NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

April 27, 1983

TO: Tucson 12 Meter Group

FROM: Buck Peery - Engineering

SUBJECT: New Elevation Drive System

We have started our investigation into installing a new drive system for the elevation motion of the 12 meter. There are a number of questions on which we need your assistance in answering.

Using the parameters we normally specify for this motion, we have made a preliminary estimate for the drive system. We find this will require two 3 hp 1750 rpm motors with a gear train having an over-all reduction ratio of 31,500 to 1 on each motor. Two systems are used for torque biasing (two systems that can work together or in opposition for fast and accurate positioning). A chart is attached showing what we think the existing parameters are, the parameters we made our estimate on, and a third column for you to fill in with what you think the parameters should be.

A brief summary of the main questions:

1. What speeds should we design for? Slew? Tracking? Acceleration?

2. What are the existing worst position torques? Stiction? Unbalance? (after final counter balance additions).

3. What wind torque should we design for? Would you collect some data, while operating, showing the relation between torque motor currents, wind velocity, wind direction and antenna position (elevation and azimuth), from which this figure might be determined.

4. How far down (degrees from zenith) do you need to operate the telescope? The existing bull gear is not symmetric about the zenith position and, when the antenna is pointing near the horizon, one end of the bull gear is near the vertical axis thru the center of the azimuth platform. The yoke arm structure occupies the center position and covers most of the azimuth platform. This requires that the elevation drives be mounted on a cantilever structure off both sides of the yoke arm base similar to the existing auxiliary drive installation. An addition to the bull gear will be needed on the down side of the yoke arm to accommodate the second elevation drive. It is

24 inches wide and 42 inches high. The estimated weight of such a package is 1500 to 2000 pounds.

5. Will shunt-wound field type D.C. motors be acceptable for the drive system? I do not know of a source for 3 hp permanent magnetic motors.

6. Will the control system (D.C. amplifiers and power supplies) be capable of controlling the D.C. motor speed smoothly over a range larger than 100:1 (the rule of thumb standard)?

7. Are there any special specifications the control system will have for the drive system?

8. How would you propose to handle this project?

   a. Buy individual pieces for you to assemble and install.
   b. Contract for package systems for you to install.
   c. Contract the complete installation.
   d. Some other approach.

Parameters	Existing	Estimate	Required	
Slew Speed	20°/min	20°/min		?
Accelerate	5°/min/min .08°/sec/sec	.25°/sec/sec		?
Tracking Speed	.25°/min	.25°/min (100/1)		?
Inertia - Elev. Axis	4,179,560 lb ft sec^2	4,179,560 lb ft sec^2		
Wind Torque	?	15,000 lb ft		?
Unbalance and Stiction Torque	?	1,750 lb ft		?
Bull Gear - P.R.	94.50"	94.5"	94.5"	
length	126° (205")	168° (275")		?
Pinion P.R.	3.00"	3.00"	3.00"	
wide	2.00"	4.00"	4.00"	
Gear Train Ratio (not including bull gear)	Aux. System N.A. (0)	1000:1		?
Motor - Type	Torque	D.C. Shunt Field		?
Speed - F.L.	.0555 rpm	1750 RPM		?
Torque - F.L.	1000 lb ft	9 lb-ft		?
No. Reg.	2	2		?
H.P.	-	3		