SUBMILLIMETER ARRAY TECHNICAL MEMORANDUM

NUMBER: 61

DATE: December 1992

FROM: Q-METRICS, INC

SUBJECT: SUBMISSION OF A BOUND COPY OF THE FINAL REPORT FOR THE THERMAL DESIGN OF THE REFLECTOR ASSEMBLY

SECTION 1 CONCEPTUAL DESIGNS FOR THE REFLECTOR ASSEMBLY THERMAL CONTROL SUBSYSTEM

SECTION 2 PRELIMINARY DESIGNS FOR THE REFLECTOR ASSEMBLY THERMAL CONTROL SUBSYSTEM

SECTION 3 STEADY-STATE, THERMAL ANALYSES OF THE REFLECTOR ASSEMBLY THERMAL CONTROL SUBSYSTEM

SECTION 4 TRANSIENT, THERMAL ANALYSES OF THE REFLECTOR ASSEMBLY THERMAL CONTROL SUBSYSTEM

Q-metrics

#61

Number: 61
Date: December 30, 1992
From: William Bruckman

December 30, 1992

Smithsonian Astrophysical Observatory
60 Garden Street
Cambridge, MA 02138

Attention: Mr. William R. Bruckman
Antenna Design Leader

Subject: Submission of a Bound Copy of the Final Report for the Thermal Design of the Reflector Assembly

Reference: SAO Purchase Order No. SA2-27746

Dear Mr. Bruckman: QMI 93046

One bound and one unbound copy of our final report are included. In response to your question raised during our last meeting, the radiative shields on the upper nodes were simulated only in those runs which considered aluminum thermal fins on the ears. The intent was to thermally isolate the upper nodes as completely as possible from the reflector panels. The result was to make the upper nodes more sensitive to the daily variation in ambient air temperature.
Based on our discussions at the time of our joint review of the draft copies of the report, the recommended thermal design for the reflector assembly comprises:

- o enclosing the truss structure within an insulated envelope (to exclude direct sunlight) which is designed to have loosely fitted panels that allow ventilation of the truss by ambient winds,
- o decreasing the thermal conductance through the panel mounting hardware by using washers fabricated from a material having a low thermal conductance, e.g., NEMA G-10 fiberglass,
- o thermally insulating each steel node so as to increase its thermal time constant (to approximately match the thermal time constant of the central hub), and
- o including a drilled and tapped hole in each steel node to allow for the modular addition of temperature sensors and, possibly, heaters. A provision for the necessary wiring should be included in the overall design of the reflector assembly and associated cabin enclosure.

A thermal control subsystem based on the above recommendations, in conjunction with CFRP tubes having a near zero coefficient of thermal expansion, could be operated as either a totally passive, (long thermal time constants), a hybrid (heaters to set initial node temperatures followed by long thermal time constants) or an active (active heaters with programmable temperature set points) system for controlling the temperature distribution of the back up structure.
We appreciated the opportunity to work with you on this interesting assignment and look forward to continuing to support your project as needed.

Very truly yours,

David W. Almgren

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