

PRIME CONTRACT NO. NSF AST 79-08925
SUBCONTRACT NO. AUI-197

PRIME CONTRACTOR: Associated Universities, Inc.

SUBCONTRACTOR: Electronic Space Systems Corporation

This is an agreement made this 10th day of August, 1981, between ASSOCIATED UNIVERSITIES, INC., (hereinafter called "AUI"), a New York corporation, and ELECTRONIC SPACE SYSTEMS CORPORATION (hereinafter called the "Subcontractor"), a Delaware corporation, with its principle offices located at Concord, Massachusetts.

AUI has entered into a contract (hereinafter called the "Prime Contract") with the United States of America (hereinafter called the "Government"), represented by the National Science Foundation (hereinafter called the "Foundation"), designated as Contract No. NSF AST 79-08925, for the construction, maintenance, and operation of a Radio Astronomy Observatory (hereinafter called the "Observatory").

The Subcontractor is willing to perform the work required by AUI, and AUI wishes the Subcontractor, in furtherance of the Prime Contract, to perform that portion of the work hereinafter more fully described.

ARTICLE I - SCOPE AND PERFORMANCE OF THE WORK

- A. The Subcontractor shall furnish all the labor and other personnel, materials, plant, and equipment necessary to perform the work described in Schedule A, incorporated herein and thereby made a part hereof, and in accordance with all the Specifications and Terms and Conditions of this Subcontract, included in Schedule B, made a part hereof and incorporated herein.

SCHEDULE A - STATEMENT OF WORK

SCHEDULE B - FIXED PRICE SUPPLY CONTRACT TERMS AND CONDITIONS

SCHEDULE C - SPECIFICATIONS

- B. Work under this Subcontract shall commence promptly upon delivery to the Subcontractor of a copy hereof executed by AUI and shall be completed within the time specified in Schedule A.

ARTICLE II - COMPENSATION

- A. The total fixed price of this Subcontract is established at \$165,822.88, subject to any limitations herein. Payment to the Subcontractor of this amount shall constitute full compensation for the proper performance of the Subcontractor's undertakings hereunder.

ARTICLE III - NOTICES

- A. All notices and communications shall be in writing and mailed or delivered to the Manager, Contracts/Legal, National Radio Astronomy

Observatory, Edgemont Road, Charlottesville, Virginia, 22901, and to the Subcontractor at the address shown above, or to such other place or places as AUI or the Subcontractor, as the case may be, shall designate in writing.

ARTICLE IV - INSPECTION AND ACCEPTANCE

Final inspection and acceptance shall be performed in accordance with the requirements contained in the Schedules attached hereto.

ARTICLE V - ASSIGNMENT TO THE GOVERNMENT

This Subcontract shall be assignable by AUI to the U.S. Government. Subject to such assignment and acceptance thereof by the Government, this Subcontract shall not bind or purport to bind the Government.

(SUBCONTRACTOR)

BY: *Susan M. Lewis*
TITLE: *Sales Manager*
DATE: *Aug. 13, 1981*

ASSOCIATED UNIVERSITIES, INC.

BY: *Kevin Shurt*
TITLE: Acting Director
DATE: 08-17-81

SCHEDULE A - STATEMENT OF WORK

I. SCOPE OF WORK

The subcontractor will provide material and services to design, manufacture, fabricate, test, and deliver the following panels in accordance with ESSCO's proposal for millimeter wave telescope panels submitted in response to the National Radio Astronomy Observatory (NRAO) Request for Proposal #228.

A. Inner Panels

(1) Twenty (20) inner panels shall have an RMS deviation from the specified parabolic shape of less than or equal to forty-five (45) micrometers.

(2) Six (6) inner panels shall have an RMS deviation from the specified parabolic shape of less than or equal to sixty (60) micrometers.

B. Outer Panels

(1) Forty-Four (44) outer panels shall have an RMS deviation from the specified parabolic shape of less than or equal to forty-five (45) micrometers.

(2) Four (4) outer panels shall have an RMS deviation from the specified parabolic shape of less than or equal to sixty-five (65) micrometers.

(3) Two (2) outer panels shall have an RMS deviation from the specified parabolic shape of less than or equal to sixty (60) micrometers.

C. Subcontractor shall not provide targets, target holes, or cut-outs for spar attachments for panels set forth in A and B, above.

D. Drawings

Subcontractor shall provide reproducible dimensional drawings of the inner and outer panels. These drawings shall be limited to use by the National Radio Astronomy Observatory.

II. INSPECTION

A. Subcontractor will provide printouts of raw measurement data from the CMM for each panel to Dr. John Findlay, NRAO, Edgemont Road, Charlottesville, Virginia, 22901, and a copy of the transmittal letter for the raw measurement data to J. Marymor at the same address.

B. Panels that deviate from the theoretical parabolic shape by any amount in excess of the RMS shown in Paragraph I, A and B, above, shall not be presented for reinspection or delivery under this subcontract.

C. Subcontractor shall advise Dr. John Findlay at least ten (10) days prior to the measurements of any panel or panels and the National Radio Astronomy Observatory may elect to have a member of its technical staff witness the measurements or the inspection of each panel manufactured by the subcontractor.

D. Acceptance of panels shall be per the written approval of Dr. John Findlay or his designee.

III. DELIVERY

A. Delivery of items listed above in I A, B, and D shall be completed on or before January 15, 1982.

B. All shipments shall be made F.O.B. the subcontractor's plant, Concord, Massachusetts.

C. Shipping instructions shall be mutually agreed upon between the NRAO and the subcontractor.

D. Packing and Packaging

Subcontractor shall provide packing crates for shipment of the seventy-six (76) panels and shall coordinate the dimensions and tie-down methods with the NRAO.

IV. COMPENSATION

In consideration of the subcontractor's undertaking hereunder, sub-

contractor shall receive the fixed sum of \$165,822.88 for all items required by this subcontract.

V. PAYMENT

A. The subcontractor shall be paid the sum of \$2,181.88 for each panel accepted and delivered, F.O.B. subcontractor's dock, Concord, Massachusetts.

B. Invoices shall be sent to the attention of J. Marymor at the NRAO, Edgemont Road, Charlottesville, Virginia, 22901, with a copy to the NRAO, Fiscal Division, Post Office Box 2, Green Bank, West Virginia, 24944.

VI. WARRANTY

A. Notwithstanding the provisions of Schedule B, Article 2, Inspection, the subcontractor warrants that the material provided hereunder shall be free of defects in workmanship and materials for the period of one (1) year from the date of acceptance at the subcontractor's dock. All defective items shall be returned to the subcontractor, freight prepaid, within a reasonable time after the discovery of the defects in the item. This warranty supercedes any other warranty, express or implied, in connection with the items delivered in accordance with the terms of this subcontract.

B. Subcontractor warrants that it will maintain the ability to produce panels of the same dimensions and quality for a period of five (5) years after completion of deliveries under this subcontract.

VII. IDENTIFICATION AND MARKING

A. Each panel shall be identified with a unique serial number which will also be referred to on the raw CMM taken from the panel.

B. Serial numbers shall be permanently applied to each panel at approximately the same location and in a legible manner.

SCHEDULE C

National Radio Astronomy Observatory

SPECIFICATIONS FOR 12-METER TELESCOPE SURFACE PANELS

June 10, 1981

1. The Reflector Surface

(a) Size and Shape.

The reflector edge will have the shape of a 48-sided polygon. The surface will be parabolic in shape, with a diameter of 12.0 meters (39 feet, 4 inches). Its focal length will be 5.04 meters (200 inches) to within ± 5 cm (± 2 inches).

(b) Characteristics

The surface will be made up of 72 individual panels, arranged in two concentric rings. There will be 24 panels in the inner ring and 48 panels in the outer ring. The surface will be solid aluminum at least 0.75 mm (0.03 inch) thick. Gaps between individual surface panels should be no greater than 2.54 mm (0.10 inch). NRAO will design and supply the attachments required to mount the panels onto the back-up structure (BUS) and to adjust the shape of the reflector surface. The weight of the proposed surface will be less than 20 kg/m² (4 lb/sq. foot). The BUS will include a quadrupod structure which will pass through the surface panels at 4 cut-out areas located about 4.3 meters (14 feet) from the reflector center. The inner panels will each have 8 attachment points to the BUS; the outer panels will each have 6 such points. A central hole of about 1.2 meters (4 feet 0 inches) in diameter will be left in the center of the reflector surface.

2. The Surface Accuracy

NRAO wishes to ensure that the telescope surface when finally mounted and adjusted has an RMS departure from the best-fitted parabolic surface of 70 μ m (0.07 mm or 0.0028 inch). This requires that the individual panels be made

and measured to a very high precision. In order to state this precision, NRAO requests that proposals describe briefly the following steps to be taken to measure and numerically quantify the individual panel accuracies:

- (a) The characteristics and accuracy of the measuring machine should be briefly stated.
- (b) The method of mounting of the plate on the machine and constraints applied to the plate should be noted.
- (c) The grid of points to be measured for each panel shape should be described. The number and location of these points should be chosen by the proposer to be, in his judgment, satisfactory to describe the shape of the panel.
- (d) After the measurements have been made, the RMS shall be derived from these measurements by a method chosen by the proposer. This method should be described in the proposal.

The actual value of the RMS which results from these measurements and steps depends to some small extent on the actual formulae agreed on. However, the upper limit of the RMS which can be accepted by NRAO is 50 μm (0.050 mm or 0.002 inches). The NRAO will also require copies of all the measurement data and the data reduction programs.

3. Materials, Identification, and Finish

The proposer shall set forth the materials of which the panels are to be fabricated, together with the physical properties of these materials.

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

The panels shall be clean, but no paint is required on either the front or back of the panels.

4. Acceptance and Delivery

NRAO intends to accept the panels at the manufacturer's plant. Such acceptance will be based on the measurement results. NRAO will be responsible for transporting the panels from the plant. The proposal should include the cost of packing the panels in suitable non-returnable crates and loading these into trucks at the manufacturer's plant.