methods to be used, this may result in a surface made at the lowest possible cost and in the shortest reasonable time.

2. Specifications of the Surface Plates

(a) Size and shape of the reflector surface

(i) The reflector will be circular in edge shape. Its diameter will be 12.0 m (39'4"). The preferred choice is for a parabolic surface, but a very slightly "shaped" reflector could be accepted. The preferred value for the (f/D)* value is 0.42, but proposals with f/D in the range 0.35 -0.50 would be acceptable.

* f = focal length
D = diameter

(ii) Surface characteristics

A surface which is composed of individual panels, arranged in two or more concentric rings, is preferred. The panels which make up the surface should be of reasonable size; i.e., the total number might be between perhaps 72 and 120. The surface must be solid metal, at least 0.75 mm (0.030") thick. Aluminum or other highly reflective material is preferred. Gaps between individual surface panels should be no greater than 1 mm (0.04"), with lower values preferred. NRAO will design and supply the attachments required to mount the panels to the BUS and to adjust the surface shape. The weight of the proposed surface should be less than 24 kgrm/m^2 (5 lb/sq. foot). The BUS will include a quadrapod subreflector support structure. This will pass through the surface panels at four cutout areas located about 4.3 m (14 feet) from the reflector center. There should be at least 4 attachment points per panel. The telescope will be operated usually in the Cassegrain mode. A central hole, of about 1.4 meter (4' 6") in diameter, should be left in the center of the surface.

3. The Accuracy of the Panels

NRAO wishes to ensure that the telescope surface when mounted and adjusted has an RMS departure from the best-fitted parabolic surface of 70 microns (0.07 mm or 0.0028"). This then requires that the individual panels be made and measured to a very high precision. To state this precision it is desirable to outline the steps by which the precision is determined. In responding to this RFP, NRAO requests that the proposal outlines these steps. The following is an example of how the steps might be described.

(a) After manufacture each panel will be mounted on a suitable measuring machine in the manufacturer's plant, capable of making 3-dimensional measures of the surface shape to a suitable accuracy. Constraints applied to the panel by the mounting points on the machine should be stated.

(b) A grid of points shall be defined for each panel shape and the panel contour shall be measured at each of these points. At least four working points (WPs) shall be marked on each panel and the location of these WPs on the final telescope surface shall be stated. The plan of the measuring grid and points to be measured shall be chosen by the proposer and should give a panel area of about 100 sq. cm (16 sq. inches) for each point measured.

(c) To describe the accuracy of the panel being measured the following computations will be made:

(i) A parabolic reference surface (PRS) of the correct focal length and orientation is passed as closely as possible through the WPs.

(ii) At each measured point the vertical (parallel to the paraboloid axis) distance between the panel surface and PRS is computed. Let it be ε_i.

Then, for N measured points, we define the panel RMS as:

$$RMS = \left\{ \frac{1}{N} \sum_{1}^{N} \left(\varepsilon_i - \bar{\varepsilon} \right)^2 \right\}^{1/2} ,$$

$$\text{where } \bar{\varepsilon} = \text{mean } \varepsilon_i = \frac{1}{N} \sum_{i=1}^{N} \varepsilon_i$$

(d) NRAO considers that the RMS of panels which meet its needs, when measured in this way, must be 50 microns (0.050 mm or 0.002"). A lower figure would be preferred.

4. General Comments

(a) Finish requirements

Surface panels should not be painted on the reflecting surface but should have a temporary coat of a peelable coating film applied after inspection and acceptance. The rear surface (including support shapes and plates) shall be given prime and finish paint coats.

(b) Materials and identification

Proposers shall set forth in their proposal the materials of which the panels are to be fabricated as well as the physical properties of these materials.

All panels to have identifying numbers such that inspection records for each panel may be identified.

5. Acceptance and Delivery

NRAO hopes to be able to accept the panels as meeting its specifications at the manufacturer's plant. This acceptance would be based on the measurement reports. NRAO would then be responsible for transporting the panels from the plant. However, it would be valuable to NRAO if the proposal could suggest and cost a suitable form of crating the panels for transport.