25 Meter Millimeter Wave Telescope
Memo # 118

NATIONAL RADIO ASTRONOMY OBSERVATORY

Charlottesville, Virginia

April 16, 1979

MEMORANDUM

TO: 25-m Design Group

FROM: W-Y. Wong

SUBJECT: Measurement of air movement inside an astrodome

Recently there are some concerns about how the 25-m behaves in pointing, when the outside wind speed is high (up to 50 mph as mentioned in memo 107 and 113) and the astrodome is in opened position.

For exposed telescope, the wind pointing is better understood. For telescope which is partially shielded, the correlation between wind speed, wind direction and the pressure distribution on the surface is not available. I cannot locate any literature on this subject matter. In order to deal with the question in a more quantitative way, I can suggest three alternatives:

1. Produce the answer imperatively. Wait till the telescope is built, then work out the correlation between wind speed, wind direction, dome direction and wind torque on the structure. I believe it is a valid suggestion so long as we don't plan to modify or to strengthen the present backup structure design.

2. Take advantage of the existing telescope with an astrodome (36-ft in Tucson, 16-ft in Texas), set up the measurement and start to collect some data.

3. Assign a study contract to a firm or other research institute to make measurement or wind tunnel test. The MPI of W. Germany was planning to do something like this. Their cost estimate was about 50 K to 60 K DM (1978 cost).

In case we adapted the second approach, which I believe we can do ourselves without high cost and large man power, then measurements on the 36-ft would be a good start. The data would be a good order of magnitude information for the 25-m design (Fig. 1). In case it warrents some closer look, then we might try to repeat the measurement with the Texas 16-ft. The Texas 16-ft seems to have a closer telescope-dome proportion to the 25-m design (Fig. 2).

The equipments required for the measurements is illustrated in the block diagram (Fig. 3). They include:

Wind Sensors - Minimum of three sets of anemometer and vane combination needed inside the dome, and one set for the outside. Each set requires its own signal conditioner with two 1-5 DCV output. I think we should borrow these equipments if possible.

Digital Voltmeter - A/D converter

BCD Interface - An I/O card interface to the computer.

Real Time Clock - An I/O card for real time information.

Computer - Data collecting with data reduction capacity. The HP9825 has .25 megabytes tape storage it can collect data continuously for 4 weeks without interruption. We have the computer and Mike Balister agreed on letting us use it for a limited period of time.

Interface to motor and position sensor of the telescope - Already existed for the 36-ft.

The set of data to be collected are as follows. Each data set is to be multiplexed and stored to the cassette tape every 5 minutes. They are:

Time - Gives implicitely the date, hour, minute and second in which the data are taken.

Telescope position - In elevation and azimuth. The dome position is implicitely defined since it follows the telescope during normal operation. Note should be automatically taken if otherwise. The voltage output of position sensors varies between 0 to 3.6 V_{max}.

Wind speed and direction - The DC voltage from the wind sensor's signal conditioners are converted and stored.

Motor torques - The elevation and azimuth drive motors currents varies between 0 to 50 amp. The voltage output is 1 V per 10 amp. These conversions are already set up for the 36-ft on-line computer.

The main power estimate is:

Tucson	3 man-weeks	(John Payne)
Green Bank	12 man-weeks	(Ron Weimer)
Charlottesville	12 man-weeks	(Woon-Yin Wong)

Cost estimate is about 10 K. The measurement schedule is one month during 1980 telescope down period. These estimates are rough and subject to revision.

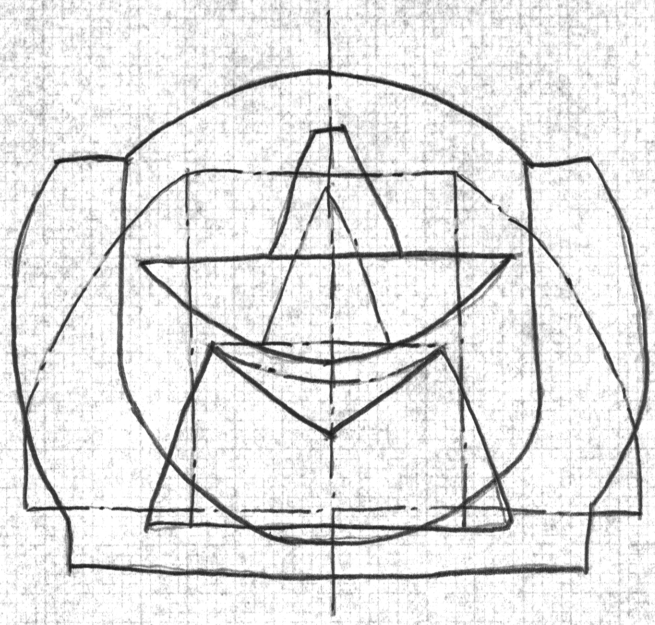

Fig. 1 With equal volume comparison of 11-m in Tucson & the 25-m

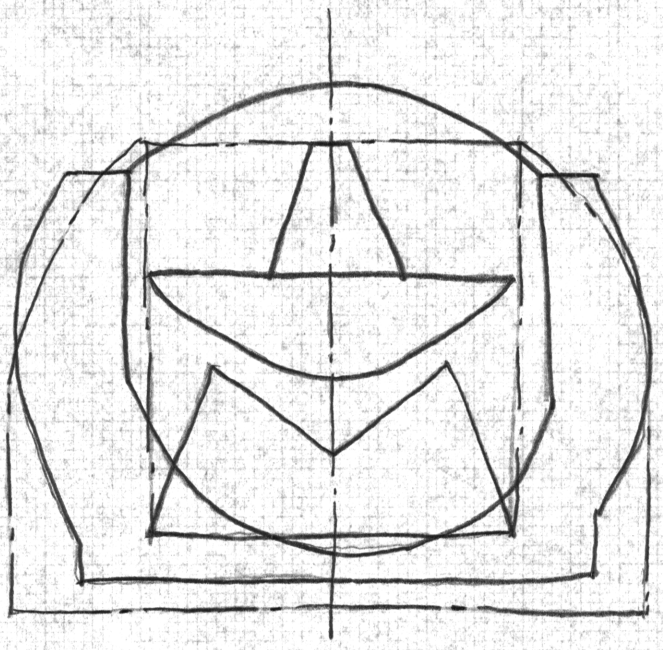

Fig. 2 With equal volume comparison of 49-m in the Univ. of Texas & the 25-m

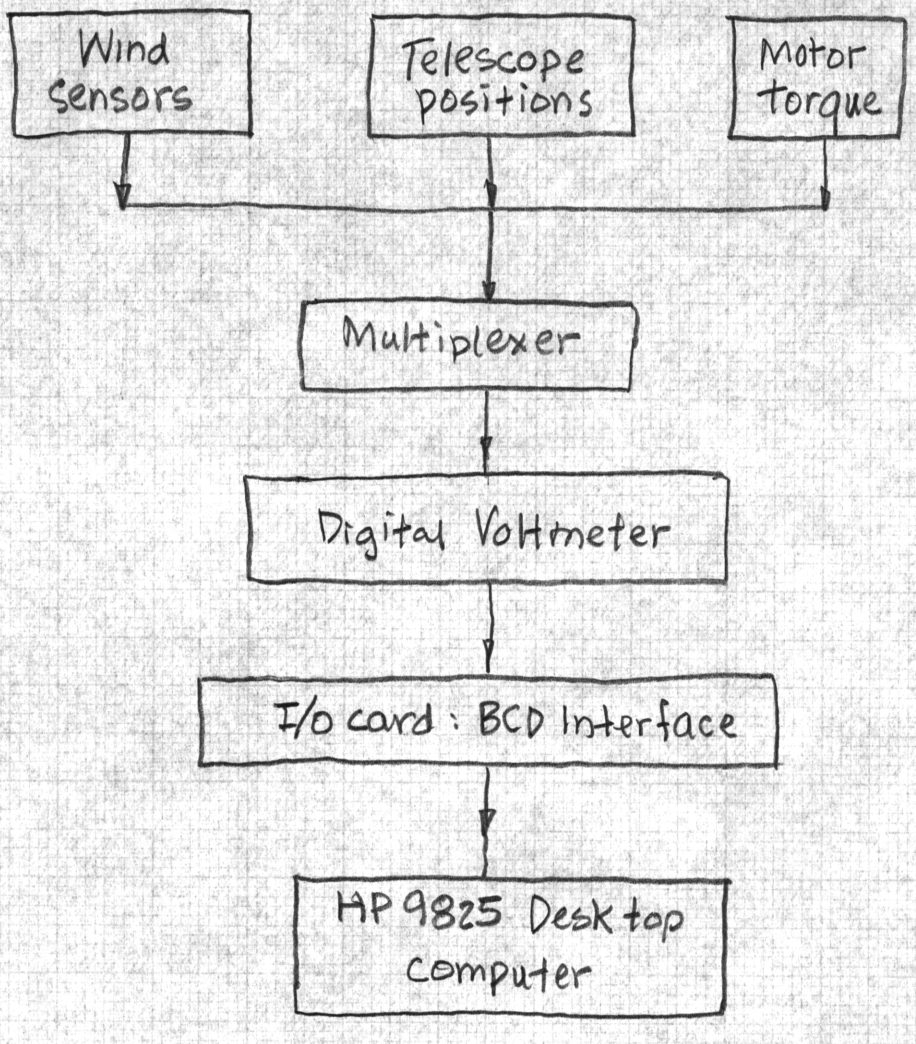

Fig 3. Instrument configuration