

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

August 9, 1989

MEMORANDUM:

TO: Addressee
FROM: J. Payne
SUBJECT: First Meeting of the Active Surface Group

This memo is a summary of the first meeting of the above group.

COMPOSITION OF GROUP: Fred Crews
Lee King (absent)
Rich Lacasse
Ron Maddalena (absent)
John Payne
Dwayne Schiebel (visitor)

OBJECTIVE OF THE GROUP:

We decided that the objective of the group for the next few months would be to define the various options that are available for controlling the telescope surface. The output of the group will be a report (by the end of December) describing each option, its cost, and its performance.

THE OPTIONS:

We see the options as follows. Each one is an add-on to the previous one. All options assume an adjustable surface.

(1) The Minimum

Surface adjusted only with elevation angle. The surface would be measured initially using holography, adjusted to the correct shape using the surface actuators and then used for several months with the surface continuously adjusted with varying elevation angle. The surface would be remeasured and reset on a time scale of weeks or months.

- (2) Add to (1) temperature sensors over the backup structure and feed adjustments into the surface based on the outputs of the various sensors. The adjustments would be based on a model of the surface.
- (3) Add to (2) the outputs from a series of wind sensors placed around the telescope.

(4) Continuous Closed-Loop Adjustments

The surface is continuously adjusted for all disturbances and is tied into the pointing reference system. Such a system would probably only be turned on for high-frequency operation. A decision to implement such a system along with the construction of the telescope would probably mean the bypassing of options (2) and (3).

QUESTIONS:

In order to start even the most preliminary design for option (1), we need answers to the following questions:

- Question 1: We need to define the nature of the surface. Is the surface fabricated from individually mounted panels, each with its set of adjustment actuators, or do we fabricate the surface from rafts of panels? At the very least we need a range of values for the number of actuators and the force required of the actuators. We prefer the raft concept for obvious reasons.
- Question 2: We need to know the range of movement of the actuators. This depends on whether we correct to the "best fit" parabola and move the ~~subreflector~~ to adjust the surface to maintain its original shape. The difference in the required range of movement is large. We prefer the "best fit" solution for reasons of reliability and resolution.

PROGRAM OF WORK:

Our program of work for the next month or two (assuming the above questions are answered) will be as follows:

- (1) To investigate all possible suitable actuators and arrive at cost, performance, and reliability numbers.
- (2) To investigate the cost and desirability of including position sensors with each actuator.
- (3) To initiate a detailed study of the various ways of realizing Option (4).

THINGS THAT ARE HAPPENING:

- (1) Norm Broten, who is very knowledgeable about actuators, will visit NRAO next month.
- (2) We are arranging a visit to JPL to learn about a new technique called SHAPES which JPL has developed for measuring antennas. It looks as if SHAPES may be applicable for our use in implementing Option (4).
- (3) We will visit the Keck telescope at the same time as the JPL visit.

- (4) We have located a company in DC that is developing a laser distance measuring instrument that may be suitable for our purposes. The company markets a system that has an accuracy of $25\ \mu\text{m}$ at a range of 5 m. They have a contract from NASA to extend the range to 100 m. We are getting additional information and will arrange a visit if this seems desirable.
- (5) Fred Crews and Rich Lacasse will visit Nobeyama with a view to learning all they can about their active service control.
- (6) Dietmar Platner (responsible for the IRAM 15-m adjustable surface) will visit Green Bank or Charlottesville in the near future.

cc: D. Emerson