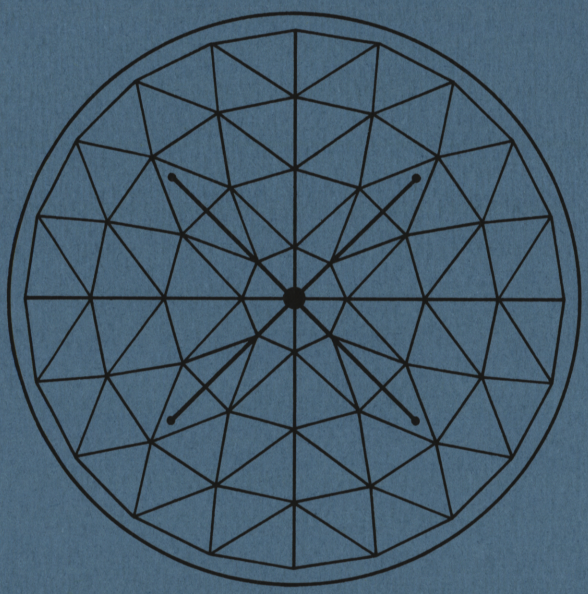

SECTION 4.0

NATIONAL RADIO ASTRONOMY OBSERVATORY
POST OFFICE BOX 2
GREEN BANK, WEST VIRGINIA 24944
TELEPHONE ARBOVALE 456-2011

PROJECT: 300 FT. DIA. HOMOLOGY RADIO TELESCOPE

SUBJECT: POSITION REFERENCE PLATFORM COST ESTIMATE

4.0 COST ESTIMATE

PREPARED BY O. R. Heine APPROVED BY _____ SUBMITTED BY S.D.L.

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4.1 GENERAL

The following cost estimates are based on quotations received from manufacturers of instruments and components considered herein and on estimated design-assembly and check-out cost figures, which are in line with cost factors applied by the industry.

All costs are inclusive, a reasonable mark-up (overhead, G&A, profit); thus, the total estimate should come close to what should be expected if the system would be quoted by a suitable manufacturing concern.

4.2 COST OF "ALL OPTICAL" REFERENCE
(3 arc. sec. system accuracy)

ITEM NO.	DESCRIPTION	MATERIAL $	ENGINEERING $	LABOR $	START-UP $
1	Laser Auto Collimators by K&E 6 req'd.	$66,000	- -	- -	$ 5,000
2	Optical polygon by Davidson Optronics 1 req'd.	13,000	- -	- -	1,000
3	Auto collimator selection matrix 1 req'd.	3,000	$ 3,000	$ 4,000	2,000
4	Auto collimater control chassis 6 req'd.	7,000	1,000	3,000	1,000
5	Inductosyn Transducer Del-Electronics 2 req'd.	18,000	- -	- -	2,000
6	Inductosyn Translator 22 bits Nat.Binary (Fecker Div. of Owens-Illinois) 2 req'd.	38,000	- -	- -	2,000

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ITEM NO.	DESCRIPTION	MATERIAL $	ENGINEERING $	LABOR $	START-UP $
7	Digital Readout 2 req'd.	$ 1,200	$ 1,400	$ 800	$ 400
8	Collimator temper. control systems 6 req'd.	7,200	2,000	3,600	2,000
9	Platform temper-control system 1 req'd.	3,000	3,000	2,000	1,000
10	Retransmission system (two axes)	1,600	1,000	1,200	600
11	Manual command station (two axes)	2,800	2,400	1,800	800
12	Platform position-ing servo (two axes)	12,000	2,000	2,000	1,200
13	Platform drive torque motors & tachometers (two axes)	7,000	2,000	2,000	1,000
14	Digital comparator 22 bits, Nat. Bin. (two axes)	6,000	3,000	4,000	1,000
15	Digital Zeroing 22 bits, Nat. Bin. (two axes)	6,000	3,000	3,000	1,000
16	Digital to analog con-verter, 12 bits Nat. Bin. w. sign (two axes)	4,000	3,000	2,400	1,600
17	Mechanical/struct. parts	8,000	6,000	4,000	6,000
	SUBTOTAL	$203,800	$32,800	$33,800	$29,600

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4.2.1. SUMMARY:

1.	Material	$203,800
2.	Engineering	32,800
3.	Labor	33,800
4.	Start-up/Check-out	29,600
	TOTAL COST OF REFERENCE PLATFORM	$300,000

4.3 COST OF COMBINATION OPTICAL-GRAVITY REFERENCE PLATFORM
(5 arc. sec. system accuracy)

ITEM NO.	DESCRIPTION	MATERIAL $	ENGINEERING $	LABOR $	START-UP $
1	Laser auto collimators by K&E 6 req'd.	$66,000	- -	- -	$ 5,000
2	Optical polygon by Davidson Optronics 1 req'd.	13,000	- -	- -	1,000
3	Auto collimator control chassis 6 req'd.	7,000	1,000	3,000	1,000
4	Pendulous tilt sensor by Kearfott 1 req'd.	7,000	- -	- -	2,000
5	Force Balance accelerometer by Kearfott 1 req'd.	5,000	- -	- -	2,000
6	Rate gyro by Kearfott 1 req'd.	14,000	- -	- -	3,000

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ITEM NO.	DESCRIPTION	MATERIAL $	ENGINEERING $	LABOR $	START-UP $
7	Tilt sensor signal conditioner 1 req'd.	$ 600	$ 1,100	$ 700	$ 300
8	Accelerometer signal conditioner 1 req'd.	600	1,100	700	300
9	Gyro control and signal conditioner 1 req'd.	2,000	2,000	1,000	1,000
10	Signal analog computer 1 req'd.	4,000	5,000	2,000	2,000
11	Synchro transmitter incldg. housing, by Vernitron 2 req'd.	9,400	1,400	1,000	1,000
12	Servo receiver 2 req'd.	16,000	6,000	4,800	2,000
13	Digital readout 2 req'd.	1,200	1,400	800	400
14	Re-transmission system (two axes)	1,600	1,000	1,200	600
15	Manual command station (two axes)	2,800	2,400	1,800	800
16	Platform positioning servo (two axes)	12,000	2,000	2,000	1,200
17	Platform drive torque motors and tachometers (two axes)	2,200	1,200	600	400

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ITEM NO.	DESCRIPTION	MATERIAL $	ENGINEERING $	LABOR $	START-UP $
18	Digital comparator 20 bits Nat.Binary (two axes)	$ 5,000	$ 3,000	$ 3,000	$ 1,000
19	Digital zeroing 20 bits Nat.Binary (two axes)	6,000	3,000	3,000	800
20	Digital to analog converter, 12 bits Nat. Bin. w. sign (two axes)	4,000	3,000	2,400	1,600
21	Platform Temp. Control 1 req'd.	3,000	3,000	2,000	1,000
22	Collimator Temp. Control 6 req'd.	7,200	2,000	3,600	2,000
23	Mechanical/structural parts	8,000	6,000	4,000	6,000
	SUBTOTAL	$197,600	$45,600	$37,600	$36,400

4.3.1 SUMMARY:

1. Material	$197,600
2. Engineering	45,600
3. Labor	37,600
4. Start-up/Check-out	36,400
TOTAL COST OF REFERENCE PLATFORM	$317,200
Say	$320,000

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4.4 COMPARISON

Both systems would work equally well; however, the "all optical" system would be more accurate and would also cost less than the "gravity/optical" system.

The material cost for the "all optical" system would be higher than for the combination "gravity optical" system, but would have only 17 basic components vs. 23 for the second system, which would require less engineering and labor and hence results in a lower systems cost.

The second system would be easier to install and check-out than the first system. This would result in a lower telescope assembly and check-out cost which should be considered in the preparation of the cost summary for the entire telescope system.

It is estimated that these cost savings would amount to approximately $20,000.00.

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