

NATIONAL RADIO ASTRONOMY OBSERVATORY

11/06/79

Engineering Memo No. 134

TO: R. Brown

FROM: Buck Peery

SUBJECT: 140' Telescope - A Review of Engineering Activities and
Status Report

Over the years the Engineering Division has assisted in a number of activities designed to improve and understand the 140' structure and its behavior. Most of these activities have had varying degrees of success with an overall result of improvements to the efficiency and pointing of the telescope. "Fine tuning" or improvements continue with the knowledge that we are reaching the point where such improvements make smaller and smaller impacts on the overall operation and the activities become more complicated and costly.

A brief summary of some of the activities under consideration and their status follow:

1. Move the Sterling mount to correct for what is calculated to be the difference in the electrical axis and the designed structural axis at zenith position. This requires moving the Sterling mount 3 cm to the east. This is a permanent change in the location of the Sterling mount inside the feed support structure. This will require two days down time of the telescope plus some shop work preparing for the field work. No special funding will be required. Drawings for the modification have been made and turned over to the shop with plans to make the modifications on the telescope in January 1980, weather permitting.
2. Modify the operators on the deformable subreflector to get more deformation. This is being done and will be tested in November 1979. This will not require any telescope down time and the cost is included in present funding.

3. Modify the Cassegrain house for the new receivers. The design for these changes is well under way and part of the work has been sent to the shop for fabrication. The design is adjusted from time to time to agree with the latest design of the receivers and feeds. It is estimated that this will require approximately 2 weeks of telescope down time. The down time will be in conjunction with that required by electronics and will run concurrently with them. This work is presently planned for late spring 1980. The cost for these modifications are included in present funding.
4. Readjust surface. This activity would not cost much in dollar expenditures but will require considerable telescope down time. The telescope surface will need to be measured again at least once and maybe more to establish an accepted reliable value for the existing surface. The Cassegrain house makes it impossible to monitor the settings with a theodolite from the top. This means the monitoring of the adjusting must be done from underneath, in the structure. This will be very time consuming. After the adjusting is finished, it will be necessary to re-measure the surface to check the final results. It is estimated this would require a month to six weeks telescope down time. At the present time we have reservations as to the value of readjusting the surface. The surface has been readjusted twice since it was originally installed and the surface rms is still about the same .050". History indicates that the readjusting had little effect on the efficiency of the telescope.
5. Provide horizontal motion of the Sterling mount to correct for the difference between the electrical axis and structural axis at any position of the telescope. This requires a major modification to the telescope as this additional motion will add considerable weight at the focal point and

require major modifications to the feed support structure. The existing load at the focal point exceeds the design load by a factor of 2. Cables have been installed between the feed legs to compensate for the excess load. Further loading will require a complete new feed support structure and feed legs. A very preliminary estimate of the investment of time and money for new feed legs, new feed support structure and a new Sterling mount with at least three motions--vertical (focus), rotation (polarization), and horizontal (adjustable correction for deflection of electrical axis) is \$400K with 18 months of design and preparation plus 4 to 8 months telescope down time for installation. This is a major design and construction project and would require the services of outside consultants and contractors. The modification of the feed legs lead to other considerations which need to be considered at the same time such as new cabling, new cryogenics lines, modifications to the service building, counterweights, etc. These changes or modification would be handled in the time estimate given above but they are not included in the dollar estimate.

6. Insulating the feed legs. - This activity is estimated to cost \$9K and would require approximately three weeks telescope down time. If cabling or cryogenic lines were to be changed or modified, this estimate could increase in time and cost.
7. Install a new and better surface. This is major modification as it will require modifications to the structure. It is estimate this would require 18 months to design and fabricate plus 8 to 12 months telescope down time to install at an estimated cost of \$900K. This is a major modification which will require the service of outside consultants and contractors.

8. Back-up Structure. It is known that the telescope does not perform the same west of the meridian as it does east of the meridian. This is thought to be caused by some change in the back-up structure. We do not have an explanation for this difference in performance as the structure is thought to be symmetrical. There are no plans for modifications. We will continue to study the problem with the hopes of determining the cause and then consider what might correct it.

We do not have a feel for a value to place on these modifications as to their relative improvements to the operation of the telescope.

There are no projected schedules for activities 4 through 8. It is understood that a surface measurement with an RF system is proposed for this spring. After activities 1 through 3 are completed, the results reviewed and the RF measurements compared with other surface measurements, scheduling of other activities will be reviewed.