NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

October 11, 1978

25-METER TELESCOPE MEMORANDUM NO. 110

To: Working Group Members

From: J. W. Findlay

Subj: 25-Meter: Things To Do

1. At our October 5 meeting I sensed a feeling that, despite our funding difficulties, we are not doing enough for the 25-meter telescope. With this feeling I concur, and so as an Appendix to this memo I have written a first draft of things to do. Let me comment on this draft.

   (a) It has surely many omissions. Also, it may be that some of the suggestions do not need to be done. I put down what came fairly quickly to me.

   (b) Some of the things are already being done; some are not. Some need outside help, but some can be done using people within NRAO. There are, for example, surely some people within NRAO who could spare some time to work on the tasks in Paragraph 4. (My memo #104 of February 15, 1978 said this--but alas, to no effect.)

   (c) The existence of a PERT plan is excellent, but it does have some dangers. See the classic reply from Koko to the Mikado to explain why he, as chief executioner, had not--as ordered--chopped off a head. "Well, your Majesty, when you order a thing to be done, it is as good as done. And if it is as good as done, why not say it is done?" Thus, although an item appears in PERT, we should still examine it to see whether it may need work now, as well as later, and be careful not to regard it as "as good as done".

2. If members of the Working Group, or others, think there is some merit in producing a better list than the Appendix, and subsequently going to work on some selected items in the list, I would be willing to try to prepare a more thoughtful plan on which work might start. So please let me have your comments.

JWF/pj

cc: W-Y. Wong, L. King, M. S. Roberts,
D. E. Hogg, H. S. Liszt, F. N. Owen

THE 25-METER TELESCOPE
(A List of Things To Do)

J. W. Findlay

1. Telescope Structure and Foundations

(a) Complete structural design by homology program. (In progress, W-Y. Wong)

(b) Check total design by Strudl or Nastran. (Planned, L. King)

(c) Complete dynamic analysis--assuming foundation resilience known. (In progress)

(d) Check whether joint design is critical--either provide guidelines for joint design or actual designs for critical joints.

(e) If not done under (b), run temperature effects using Monte Carlo techniques, but based on reasonable temperature environmental data.

(f) If not done under (b), check wind-load effects for some simplified wind loads.

(g) If results of (f) look doubtful, go to (d) in Astrodome--Paragraph 2.

(h) As soon as foundation data is known, return to and check (c).

2. Astrodome Structure and Foundations

(a) Check overall design concept with a consultant. This is not to be a detailed stress analysis but rather an answer to the question--is Lee King's concept a reasonable and cost-effective approach to the design of our astrodome?

(b) Do astrodome foundation design--after foundation data is known.

(c) Is there likely to be any interaction between astrodome and telescope via the foundations? In particular, what will be telescope tilts due to wind forces on the astrodome? Are these serious?

(d) If the telescope design is such that irregular winds of mean value about 4 m/sec (9 m/hr) cause noticeable pointing errors, consider ways of estimating wind patterns within the astrodome. Are wind-tunnel tests of any use? Do we really mean that the telescope should work with 50 mile/hour winds blowing and the astrodome door open (MAG memo of 1 May 1978)?

3. Drive Systems

(a) Carry through first mechanical design of both telescope and astrodome drive systems. Make first selection of components as far as the drive motors to be used.

(b) Do a block diagram design of the joint telescope/astrodome drive system. To what extent are these systems to be tightly linked and is any operator/observer interaction with the telescope/astrodome drive interface needed? If so, how and when is it needed.

(c) Do a similar design to (b) for the astrodome door drive system. How is it integrated with the astrodome and telescope drives? What freedom is needed in door operations which are separate from astrodome and telescope operations?

(d) Make a first mechanical design for the sub-reflector mounting and its drives. Specify all sub-reflector movements needed. Check that dynamic behaviour of the sub-reflector and its support legs is OK.

4. Control System

The final system which controls the telescope and astrodome must be developed as an integrated system into which all control and correction functions can be set. It must also suit the telescope observers, be capable of some modifications and improvements as experience dictates and yet it must

continue to present a fairly simple and fairly constant face to the observers.

(a) Definition of operational needs. Define the needs for control for all parts of the telescope. These parts include the telescope drives, the sub-reflector drives, the astrodome and its door drives and the provision from the control system of data-taking commands. This first control definition should include the various limit switch and safety devices.

(b) Define the telescope's need for pointing corrections.

(i) The form of the principal pointing correction algorithm should be defined. This will affect the pointing control program and the sub-reflector focus program. Does it include a sub-reflector tilt or translation program?

(ii) It will probably be desirable to include in the pointing corrections the effects of a varying atmosphere and the effects of measured temperatures at various parts of the telescope structure and at some points within the astrodome. The first step at defining how many and what sort of input parameters should be made so that the control system can accommodate them.

(iii) As an extension of (a) above, the possible need for an automatic pointing calibration and correction program should be studied. Does the telescope need such a program; more importantly, can one be devised which is of general use?

(iv) Will there be a need to modify any servo responses as operational conditions change?

(c) Control system design concepts. After the first definition of (a), (b) above have been made, one or more control concepts should be worked out in block form. These should show where control can and should originate; how separate control stations should be set up between manual/automatic control; how the various servo-loops get closed in the control systems, and so on.

The discussion of these system design concepts should be allowed considerable time. In particular, there should be good interaction between the following types of people:

(i) Observers--line and continuum.

(ii) Computer people, both FORTH and other schools

(iii) Electronic systems designers.

As a personal comment, this area is one where we should do well, but it will take some time and some good people.

5. Housekeeping

Many important details come under this heading. Some, in random order, are:

(a) What goes into a main control room, what into other rooms, and is there an equipment room rotating with the telescope?

(b) What are our specifications for temperature control, weight, waveguide, etc., for the telescope vertex room?

(c) How will the cable-wrap system work? A first definition of cables and waveguide should be made.

(d) Will the pintle-bearing/azimuth encoder create problems? No wheel and track antenna of high positional precision has yet been built.

(e) Encoder couplings working to better than one arc second can be difficult. Is present coupling design satisfactory, or do we worry?

6. The Doors are Closed!

There can be no violent changes in any of the presently chosen concepts:

(a) The telescope specifications and performance as set out in Table I.1 of Vol. I of the proposal. (Improvements to these are possible. For example, the telescope will now depress about one degree below the horizon.)

(b) The telescope will follow closely the design of Vols. I and II. It will be enclosed in an astrodome.

(c) The main reflector will be parabolic--not shaped for greater gain.