

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

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25-m Millimeter Wave Telescope Memorandum No. 123

To: H. Hvatum

From: B. Peery

Subj: 25-Meter Millimeter Wave Telescope Design Activities Summary

Since issue of the proposal "A 25-Meter Telescope for Millimeter Wavelengths" in September 1975, the NRAO has expended considerable effort toward updating and improving the conceptual plans and designs set forth in the proposal. All branches of NRAO (scientific staff, engineering staff, and operating staffs from Tucson, the VLA and Green Bank) have participated within the time and funds available from normal operations.

The following list of specific areas and items indicates the type and extent of this effort.

1. The possible sites have been studied and a definite recommendation for Mauna Kea in Hawaii as the site was made.
2. An exact location for the telescope on Mauna Kea was chosen and an accurate topographical map of the area was made. (Contract with All States Aerial Surveys, Inc., Pittsburgh, PA.)
3. A conceptual building and site plan for the Mauna Kea site has been developed. (In house)
4. Contact, on an informal basis, has been established with other research groups and the University of Hawaii operating on Mauna Kea to keep abreast of problems and special equipment required to do research at that site and elevation. This input will be incorporated in the final design.
5. Continual refinement and updating has been carried on of the homology conceptual structural design for this telescope. The updated designs are being cross checked using other structural programs widely used by industry, such as NASTRAN and STRUDEL, for agreement in performance of the structure.
6. A review of operating conditions and operating requirements resulted in a definite decision to use an astrodome with an RF transparent spherical shaped door instead of a radome.

7. A conceptual structural design of a radome has been developed. This design has been used to partially develop preliminary design drawings.

8. Samples of twelve different types of materials have been obtained and tested for RF transmissivity for use in the astrodome door. Some of these materials have been placed at high altitudes, such as Mauna Kea, Kitt Peak and Mt. Lemmon, for exposure tests. The search continues for new, improved materials that might meet the requirements.

9. Two surface measuring systems ("The Rat" and "Stepper") have been developed and tested for measuring and assisting in setting the final surface of the telescope. Research continues on improving and updating these systems and other possible systems of surface measurements.

10. Two prototype machined, cast aluminum surface plates have been manufactured, with a surface accuracy of 50 μm . (Aeronutronics Ford, Palo Alto, CA)

11. We have a contract with the Harris Corporation, Government Products Division, Melbourne, Florida for the manufacture of three lightweight, molded carbon fiber sandwich construction surface plates to be delivered in September, 1979. The materials of carbon fiber and nylon honeycomb seem to indicate lighter weight, better thermal and structural qualities and faster and cheaper fabrication when compared with machined cast aluminum. The results will not be known until the contract is completed.

12. In July, 1977, Volume II "A 25-Meter Telescope for Millimeter Wavelengths" was issued, reflecting some of the work outlined above.

13. Cost estimates have been updated to reflect inflation, new information and various funding schemes.

14. A number of funding plans have been developed.

15. A Program Evaluation and Review Technique--PERT--has been developed for the design and construction of the site, telescope and astrodome. This is reviewed and updated at frequent intervals.

16. Preliminary study and design has been started for foundations and soil analysis for the site on Mauna Kea. Soil analysis will be done under contract with a suitable engineering firm.

17. A conceptual design has been developed for the temperature control of the astrodome, using outside air.

18. High-frequency electronics is being developed continually in Charlottesville and Tucson for use on the 36-foot, with plans for its adaptation to the 25-meter telescope.

19. Research is being done into the human problems related to high elevation (4000 meter) work environment. Is oxygen enrichment or pressurization needed?