NATIONAL RADIO ASTRONOMY OBSERVATORY
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TELEPHONE 505 835 2924 TWX 910 988 1710 VLA SITE 505 772 4011

January 13, 1981

25 METER MILLIMETER WAVE TELESCOPE
MEMO No. 144

See Attached Letters

Farrand
~~Farr and~~ Corporation
99 Wall Street
Valhalla, N. Y. 10595

Attn: Mr. William Grace

Subject: Position Indicating System for a 25 Meter Antenna

Reference: Letter dated January 15, 1980

Gentlemen:

By letter dated January 15, 1980 Farrand Corporation was requested to indicate its interest in and capabilities to provide certain position indicating equipment for a 25 meter diameter high precision antenna. Since this project has now reached a more active state and no response has been received from Farrand Corporation to date this letter is written to request Farrand to inform the National Radio Astronomy Observatory of its interest and capabilities in furnishing the equipment set forth in the letter of January 15, 1980. A copy of that letter is enclosed.

Very truly yours,

William G. Horne
Project Manager, 25M Project

OPERATED BY ASSOCIATED UNIVERSITIES, INC.,
UNDER CONTRACT WITH THE NATIONAL SCIENCE FOUNDATION

FARRAND CONTROLS
Division of Farrand Industries, Inc.

May 19, 1981

Mr. William G. Horne
Project Manager, 25M Project
National Radio Astronomy Observatory
1000 Bullock Boulevard N.W.
P. O. Box O
Socorro, NM 87801

Reference: Your letter dated January 13, 1981

Gentlemen:

Having studied and considered your "Position Indicating System for a 25 Meter Antenna" requirement in 1980 and again this year, we must decline to bid on this equipment.

I am sorry for any inconvenience we may have caused you; I was under the impression that you had been contacted by telephone in February of 1980 when I was in Europe.

We cannot meet the accuracy and resolution requirements with existing components and our present workload precludes our taking on any further developemnt work for low production volume items.

It is unfortunate that we are not producing any items that could be easily altered or converted to your requirements.

We would appreciate being given the opportunity to consider your future requirements. Our engineering workload is not always this heavy and we would be happy to work with you in the future.

Very truly yours,

William H. Grace
Vice President of
Advanced Engineering

WHG/ja

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January 15, 1980

Farrand Corporation
99 Wall Street
Valhalla, NY 10595

Attn: Mr. William Grace

Subject: Position Indicating System for a 25 Meter Antenna

Dear Bill:

In accordance with our telephone conversation of December 19, 1979 in which I inquired as to availability and approximate pricing for position indicating and data converter equipment for a proposed 25 meter antenna to operate at millimeter wavelengths, I am setting forth a very preliminary set of specifications for the system.

General - The system is to consist of two axis mounted transducers (including flexible couplings) and a data converter, one transducer to mount to the elevation axis, one to mount to the azimuth axis of a large tracking antenna. The system will derive digital natural binary information from the transducer on each of the axes for transmission to the data converter which shall provide DTL/TTL outputs of the two antenna axis positions for use with other equipment.

Accuracy - The system accuracy shall be able to provide digital axis position with a resolution of 0.077 arc seconds, an RMS error not greater than 0.2317 arc seconds, a peak error not greater than 0.4635 arc seconds and a peak to peak error not greater than 0.618 arc seconds (essentially what we are saying is a 24 bit inductosyn).

We could use a 22 bit inductosyn with a resolution of 0.309 arc seconds, but the RMS error, peak error and peak to peak errors would have to be as stated above, so I question whether a 22 bit inductosyn could meet our requirements. The allowable errors I have stated would be checked by a measurement of some 120 points in a revolution of the position transducer. The position transducer must meet the accuracy requirements over a dynamic range of 0^{o}/sec to 0.01^{o}/sec with acceleration of $0^{o}/sec^{2}$ to $0.01^{o}/sec^{2}$ under the environmental condition stated hereafter. These are the requirements for tracking operation. Under antenna slewing conditions, velocity to 0.667^{o}/sec and acceleration to $0.25^{o}/sec^{2}$, the error shall not exceed 20 seconds rms. The system shall

$4^{o}.5^{2}$/sec² actual (Les)
Les

provide unambiguous absolute angle data without requiring rotation of the input shaft through any reference position. Since the antenna will rotate in azimuth ± 270 degress (total 540°), a synthetic bit will be generated by use of lead/lag switches on the azimuth axis to differentiate between 0°-360° and 360°-720° through the antenna control unit.

Digital Output Data - The data shall be available from the output register of each axis in 24 bit natural binary form with characteristics suitable for driving two standard load of DTL or TTL logic. The output data should be in the form of binary digits reading from 0° to 360° for CW rotor movement of the transducer. The data is to be available except during the update intervals of not longer than 10 microseconds. During the update interval the system shall provide an inhibit signal for each axis, indicating the time period during which the reading may result in errors due to carry ripple and ambiguity resolution. An alternate method would be a response to an external pulse which would freeze the output for 10 microseconds, to occur once each 0.01 seconds approximately.

Analog Data - An extra 60 Hz → or 400 Hz, size 5 or 15 one speed synchro or resolver accurate to about
30 ~~two~~ minutes, rms, shall be included in each data transducer to provide analog data electrically independent of the remainder of the equipment. Analog display and excitation shall be located in the Antenna Control Unit (by others).

Environmental - The data transducer and transmitter will be located on the ends of the azimuth and elevation shafts of the antenna, exposed to ambient temperatures ranging between -15°F and +110°F, with a humidity of 0-98%, at an altitude of 14,000 feet. The data converter unit which converts the signal from the data transmitter will be located in a standard cabinet in an equipment enclosure at the base of the antenna. The data converter shall operate in a temperature environment of +50°F to +120°F and will be protected from rain. The data transducer/tranmitter units should be temperature compensated and/or heated if necessary or may be furnished with a heater/blower arrangement to keep above ambient and prevent infiltration of dust. Required shielded cables and connectors for transmission of the signals from the data transducers to the data converter, should be provided as part of this equipment - length approximately 75 feet for elevation, 35 feet for azimuth. Plugs for connection from the data converter to the antenna control unit shall be provided in the data converter unit, but cables will be by others.

AC power will be furnished to the position indicating system at 120 volts, single phase, 60 Hz, any other required voltages for the system must be provided by the system. Display of position of each axis will be both analog and digital (in binary form) and will be located in the Antenna Control Unit provided by AUI.

As stated in our conversation, this inquiry is made to determine the availability, accuracy and approximate price of the desired equipment. Requirements set forth above should not be considered as final, and it is understood that pricing is

budgetary and not a quotation. Your assistance and cooperation will be greatly appreciated. Should you have any further questions, please feel free to contact me, and I will try to answer them.

Very truly yours,

William G. Horne
Antenna Division

WGH/dl