

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia
May 5, 1976

ENGINEERING MEMO #101

TO: F. Crews B. Turner
J. Findlay S. von Hoerner
R. Fisher H. Brown
D. Hogg B. delGiudice
W. Howard J. Ralston
H. Hvatum W. Wong
K. Kellermann

FROM: B. Peery - Engineering

SUBJECT: 140' Improvements

Attached is a copy of the writer's summary of the meeting of February 12, 1976, which was made immediately following the meeting. It will be noted that the summary lists a number of actions to be taken. All of these actions have not been completed and some have not been started.

The following is a summary of how things stand to date:

S. von Hoerner has written Engineering Internal Report 100 - "Thermal Deformations of the 140-ft Building" which has been distributed to all who attended the meeting.

Members of the Engineering Division have developed the following estimates based on the best information they could secure without requesting binding bids:

Estimated time to complete after Award of Contract - Actual Installation does not include time for scheduling or weather

20% Contingency

<u>Action under Consideration</u>	<u>Estimate</u>	<u>Contingency</u>	<u>Total</u>	<u>Estimated time to complete after Award of Contract - Actual Installation does not include time for scheduling or weather</u>
1. Spray insulation on yoke arms and polar shaft (1½ inches thick).	\$10,000	\$2,000	\$12,000	2 weeks
2. Spray insulation on deck (3 inches thick) with electric heat beneath it and concrete on top for a wear surface.	11,500	2,300	13,800	2 weeks
3. Spray insulation on pedestal above the deck (1/2 inch thick).	3,800	760	4,560	1 week
4. Spray insulation of concrete base supporting the telescope (everything below the deck) (3 inches thick).	105,600	21,120	126,720	12 weeks
<u>Total Estimated Cost insulation</u>			<u>157,080</u>	<u>14 weeks</u>
(Note: Electric heat and concrete in 2 above to be furnished and installed with our forces.) (This does not include any painting.)				
5. Design and manufacture of deformable subreflector	23,000	4,600	27,600	6 months
Materials flexure test \$2,000				
Dynamic analysis 2,000				
Engineering & tooling 6,000				
Manufacturing 13,000				
6. Deforming System and interface with telescope and operating system. (This is for materials only - labor by our forces.)	24,200	4,840	29,040	10 months
7. Test stand and instrumentation for field testing	2,500	500	<u>3,000</u>	<u>3 months</u>
<u>Total Estimated Cost deformable subreflector</u>			<u>\$ 59,640</u>	<u>16 months</u>
<u>TOTAL - All Actions</u>			<u>216,720</u>	<u>16 months</u>

Note: It would take approximately 3 months to let a contract before the 16 months could start.

The above estimates are based on conceptual designs for a subreflector and deforming system. Considerable detail design is yet to be done requiring many man hours. Areas yet in question and requiring definite answers are:

1. What is the best material for the subreflector to accept deforming as proposed?
2. Will the subreflector deform as predicted?
3. What is the best system for deforming?
4. Will the subreflector and deforming equipment operate and survive with nutation?
5. Can the subreflector and all deforming equipment be built in a package that weighs 300 pounds or less? This weight limitation is a must as we are now above the weight limit for the Sterling mount.

BP/bbs

Summary of Meeting - 2/12/96.

Problems with 140' which might be improved-

1. Pointing accuracy
2. Efficiency

Major cause of pointing error is thermal deformation -
in :

1. Yoke arms -
2. Polar shaft
3. Concrete Base -

Suggested Corrections :

1. Insulate yoke arms -
2. Insulate Polar Shaft -
3. Insulate Deck surface to include some heat -
4. Build insulated building over entire polar shaft & most of deck - Provide heat in side building - (In lieu of 2 & 3)
5. Install thermistors thru out structure to feed data to computer for Correction -
6. Install electronic levels in structure to feed data to computer for Correction -

Agreed to :

1. Pursue #1 & #2 with spray on insulation by getting estimating costs - & detail specs.
2. Do further study to exactly how much would help - Estimating Cost & Specs & detail of #3.
3. Deferred #4 until other alternates are completed -

4. - #5 & #6 would be used on limited basis
5. - Some thought be given to optical & light ray detection of telescope deformation for computer input.

Major ~~cause of source of~~ conditions leading to lower efficiency are:

1. Gravity Deformation
2. Surface conditions of dish.

Suggested Corrections:

1. Construct "deformable" sub reflector to correct for #1
2. Correct surface once conditions ~~is~~ of surface established - for #2.
3. Include some correction in deformable sub reflector for #2 if feasible.

Agreeded-

1. To refine design, update estimate, & include an estimate for all ancillary projects required by "deformable sub reflector" - Such as: Frame interface, counter weights, electronics & interface, cabling, computer interface, nutating system interface & test equipment - etc. - #1
2. Study possible measurement of each panel on telescope by designing and testing a template or templates - Preparatory to

a study & recommendations for 2 & 3-

Engineering To:

1. Write specs, and secure more accurate estimate for spray on insulation on yoke arms and polar shaft
2. Write specs, and secure a good estimate for insulation, floor and heat on deck after more definite parameters are received-
3. Refine design of deformable sub reflector and deforming system, write specs, and secure an estimate.
4. Describe, write specs, and secure estimates for all ancillary equipment, systems, and interface needed to make the deformable sub reflector a complete operating system-
5. Design, have built & test templates to measure individual panels-
6. Write summary report of progress & estimates of each for further review and possibly action. (Target time 4-6 wks)

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May 24, 1976

MEMORANDUM

TO: F. Crews B. Turner
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FROM: B. Peery - Engineering

SUBJECT: Engineering Memo #101

Please replace the cost estimate in the memo with the attached revised estimate.

The revised estimate is to revise item 4. The previous estimate used too large an area (square footage) to be insulated as well as including items 2 and 3.

Attachment