NOTES ON IMPROVING THE 36-FOOT TELESCOPE

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1. Introduction

A few of us (J.W.F., R. Werner, W-Y. Wong, L. King, J. Payne) met yesterday to review what is being done on the ways to improve the 36-foot. These notes summarize what has been done and what we propose to do.

2. Reflector Design

(a) L. King has produced a first design of a structure for the telescope above the elevation axis. This design (which has been done twice with identical geometry but different weights) is basically similar in dimensions to that described in Werner's memo of July 17, 1973, paragraph 8, except that King has adopted a space-frame design. This is very amenable to computation and we generally like it. King's memo is available to anyone who wants it. The main results for the heavier of the two designs are:

Weight of whole structure $\doteq$ 49800 lbs. (includes surface). RMS due to gravity deflections could be 0.0015 inch (0.038 mm) over the range of elevation angles from zenith to 30°. The structure is planned to carry Philco-Ford surface plates on adjustable mounts.

(b) We plan to adopt King's heavier design as our baseline for further studies. We may come back later and go for further improvements, but not now.

(c) Next steps which we plan are as follows:

(i) Accept as a working goal a surface error budget approximately as follows:

Error Source	1σ value mm/in.
(1) Gravitational distortion zenith to 30° elevation	0.040 (0.0016")
(2) Manufacturing tolerances of sur-face plates	0.040 (0.0016")
(3) Setting tolerances of plates	0.040 (0.0016")
(4) Effects on surface tolerance of 7 ± 3 m/h winds	0.025 (0.001")
(5) Effects on surface tolerance of 2°F temperature differences	0.025 (0.001")
(6) Manufacturing tolerance of sub-reflector	0.025 (0.001")

RSS = 0.0817 mm (0.0032")

These are suggestions only, but lead to an RSS value of $\lambda/15$ at 1.2 mm.

(ii)   Examine the error sources in this budget, using King's design, to see whether they can be met. People involved would be:

(1)   Already done by King.

(2)   Probably just OK (J.W.F. and Horne)

(3)   R. Werner, J.W.F., J. Payne. Anyone else who wants to join.

(4),(5) King.

(6)   Payne.

3. The Pointing Error Budget

(a) A proposed budget - The HPBW at 1.2 mm (1.4 λ/D) will be 23 arc seconds. We will thus accept as a first shot at a pointing error budget the following:

Error Source	1σ value - arc seconds
(1) Half-bit on encoders	1.24
(2) Effects of 7 ± 3 m/h wind on drive and control system—measured on sky	1.0 worst case; 0.5 used in RSS
(3) Same wind on King's reflector support, including subreflector motion	1.5 used in RSS; 3.0 worst case
(4) Same wind on existing tower when it carries King reflector	3.0 for worst case; 1.5 used in RSS
(5) ΔT = 2°F on King reflector	2.0
(6) ΔT = 2°F on the existing tower	2.0
(7) Stick-slip and limit cycling on drive system	2.0
(8) Acceleration and tracking errors of servo—no wind—angles measured on sky	3.0 worst case; 1.5 used in RSS

RSS = 4.53 arc seconds

This RSS value is 1/5 (HPBW)—but I have to accept it at present. Note that wind and ΔT effects may not occur together. However, it emphasises our usual conclusion "pointing is a big problem for mm-wave antennas".

(b) Work to be done

(1) I believe this is OK for existing encoders.

(2),(7),(8) Werner and/or Payne.

(3),(5) King.

(4),(6) Wong.

(c)   Information needed

We need:

(i)   Measured locked-rotor frequencies of existing telescope for both axes. On azimuth at zenith and at some other elevation angle.

(ii)   Confirmation of drive torques available on existing telescope.

(iii)   Check on inertia of existing dish.

(iv)   Friction/stiction effects on both axes of existing dish. Does cable-wrap influence stiction?

All above could come from Payne at Tucson, but see note at end on manpower.

4. Servo Design

Werner in his July 17 memo has a tabulation. Payne has computed two systems and can provide the results. We see little difficulty in the servo design when we have the data outlined in 3(c) above.

5. Manpower

We are using all those mentioned so far. Will W. Horne and G. Peery please watch out that we don't foul up their priorities for other (perhaps more important) work. Will M. Gordon consider how and where B. Ulich joins in? Will S. Weinreb consider the extent of J. Payne's involvement when he gets to Tucson? I don't see any problems but will be happy to discuss anytime with anyone.

Horne and J.W.F. will be in Tucson for the AAS meeting. We might have a further discussion at that time.

JWF/pj

<u>Distribution</u>

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