

KG
11366
v. 943

LXVI

Plate

2751

2752

Harvard Lunar Plates

Measures and Reductions

Mary Fowler.

Volume LXVI

Plate No.	Date	Page
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1913 Feb. 14

27 51

Star - Measures

1914 Apr. 1.

1

	d	N
1	16355	20051
16.4	1288485	1352029
12.4	87	15
	59	62
	<u>12.3471</u>	<u>13463</u>

	d	N
1	16121	20219
	984031	1649506
	39	94
	29	29
	<u>16.3711</u>	<u>3725</u>

	d	N
2	15260	18091
19.4	915658	1419496
28.6	59	98
	65	10
	<u>28.6109</u>	<u>6097</u>

	d	N
	15889	19241
	922030	15888
	30	9591
	00	41
	<u>19.3331</u>	<u>3350</u>

	d	N
3	15459	1307077
29.8	1522019	69
16.0	21	12842
	<u>160234</u>	<u>0230</u>

	d	N
	20058	19389
	1823439	1120197
	39	0597
	60	92
	<u>29.8179</u>	<u>8189</u>

Grade 5

1913 Feb. 14

2751

Star - Measurers

1914 Apr. 1.

1

	d.	N
1	16355	20051
16.4	1288485	1352029
12.4	87	15
	59	62
	<u>123471</u>	<u>13463</u>

	d.	N
1	16121	20219
	9840	1649106
	3931	94
	29	29
	<u>163711</u>	<u>3725</u>

2	15260	18091
19.4	915658	1419496
28.6	59	98
	65	10
	<u>286109</u>	<u>6097</u>

	15889	19241
	922030	15888
	30	9591
	00	41
	<u>193331</u>	<u>3350</u>

3	15459	13070
29.8	1522019	6977
16.0	21	12842
	<u>160234</u>	<u>0230</u>

	20058	19389
	1823439	1120197
	39	0597
	60	92
	<u>298179</u>	<u>8189</u>

Grade 5

2751

moon-measures.

2

	d	N	d	N
1	19359	15435		
18.9	1569100	911324		
18.4	96	18		
min	64	46		
in	18.3665	3676		

f

2 scratch

18.5	18379	16041	19086	16512
18.4	1411923	1031409	13820	11749
	21	16	2721	3936
	89	56	41	29
	18.4262	4263	18.4784	4780

3	18009	16026
18.0	11965	1208792
18.6	5754	77
	25	34
	18.6060	6056

4

17.5

19.0

17555	18202
12319	1341922
1929	07
50	20
17.4770	4795

5

16.9

20.0

13684	1308079
1323130	66
31	12640
16.9547	9565

6

16.9

20.4

min

26

13673	19089
1279570	9948
88	5047
	00
16.9118	9151

2751

known - means

2

	19359	15435
189	1569100	911324
18.4	96	18
min	64	46
in	18.3665	3676

1

2 watch

185	18379	16041	19086	16512
184	1411923	1031409	13820	11749
	21	16	27	39
	89	56	41	29
	18.4262	4263	18.4784	4780

3	18009	16026
18.0	11965	1208792
18.6	5754	77
	25	34
	18.6060	6056

4

17.5
19.0

17555	18202
1231929	1341922
19	07
50	20
17.4770	4795

5

16.9
20.0

13684	1308079
1323130	66
31	12640
16.9547	9565

6

16.9
20.9
min
26

13673	19089
1279590	9948
88	5047
	00
169118	9151

2751

d

4

lunar-measures

N

d

N

3

7

17.0

21.0

12632

12619

1912

15870

6468

15849

16.9985.99828

17.6

22.0

15874

1265038

32

82

17.6764

20181

13390

1632

89

.67749

18.0

22.3

14162

1204024

3034

75

22.2133

19933

1210201

95

43

2158

2751

d

4

moon-measures

n

d

n

3

$$\begin{array}{r} 7 \\ 17.0 \\ 21.0 \end{array}$$

$$\begin{array}{r} 12632 \\ 12619 \\ 1912 \end{array}$$

$$\begin{array}{r} 15870 \\ 6468 \\ 15849 \end{array}$$
1699859982

$$\begin{array}{r} 8 \\ 17.6 \\ 22.0 \end{array}$$

$$\begin{array}{r} 15874 \\ 1265038 \\ 32 \\ 82 \end{array}$$

$$\begin{array}{r} 20181 \\ 1339032 \\ 1610 \\ 89 \end{array}$$
1767646774

$$\begin{array}{r} 9 \\ 18.0 \\ 22.3 \end{array} \quad \begin{array}{r} 14162 \\ 1204024 \\ 3034 \\ 75 \end{array}$$
22.2133

$$\begin{array}{r} 19933 \\ 1210201 \\ 95 \\ 43 \end{array}$$
2158

2751	Times etc.					
Expt. stars 1913 Feb. 14	4 ^h 16 ^m ✓	- 4 ^h 28 ^m ✓				
" " known	4 22 29.9 ✓	- 4 22 30.2 ✓				
clock fast	0 47.7 ✓					
H sid. T.	4 21 42.35 ✓	0 - α = + 0° 20' 50" ✓				
H long	4 44 31.05 ✓					
G Sid. T.	9 06 13.40 ✓					
Sid. T. known	21 35 35.66 ✓					
Interval	11 30 37.74 ✓					
Reduction	1 53.14 ✓					
G. M. T.	11 28 44.60 ✓					

From Kant. Alman.	R. A.	Decl.
known 11 ^h	3 ^h 59 ^m 44 ^s 94 ✓	+ 25° 08' 10" 0 ✓
known in 1 st = 2° 35' 54" ✓		8° 053' ✓
" " 28.7433 ✓	+ 1 07.70 ✓	+ 3 51.5 ✓
Tabular place	4 00 52.64 ✓	+ 25 12 01.5 ✓

Levors Page 9 days		
" parallax	57' 16" 19 ✓	
" Semidiameter	15 37.9 ✓	
	9 37.9 ✓	
934 = 15.0 ✓		
938 = 15.2		
Augmentation	+ 15.2 ✓	
Irradiation (5)	- 1.0 ✓	
R	952.1 ✓	
R	20409 ✓	
(1 + a/R)	20416 ✓	
R ²	41682 ✓	
α = + 33		

2751	Turner etc.						
Exp 1 star 1913 Feb 14	4 ^h 16 ^m	- 4 ^h 28 ^m					
known	4 22	299 - 4 22	302				
clock fast	0	47.7					
H ₂ I T	4 21	4235	6 - 2 - 40	20	50		
H ₂ long	4 44	3105					
G S ₂ I T	9 06	1340					
Sid T ₁ known	21 35	3566					
Interval	11 30	3774					
Reduction		1 53.14					
G ₁ I T	11 28	4460					

from Hunt Allen	R A.	Decl.					
known 11 ^h	3 ^h 59 ^m	44 ^h 94	+ 25° 08'	10'0			
known 11 ^h 23554			8'053				
28.7433	+ 1	07.70	+ 3	51.5			
Tabular place	4 00	5264	+ 25	12	01.5		

known's Age 9 days							
parallax		57	16.19				
secundaries		15	379				
R			9379				
Augmentation		-	152				
Immaturity		-	10				
R			9521				
R			20409				
11 + a/R			20416				
R ²			41682				
a = + 33							

2751

Plate Constants

x	y	RA	$Decl.$
16.3718	12.3467	3 59 ^m 09 ^s	+23 52 01
19.3340	28.6103	4 00 48	25 58 36
29.8184	16.0232	4 06 47	24 20 40
3165.52	56.98	11 65 10.4	+72 130 77
21.84	18.99	4 02 15	+24 43 46
-18	-22	- 1 59	+ 23 20
3.84	3.00	4 00 16	+25 07 06
31	465		
1195	1400		
= 1 ^m 59 ^s	= 23' 20"	Center of Plate	$\begin{cases} A = 4^h 00^m 16^s \\ D = +25^{\circ} 07' 06'' \end{cases}$

$x - \bar{x}$	-51.54	-3.32	-26.26
+3316	-636 = +2680	-54 = +2626	= 0
+4164	-1473 = +2691	-64 = +2627	= +1
+3549	-825 = +2724	-98 = +2626	= 0
18.9550	-1051	-63	= 18.5810 ✓

$y - \bar{y}$	+53.24	-0.84	-86.9		
+8	+871	+879	-10	+869	= 0
-136	+1028	+892	-23	+869	= 0
-705	+1586	+881	-13	+868	= -1
20.4099	+1008	-16			= 20.4222

Tables	$a = +0.9$	$e = +0.9$	$a - e = 0.0$	$b + a = 0.0$
Obs	$a = +3.3$	$e = +0.8$	$a - e = +2.5$	$b + a = -1.7$

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Plate Constant

x	y	RA	$Decl.$
16.3718	12.3467	3 59 09	+23 52 01
19.3340	28.6103	4 00 48	25 58 26
29.8189	16.0232	4 06 47	24 20 40
31.6552	56.98	11 65 10.4	72 130 77
21.84	18.99	4 02 15	+24 43 46
-18		- 1 59	+ 23 30
3.44	3.00	4 00 16	+25 07 06
31	4.65		
11.95	14.00		
1 59	23' 20"		

Center RA = 4 00 16
 Plate Dec = +25 07 06

26-3	-51.54	-33.20	-26.26		
+331.6	-63.6	+26.80	-54	+26.26	= 0
+41.64	-14.73	+26.91	-64	+26.27	= +1
+35.49	-8.25	+27.24	-98	+26.26	= 0
18.9550	-10.51	-63			= 18.5810

4-11	+53.21	-0.84	-8.69		
+8	-8.71	+8.79	-10	+8.69	0
-13.6	+10.28	+8.92	-23	+8.69	0
-7.05	+15.86	+8.81	-13	+8.69	-1
20.4099	+10.08	-16			= 20.4222

Tables

a = +0.9 b = +0.9 c = 0.0 d + a = 0.0

Obs

a = +3.3 b = +0.8 c = -2.5 d + a = -1.7

2751 Standard Coordinates

Cape W. 584 mg 5.6

Cape W. 589 mg 7.5

Cape W. 608 mg 8.7

C	3	58	22	74	4	00	00	46	4	06	00	35
L				74				49				
B				71				45				
mean	3	58	22	73	4	00	00	47				
Proc				+ 46.64				+ 47.27				+ 46.85
α	3	59	09	37	4	00	44	74	4	06	47	20
A	4	00	16		4	00	16		4	00	16	
$\alpha - A$	-	1	06	63	+			31.74	+	6	31	20
$\sin(\alpha - A)$				- 66.63				+ 31.74				+ 39.11
$\log \dots$				1.82367m				1.50161				2.59234
$\dots$				9.96118				9.95374				9.95956
$\dots$				0.29209m				9.96259				1.05914
$\dots$				- 1.9593				+ 0.9175				+ 1.4589
$\dots$				-				+				46
$\dots$				16.0402				189.176				29.4635
$\dots$				16.3718				193.340				29.8184
$\dots$				+ 33.16				+ 41.64				+ 35.49

C	+ 23°	49'	50.88	+ 25°	56'	25.7	+ 24°	18'	35.6
L			51.1			25.6			
B			50.1			25.9			
mean	+ 23	49	50.7	+ 25	56	25.7	+ 24	18	35.6
Proc		+ 2	11.4		+ 2	09.9		+ 2	04.0
δ	+ 23	52	02.1	+ 25	58	35.6	+ 24	20	39.6
D	+ 25	07	06	+ 25	07	06	+ 25	07	06
$\delta - D$	- 1	15	03.9	+	51	29.6	-	46	26.4
$\tan(\delta - D)$			- 45.046			+ 30.89.8			- 27.86.6
$\log \dots$			3.65365m			3.48993			3.44508m
$\dots$			0.98480m			0.82108			0.77623m
$\dots$			9.6459			9.6877			9.6556
$\dots$			0.5842			9.9252			2.1183
$\dots$			72835			6.6663			8.8273
$\dots$			- 9.6560			+ 6.6234			- 5.9735
$\dots$			+			+			672
$\dots$			12.3459			28.6239			16.0937
$\dots$			12.3467			28.6103			16.0232
$\dots$			+			- 136			- 705

2751 Mandana Condensation

Cape W. 584 mag 1.6

Cape W. 589 mag 1.5

Cape W. 603 mag 1.87

C	3	58	22	74	4	00	00	46	4	06	00	35
L				74				49				
E				71				45				
mean	3	58	22	73	4	00	00	47				
Pmc				74				47				46.85
d	3	59	09	37	4	00	47	74	4	06	47	20
A	4	00	16		4	00	16		4	00	16	
A-A	-	1	06	63	+		31	74	+	6	31	20
A(A-A)				66				74				39
log				1.82367m				1.50161				2.59234
ans				9.96118				9.95374				9.95916
3 ₀				0.29209m				9.96259				1.05914
3 ₁				-1.9593				+0.9175				+1.14589
3 ₂				-				1				46
3 ₃				160402				189176				29.4635
3 ₄				16.3718				193340				29.8184
2-3				+3316				+4164				+3599

C	+23°	49'	50.88"	+25°	56'	25.7"	+29°	18'	35.6"
L			51.1			25.6			
E			50.1			25.9			
mean	+23	49	50.7	+25	56	25.7	+24	18	35.6
Pmc			10.4			09.9			04.0
d	+23	52	01.1	+25	58	35.6	+24	20	39.6
D	+25	07	06	+25	07	06	+25	07	06
S-D	-1	15	04.9	+	51	29.6	-	46	26.4
tan(6.1)			-45056			+30898			-27866
log			3.65375m			3.48993			3.44508m
3 ₀			0.98490m			0.82108			0.77623m
ans			9.6459			9.6877			9.6556
3 ₁			0.5842			9.9252			2.1183
3 ₂			72835			66663			8.8273
3 ₃			-96582			+66234			-59735
3 ₄			+			5			672
3 ₅			12.3437			28.6239			16.0937
3 ₆			12.3467			28.6103			16.0232
3 ₇			+			30			-705

	p	$p-c$	$\lambda_{\text{min}}(p-c)$	$\beta_{\text{cor}}(p-c)$	λ_0	Corr.
1	180.0	190.6	+1.5	+5.6	-3.8	-0.4 = -3.7
2	193.5	204.1	+3.3	+5.2	-1.6	-0.2 = -1.8
3	207.8	218.4	+4.9	+4.5	+0.7	0.0 = 0
4	226.5	237.1	+6.8	+3.1	+4.0	-0.3 = -2.8
5	258.4	269.0	+8.0	+0.0	+8.3	-1.4 = -12.9
6	270.0	280.6	+7.9	-1.1	+9.3	+0.2 = +1.8
7	286.8	297.4	+7.2	-2.6	+10.1	+0.3 = +2.8
8	321.2	331.8	+3.8	-5.0	+9.1	-0.5 = -4.6
9	332.2	342.8	+2.4	-5.5	+8.2	+0.8 = +7.4

$$\begin{aligned} \lambda &= -8.06 \\ \beta &= -5.7 \\ c &= 349.4 \end{aligned}$$

	Old $0-c$	Hayn Corr.	New $0-c$
1	+5.6	-3.7	+9.3
2	-4.4	-1.8	-2.6
3	+8	0	+8
4	+3.8	-2.8	+6.6
5	+1.5	-12.9	+14.4
6	+4.0	+1.8	+2.2
7	+12.1	+2.8	+9.3
8	-3.8	-4.6	+8
9	+2.3	+7.4	-5.1

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Moon's Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	18.9560	0.0000	0.0000	4.1738	+56
2	18.4782	-0.4778	0.2283	4.1638	-44
3	18.0000	-0.9560	0.9139	4.1690	+8
4	17.4782	-1.4778	2.1839	4.1720	+38
5	16.9556	-2.0004	4.0016	4.1697	+15
6	16.9134	-2.0426	4.1722	4.1722	+40
7	16.9984	-1.9576	3.8322	4.1803	+121
8	17.6769	-1.2791	1.6363	4.1644	-38
9	18.0000	-0.9560	0.9139	4.1705	+23

Comp. $R^2 = 4.1682$

	y	$y - y_0$	$(y - y_0)^2$
-1	18.3670	-2.0430	4.1738
2	18.4262	-1.9838	3.9355
3	18.6058	-1.8042	3.2551
4	19.0000	-1.4100	1.9881
5	20.0000	-0.4100	0.1681
6	20.4100	0.0000	0.0000
7	21.0000	+0.5900	0.3481
8	22.0000	+1.5900	2.5281
9	22.2146	+1.8046	3.2566

Approx. Center

$$x = 18.0 \quad y = 18.6058$$

$$\underline{22.2146}$$

$$40.8204$$

$$y_0 = 20.4102$$

$$y_{\text{min}} = 18.3670$$

$$R = 2.0432$$

$$x_{\text{min}} = 16.9134$$

$$x_0 = 18.9566$$

$$\text{Center } \begin{cases} x_0 = 18.9560 \\ y_0 = 20.4100 \end{cases}$$

	z	$z - x_0$	$(z - x_0)^2$	$(z - x_0)^2 + (y - y_0)^2$	$o - c$
1	18.9560	0.0000	0.0000	4.1738	+5.6
2	18.4782	-0.4778	0.2283	4.1638	-4.4
3	18.0000	-0.9560	0.9139	4.1690	+8
4	17.4782	-1.4778	2.1839	4.1720	+3.8
5	16.9556	-2.0004	4.0016	4.1697	+1.5
6	16.9134	-2.0426	4.1722	4.1722	+4.0
7	16.9984	-1.9576	3.8322	4.1803	+12.1
8	17.6769	-1.2791	1.6363	4.1644	-3.8
9	18.0000	-0.9560	0.9139	4.1705	+2.3

Comp. R^2 : 4.1682

	y	$y - y_0$	$(y - y_0)^2$
1	18.3670	-2.0430	4.1738
2	18.4262	-1.9838	3.9355
3	18.6058	-1.8042	3.2551
4	19.0000	-1.4100	1.9881
5	20.0000	-0.4100	0.1681
6	20.4100	0.0000	0.0000
7	21.0000	+0.5900	0.3481
8	22.0000	+1.5900	2.5281
9	22.2146	+1.8046	3.2566

Approx. Center.

$$\begin{aligned}
 z &= 18.0 & y &= 18.6058 \\
 & & & \underline{22.2146} \\
 & & & 40.8204 \\
 & & y_0 &= 20.4102 \\
 y - \text{min} &= 18.3670 \\
 R &= 2.0432 \\
 z - \text{min} &= 16.9134 \\
 x_0 &= 18.9566
 \end{aligned}$$

$$\begin{aligned}
 \text{Center } \{ & x_0 = 18.9560 \\
 & y = 20.4100
 \end{aligned}$$

Formation of Normals

With Haykin Corrections

	ab	an	bn		an	bn
1	- 0.00	+ 0.0	- 114.0	+	0.0	- 189.8
2	+ 0.95	+ 21.1	+ 87.1	+	12.5	+ 51.5
3	+ 1.73	- 7.8	- 14.4	-	7.7	- 14.4
4	+ 2.09	- 56.2	- 53.6	-	97.6	- 93.0
5	+ 0.82	- 30.0	- 6.2	-	285.0	- 59.0
6	- 0.00	- 81.5	+ 0.0	-	45.0	+ 0.0
7	- 1.16	- 237.0	+ 71.4	-	182.2	+ 54.9
8	- 2.04	+ 48.6	- 60.5	-	10.2	+ 12.7
9	- 1.73	- 22.1	+ 41.4	+	49.0	- 91.8
	+ 0.66	- 364.9	- 48.8	-	569.2	- 328.9

Residuals with Haykin Corrections.

	O	C	O - C
1	+ 9.3	- 0 + 32 = + 32	+ 6.1
2	- 2.6	+ 15 + 31 = + 46	- 7.2
3	+ 8	+ 30 + 28 = + 58	- 5.0
4	+ 6.6	+ 46 + 22 = + 68	- 2
5	+ 14.4	+ 63 + 5 = + 68	+ 7.6
6	+ 2.2	+ 64 - 0 = + 64	- 4.2
7	+ 9.3	+ 61 - 9 = + 52	+ 4.1
8	+ 8	+ 40 - 25 = + 15	- 7
9	- 5.1	+ 30 - 28 = + 2	- 5.3

+ 17.8 - 22.6

Average = 4.5

2751. Moon's Center.

Conditional Equations

	a	b	c		c	o - c
1	0.00	-2.04	+56	0 + 4 = +4	+52	
2	-0.48	-1.98	-44	+10 + 4 = +14	-58	
3	-0.96	-1.80	+8	+20 + 3 = +23	-15	
4	-1.48	-1.41	+38	+30 + 3 = +33	+5	
5	-2.00	-0.41	-15	+40 + 1 = +41	-26	
6	-2.04	+0.00	+40	+42 - 0 = +42	-2	
7	-1.96	+0.59	-121	+40 - 1 = +39	+82	
8	-1.28	+1.59	-38	+26 - 3 = +23	-61	
9	-0.96	+1.80	+23	+20 - 3 = +17	+6	
						+145 - 162

Normal Equations

Average = 34

$$\begin{aligned}
 &+17.88 + 0.66 = -365 \quad (-569) \\
 &+0.66 + 19.65 = -49 \quad (-329) \\
 &-0.66 - 0.02 = +13 \quad (+21) \\
 &\quad +19.63 = -36 \quad (-308) \quad b = -1.8 \quad (-15.7) \\
 &+17.88 = -365 + 1 = -364 \quad a = -20.4 \quad (-31.3) \\
 &\quad = (-569 + 10 = -559)
 \end{aligned}$$

Arc measured = 152° Average $o-c = -2$

$$\frac{pc}{m} = 0.16$$

$$\frac{-2}{16} = -0.12 \quad \Delta n = -0.1$$

2751

Innovative Center

Conditional Equations

	a	b	c		c	0 - c
1	0.00	-2.04	+ .56	0 + 4 = + 4	+ 5.2	
2	-0.48	-1.98	- 44	+ 10 + 4 = + 14	- 5.8	
3	-0.96	-1.80	+ 8	+ 20 + 3 = + 23	- 1.5	
4	-1.48	-1.41	+ 3.8	+ 30 + 3 = + 33	+ 5	
5	-2.00	-0.41	- 1.5	+ 40 + 1 = + 41	- 2.6	
6	-2.04	+0.00	+ 4.0	+ 42 - 0 = + 42	- 2	
7	-1.96	+0.59	- 1.21	+ 40 - 1 = + 39	+ 8.2	
8	-1.28	+1.59	- 3.8	+ 26 - 3 = + 23	- 6.1	
9	-0.96	+1.80	+ 2.3	+ 20 - 3 = + 17	+ 6	
						+ 14.5 - 16.2

Normal Equations

Average = 39

$$+ 17.88 + 0.66 = - 36.5$$

$$+ 0.66 + 19.65 = - 4.9$$

$$- 0.66 - 0.02 = + 1.3$$

$$+ 19.63 = - 3.6$$

$$b = - 1.8$$

$$+ 17.88 = - 36.5 + 1 = - 36.4$$

$$a = - 20.4$$

Arc measured = 1.52° Average $0-c = - 2$

$$\frac{rc}{\pi} = 0.16$$

$$\frac{-2}{16} = -0.12 \quad \Delta z = - 0.1$$

2751 Moon's Mean Position (1912.0)

$$X_0 = 18.9560^\circ \quad Y_0 = 20.4100^\circ$$

$$\frac{1}{2}a = \frac{-10^\circ}{2} \quad \frac{1}{2}b = \frac{-1^\circ}{2}$$

$$18.9550^\circ \quad 20.4099^\circ$$

$$\text{Hayn } (18.9544) \quad (20.4092)$$

$$\text{From Plate Constants } X = 18.5810^\circ \quad Y = 20.4222^\circ$$

$$(18.5804) \quad (20.4215)$$

$$\xi = +0.5810^\circ \quad (5804) \quad \eta = -1.5778^\circ \quad (-1.5785)$$

$$\log \xi = 9.76418^\circ \quad (9.76373) \quad 0.19805$$

$$\cos \xi = 9.95758$$

$$\cos \eta = 8.50724$$

$$\log \tan \xi = 9.6687^\circ$$

$$\log \tan \eta = 9.5284^\circ$$

$$7.0534$$

$$\log(\xi-1) = 1.29936^\circ \quad (1.29891)$$

$$\log \eta = 6.2505^\circ$$

$$\alpha - 4 = +19.92^\circ \quad (19.90)$$

$$\eta_1 = +2^\circ$$

$$\eta_0 = -1.5780^\circ \quad (-1.5787)$$

$$A \quad 4 \quad 00 \quad 16^\circ$$

$$\alpha_0 = 4 \quad 00 \quad 35.92^\circ \quad (35.90)$$

$$\log \eta_0 = 0.19811^\circ \quad (0.19830)$$

$$7.33115$$

$$\text{Reduct. dht.} \quad + 0.45^\circ$$

$$\log(\xi-D) = 2.86696^\circ \quad (2.86715)$$

$$\alpha' = 4 \quad 00 \quad 36.37^\circ \quad (36.35)$$

$$\xi - D = -12 \quad 16.1^\circ \quad (16.5)$$

$$D = +25 \quad 07 \quad 06^\circ$$

$$S_0 = +24 \quad 54 \quad 49.9^\circ \quad (49.5)$$

$$\text{Red.} = +11.1^\circ$$

$$S' = +24 \quad 55 \quad 01.0^\circ \quad (00.6)$$

2751 Moon's Mean Position (1912.0)

9

$$\begin{array}{rcl}
 X_0 & = & 18.9560 \quad Y_0 = 20.4100 \\
 \Delta\alpha & = & -10 \quad \Delta\delta = -1 \\
 \hline
 & & 18.9550 \quad 20.4099
 \end{array}$$

From Plate Constants $X = 18.55810 \quad Y = 20.4222$

$$z = +0.5810$$

$$\eta = -1.5778$$

$$\log S = 9.76918$$

$$\cos \delta = 9.95758$$

$$\log \sin \delta = 8.50724$$

$$(K-\alpha) = 129936$$

$$\alpha - 4 = +1992$$

$$A \quad 4 \quad 00 \quad 16$$

$$X_0 = 4 \quad 00 \quad 35.92$$

$$\text{Radial dkt.} \quad + \quad 0.45$$

$$X' = 4 \quad 00 \quad 36.37$$

$$0.19805$$

$$\log \tan \delta = 9.6687$$

$$z = 9.5284$$

$$7.0539$$

$$\eta_1 = 62505$$

$$\eta_2 = +2$$

$$\eta_0 = -1.5780$$

$$\log \eta_0 = 0.19811$$

$$733115$$

$$(d-1) = 286696$$

$$S-D = -12 \quad 16.1$$

$$D = +25 \quad 07. \quad 06$$

$$S_0 = +24 \quad 54 \quad 49.9$$

$$\text{Radial} = +11.1$$

$$S' = +24 \quad 55 \quad 01.0$$

2751

Red ad. brown aph.

$$S = +24^{\circ} 55'$$

$$H + X \quad 0^{\circ} \quad 27^{\circ} = 6^{\circ} 45'$$

$$H \quad 20' \quad 26$$

$$X \quad 4 \quad 01$$

$$G \quad 18 \quad 55$$

$$G + X \quad 22 \quad 56 = 344^{\circ}$$

$$\log \cos(G+X) \quad 9.9828$$

$$S \quad 0.9767$$

$$\sin \quad 9.9403m$$

$$\tan S \quad 9.6070$$

$$\sin \quad 8.8239$$

$$(S') \quad 0.9595$$

$$(S') \quad 8.9079m$$

$$L \quad +0.36$$

$$S \quad -0.08$$

$$L \quad +0.17$$

$$+0.45$$

$$\log \cos S \quad 9.9576$$

$$S \quad 0.8282m$$

$$(L) \quad 0.7858m$$

$$\log \sin S \quad 9.6246$$

$$\cos(H+X) \quad 9.9970$$

$$L \quad 1.2862$$

$$\sin \quad 9.0702$$

$$\sec S \quad 0.0424$$

$$\sin \quad 8.8239$$

$$(L') \quad 0.9078$$

$$L \quad 9.2227$$

$$S' \quad +9.11$$

$$L' \quad +8.09$$

$$L \quad -6.11$$

$$+11.09$$

2,751 - Lunar Parallax.
 $\alpha = 4 \quad 00 \quad 36.37^{\circ}$ (36.35)
 $\delta = 4 \quad 21 \quad 42.35^{\circ}$
 $\delta - \alpha = + \quad 21 \quad 06^{\circ}$
 $= + \quad 5^{\circ} \quad 16' \quad 30''$

$- \quad 2 \quad 09^{\circ}$
 $+ \quad 5 \quad 14 \quad 21^{\circ}$

9.95727
 0.00000
 000181
 9.95908

$\delta = 42 \quad 18 \quad 17^{\circ}$

$24 \quad 55 \quad 01^{\circ}$

$\delta - \alpha = 17 \quad 23 \quad 16^{\circ}$

9.82640
 8.22163
 9.47544
 017194
 7.69542

$\delta - \delta' = +17 \quad 02.9^{\circ}$

$\delta = +25 \quad 12 \quad 03.9^{\circ}$ (03.5)

Rantala $\delta = +25 \quad 12 \quad 01.5^{\circ}$

$\delta - \alpha = + \quad 2.4^{\circ}$

With Hansen's correction (+ 2.0)

$\delta' = +24^{\circ} \quad 55' \quad 01.0''$ (11) (1006)

$\pi = 57' \quad 16'' \quad 19^{\circ}$

9.86913
 8.22163
 8.96349
 0.04343
 7.09768

$\alpha - \alpha' = +4' \quad 18.29^{\circ}$

$\alpha - \alpha' = +17.22^{\circ}$

$\alpha = 4 \quad 00 \quad 53.59^{\circ}$ (53.57)

$\alpha = 4 \quad 00 \quad 52.64^{\circ}$

$+0.95^{\circ}$

(+0.93)

2,751

Lunar Parallax

11

$$\begin{array}{r}
 \alpha = 4 \quad 00 \quad 36.37 \\
 \delta = 4 \quad 21 \quad 42.35 \\
 \alpha - \alpha' = 1 \quad 21 \quad 06 \\
 \quad \quad \quad + 5^{\circ} \quad 16' \quad 30''
 \end{array}$$

$$\begin{array}{r}
 \quad \quad \quad 1 \quad 2 \quad 09 \\
 \quad \quad \quad \quad \quad 1 \\
 \quad \quad \quad + 5 \quad 14 \quad 21
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.00181 \\
 \hline
 9.95908
 \end{array}$$

$$\delta = 42 \quad 18 \quad 32$$

$$24 \quad 55 \quad 01$$

$$\delta - \delta' = 17 \quad 23 \quad 21$$

$$\begin{array}{r}
 9.82640 \\
 8.22163 \\
 9.97546 \\
 0.17193 \\
 \hline
 7.69542
 \end{array}$$

$$\delta - \delta' = \quad \quad + 17 \quad 02.9$$

$$\delta = +25 \quad 12 \quad 03.9$$

$$\text{Hantoku } \delta = +25 \quad 12 \quad 01.5$$

$$\alpha - \alpha' = \quad \quad + 2.4$$

$$S_0' = +24^{\circ} \quad 55' \quad 01''$$

$$IT \quad 57' \quad 16.19$$

$$\begin{array}{r}
 9.86913 \\
 8.22163 \\
 8.96349 \\
 0.04343 \\
 \hline
 7.09768
 \end{array}$$

$$\alpha - \alpha' = +4' \quad 18.29$$

$$\alpha - \alpha' = +17.22$$

$$\alpha = 4 \quad 00 \quad 53.59$$

$$\alpha = 4 \quad 00 \quad 52.64$$

$$+095$$

2
17
2
3
29
16
3
29
16

1913, Feb. 14

2752

d

1 17532

5.6 9819

12.7 16

10

12.7709

3 11301

18.6 11255

29.0 54

29.0047

3 15749

29.4 14345

16.1 45

05

16.1400

Stars measured

4

N

15454

1316058

61

34

.7710

1054050

49

10498

.0048

14300

570809

02

00

.1406

1914 Apr. 2

d

N

16743

1287972

69

13

15.6642

17100

1433938

30

73

18.7244

15481

930000

01

51

29.3837

17206

1405356

49

00

.6149

16151

891100

09

50

17243

16501

1265973

72

12

3837

Grade 4

3 20029

29.1 16281

16.3 83

07

16.3236

19155

1240000

00

51

.3248

760503

11

6680

29.0926

13788

1286057

60

.0929

1913 Feb 14

2752

d

$$\begin{array}{r}
 1 \\
 17532 \\
 156 \quad 9819 \quad 19 \\
 127 \quad 16 \\
 10 \\
 \hline
 127709
 \end{array}$$

$$\begin{array}{r}
 2 \\
 11301 \\
 186 \quad 11255 \quad 54 \\
 290 \quad 59 \\
 \hline
 290047
 \end{array}$$

$$\begin{array}{r}
 3 \\
 15749 \\
 294 \quad 14345 \quad 40 \\
 161 \quad 45 \\
 05 \\
 \hline
 161400
 \end{array}$$

Stars measured

4

N

$$\begin{array}{r}
 15459 \\
 1316058 \\
 61 \\
 34 \\
 \hline
 7710
 \end{array}$$

$$\begin{array}{r}
 1054050 \\
 49 \\
 10498 \\
 \hline
 0048
 \end{array}$$

$$\begin{array}{r}
 14300 \\
 570809 \\
 02 \\
 00 \\
 \hline
 1406
 \end{array}$$

1914 Apr 2

2

N

12

$$\begin{array}{r}
 16743 \\
 1287972 \\
 69 \\
 13 \\
 \hline
 156642
 \end{array}$$

$$\begin{array}{r}
 17100 \\
 1433938 \\
 3038 \\
 73 \\
 \hline
 187244
 \end{array}$$

$$\begin{array}{r}
 15481 \\
 930000 \\
 01 \\
 51 \\
 \hline
 293837
 \end{array}$$

$$\begin{array}{r}
 17206 \\
 1405356 \\
 4956 \\
 00 \\
 \hline
 6149
 \end{array}$$

$$\begin{array}{r}
 16151 \\
 891100 \\
 0900 \\
 50 \\
 \hline
 7243
 \end{array}$$

$$\begin{array}{r}
 16501 \\
 1265973 \\
 72 \\
 12 \\
 \hline
 3837
 \end{array}$$

Grade 4

$$\begin{array}{r}
 20029 \\
 291 \quad 1678185 \\
 163 \quad 83 \\
 07 \\
 \hline
 163236
 \end{array}$$

$$\begin{array}{r}
 19155 \\
 1240000 \\
 00 \\
 51 \\
 \hline
 3248
 \end{array}$$

$$\begin{array}{r}
 760103 \\
 11 \\
 6680 \\
 \hline
 290926
 \end{array}$$

$$\begin{array}{r}
 13788 \\
 1286057 \\
 6057 \\
 \hline
 0929
 \end{array}$$

2752 $\frac{1}{4}$ Moon measures $\frac{1}{4}$ in

$\frac{1}{4}$
19.0
19.0
min
in
y

min in y = approx. 19.0000

1 scratch

18.6 19851
19.0 1936869
70
49
19.0462

17918
839098
99
19
.0477

20419
1601921
22
19
18.5602

18200
1261066
02
92
.5590

2
18.0 17745
19.4 1519090
87
50
19.2557

17839
1039074
85
39
.2544

18619
1081818
21
09
17.2208

18170
1592130
39
60
.2238

4 scratch

17.0 18829
20.4 1248082
85
26
20.6345

18539
1488187
84
49
.6341

15230
1500900
01
16.9773

1433131
30
14100
.9769

5
16.9
21.0
min
in
x

12115 1583119
11467 2122
5160 15166
16.9344 .9343

2752

Moon Measures

13

★

19.0

19.0

min

in

y

min in y = approx. 19.0000

1 scratch

18.6 19851
 19.0 1936869
 70
 49
19.0462

17918
 839098
 99
 19
0477

20419
 1601921
 22
 19
18.5602

18200
 1261.06
 02
 92
5590

2
 18.0 17745
 19.4 1519090
 87
 50
19.2557

17839
 1039074
 85
 39
2544

18619
 1081818
 21
 09
17.2208

18170
 1592130
 39
 60
2238

4 scratch
 17.0 18829
 20.4 1248082
 85
 26
20.6345

18539
 1488187
 84
 49
6341

15230
 1500900
 01
16.9773

1433131
 3031
 14100
9769

5
 16.9
 21.0
 min
 in
 x

12115
 1146760
 51
16.9344

1583119
 2122
 15166
9343

2752 Moon Measures.

14

d	u	v	d^2	v
6 scratch				
17.0	16765	19511	13226	1067970
215	1153131	1473030	1308080	7570
	25	29	78	10537
	56	01		
<u>21.5231</u>	<u>.5224</u>	<u>16.9853</u>	<u>.9862</u>	

7
172
22.0

17139	15655
885431	1395049
3839	50
31	41
<u>17.1708</u>	<u>.1702</u>

8	
18.0	15806
22.8	740999
	92
	90
<u>22.8396</u>	<u>.8426</u>

remeasure (8)

.8418

2752 Moon Measures

d	u	v	d	v
6 Scratch				
17.0	16765	19511	13226	1067970
215	1153131	1473030	1308080	75
	25	29	78	10537
	56	01		
<u>21.5231</u>	<u>5224</u>	<u>16.9853</u>	<u>9862</u>	

7
172
220

17139
885431
3839
31
171708

15655
1395049
50
41
1702

8	15806	15083
18.0	740999	1350812
228	92	07
	90	81
<u>22.8396</u>	<u>.8426</u>	

measure (8)

.8418

2752	Times	2	Te				
Expt. station	1913 Feb. 14	4 ^h	32 ^m	✓	-4 ^h	44 ^m	✓
... known		4	37	53.8	✓	4	37 54.4
Clock fast			0	477	✓		
H. Sid. T.		4	37	06.4	✓	0-4-+0	36 ^m
Whong		4	44	31.0	✓		
G. Sid. T.		9	21	37.4	✓		
Sid. T. known		21	35	35.6	✓		
Intervar		11	46	01.7	✓		
Radiation			1	55.6	✓		
G. M. T.		11	44	06.1	✓		

From Hart Allen:	R A	Decl.	
Known 12 ^h	4 ^h 02 ^m 06.39	✓	+25° 16' 11.2"
Known in 1 ^m 2.3608			7.971"
" -15.8978"	- 37.53	✓	- 2 06.7
Tabular place	4 01 28.86	✓	+25 14 04.5

Lucas's age 9 days.

$$934 = 14.9 \checkmark$$

$$938 = 15.0$$

parallax	57'	16.78	✓
Semidiameter	15	38.0	✓
R		938.0	✓
Augmentation		+ 15.0	✓
Irradiation (4)		- 0.8	✓
R		952.2	✓
R		2.0411	✓
(1+a) R		2.0418	✓
R ²		4.1690	✓

$$a = +3.2$$

2752 Times 2 Fe
 Epl. station 1913 Feb. 14 4^h 32^m - 4^h 44^m
 known 4 37 53.8 - 4 37 54.4
 Clock fast 0 477

H. Sid T. 4 37 06.4 0-4-+0^h 36^m
 Whom 4 44 31.05
 G. Sid T. 9 21 37.45
 Sid T. in known 21 35 35.66
 Interval 11 46 01.79
 Reduction 1 55.66
 G. in T. 11 44 06.13

From Hunt Allen. R A. Decl.
 known 12^m 4^h 02^m 06.39 +25° 16' 11.2
 known - 1^m 2.36.06 7971
 -15.8978 - 37.53 - 2 06.7
 Tabular place 4 01 28.86 +25 14 04.5

lucous age 9 days.

parallax 57' 16" 70

semidiam 15 38.0

R 938.0

Amplification + 150

Irradiation (4) - 08

R 9522

R 20411

a = +32 (1+a) R 20418

R² 4.1690

934 = 149
 938 = 150

2752

Plate Constants

16

	1	2	3	3
2	15.6146	18.7244	29.3837	29.0928
3	16.0402	18.9176	29.4635	29.4635
2-3	-4256	-1932	-798	-3707

4	12.7710	29.0048	16.1403	16.3242
3	12.3459	28.6239	16.0937	16.0937
4-3	+4251	+3809	+466	+2305

$$\begin{array}{rclcl}
 2-3 & -142.54 & -3.2x & +6126 & \\
 -4256 - 1820 = & -6076 & -50 = & -6126 & = 0 \\
 -1932 - 4133 = & -6065 & -60 = & -6125 & = +1 \\
 -3707 - 2326 = & -6033 & -93 = & -6126 & = 0 \\
 18.9752 - 29.99 & & -61 & & = 192818
 \end{array}$$

$$\begin{array}{rclcl}
 4-3 & +144.5x & -0.49 & -6503 & \\
 +4251 + 2256 = & +6507 & -5 = & +6502 & = -1 \\
 +3809 + 2706 = & +6515 & -12 = & +6504 & = +1 \\
 +2305 + 4204 = & +6509 & -7 = & +6502 & = -1 \\
 21.0478 + 2742 & & -8 & & = 20.6709
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables } a = +0.9 & e = +0.9 & a-e = & 0.0 & b+d = 0.0 \\
 \text{Obs } a = +3.2 & e = +0.4 & a-e = & +2.8 & b+d = -2.0
 \end{array}$$

2752

Plate Constants

16

	1	2	3	4
x	156196	187244	293837	290928
y	160402	189176	294635	294635
z	-4256	-1932	-798	-3707

x	127710	290048	161403	163242
y	123459	286239	160937	160937
z	+4251	+3809	+466	+2305

2-3	-14254	-322	+6126		
-4256	-1820	-6076	-50	-6126	0
-1932	-4133	-6065	-60	-6125	+1
-3707	-2326	-6033	-93	-6126	0
189752	-2999	-61			= 192818

$4 - m$	$+ 14452$	$- 044$	$- 6503$		
$+ 4251$	$+ 2256$	$+ 6507$	$- 5$	$+ 6502$	$= - 1$
$+ 3809$	$+ 2706$	$+ 6516$	$- 12$	$+ 6504$	$= + 1$
$+ 2305$	$+ 4204$	$+ 6509$	$- 7$	$+ 6502$	$= - 1$
210478	$+ 2742$	$- 8$			$= 206709$

Taken $a = +0.9$ $e = +0.9$ $a - e = 0.0$ $b + a = 0.0$
 Obs $a = +3.2$ $e = +0.4$ $a - e = +2.8$ $b + a = -2.0$

	p	$p-c$	$\lambda \sin(p-c)$	$\lambda \cos(p-c)$	θ	Hayn. Cor.	
1	191.8	202.4	+3.0	+5.3	-20	+0.5	+4.6
2	208.6	219.2	+5.0	+4.9	+0.9	0.0	0
3	239.2	249.8	+7.6	+2.0	+5.9	+0.4	+3.7
4	258.4	269.0	+8.0	+0.0	-8.3	-1.3	-11.9
5	270.0	280.6	+7.9	-1.1	+9.3	+0.2	+1.8
6	283.5	294.1	+7.4	-2.3	+10.0	+1.2?	+11.0
7	297.8	308.4	+6.4	-3.4	+10.1	+0.5	+4.6
8	331.4	342.0	+2.5	-5.4	+8.2	+0.6	+5.5

$$\lambda = -8.06$$

$$p = -5.7$$

$$c = 349.4$$

	Old $o-c$	Hayn	new $(o-c)$
1	+3.7	+4.6	- .9
2	+2.7	0	+2.7
3	+1.71	+3.7	+1.34
4	+1.29	-11.9	+2.48
5	+1.77	+1.8	+1.59
6	+3.42	+11.0	+2.32
7	+1.35	+4.6	+8.9
8	+1.02	+5.5	+4.7

2752

Linear Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$o - c$
1	18.5596	-0.4204	0.1767	4.1727	+37
2	18.0000	-0.9800	0.9604	4.1717	+27
3	17.2222	-1.7578	3.0899	4.1861	+17.1
4	16.9771	-2.0029	4.0116	4.1819	+129
5	16.9344	-2.0456	4.1845	4.1867	+177
6	16.9858	-1.9942	3.9768	4.2032	+342
7	17.1705	-1.8095	3.2743	4.1825	+135
8	18.0000	-0.9800	0.9604	4.1792	+102

Comp: 4.1690

	y	$y - y_0$	$(y - y_0)^2$
1	19.0480	-1.9990	3.9960
2	19.2550	-1.7920	3.2113
3	20.0000	-1.0470	1.0962
4	20.6343	-0.4127	0.1703
5	21.0000	-0.0470	0.0022
6	21.5228	+0.4758	0.2264
7	22.0000	+0.9530	0.9082
8	22.8411	+1.7941	3.2188

Approx Center

$$x = 18.0 \quad y = 19.2550$$

$$\frac{22.8411}{42.0961}$$

$$y_0 = 21.0480$$

$$y_{\text{mean}} = 19.0000$$

$$R = 2.0480$$

$$x_{\text{mean}} = 16.9344$$

$$x_0 = 18.9824$$

$$\text{Center} \left\{ \begin{array}{l} x_0 = 18.9800 \\ y_0 = 21.0470 \end{array} \right.$$

2752

Linear Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	185596	-04204	0.1767	4.1727	+37
2	180000	-09800	0.9604	4.1717	+27
3	172222	-17578	3.0899	4.1861	+171
4	169771	-20029	4.0116	4.1819	+129
5	169344	-20456	4.1845	4.1867	+177
6	169858	-19942	3.9768	4.2032	+342
7	171705	-18095	3.2743	4.1825	+135
8	180000	-09800	0.9604	4.1792	+102

Comp P: 41690

	y	$y - y_0$	$(y - y_0)^2$
1	190480	-19990	39960
2	192550	-17920	32113
3	200000	-10470	10962
4	206343	-04127	0.1703
5	210000	-06470	0.0022
6	215228	+04758	0.2264
7	220000	+09530	0.9082
8	228411	+17441	3.2188

Approx Center

$$\begin{aligned}
 \Sigma x &= 180 & y &= 192550 \\
 \Sigma x^2 &= 225411 \\
 \Sigma xy &= 420961 \\
 Y_0 &= 210480 \\
 x_{\text{mean}} &= 190000 \\
 R &= 20480 \\
 x_{\text{mean}} &= 169344 \\
 X_0 &= 189824
 \end{aligned}$$

$$\begin{aligned}
 \text{Center} & \left\{ \begin{aligned} X_0 &= 189800 \\ Y_0 &= 210470 \end{aligned} \right.
 \end{aligned}$$

Formation of noumab

	ab	an	bn	an	bn
1	+ 0.89	- 15.5	- 74.0	+ 3.8	+ 18.0
2	+ 1.75	- 26.4	- 48.3	- 26.4	- 48.4
3	+ 1.85	- 301.0	- 129.6	- 236.0	- 141.0
4	+ 0.82	- 258.0	- 53.0	- 496.0	- 101.8
5	+ 0.10	- 363.0	- 8.5	- 326.0	- 8.0
6	- 0.98	- 681.0	+ 164.2	- 462.0	+ 111.2
7	- 1.72	- 244.0	+ 128.2	- 161.0	+ 84.5
8	- 1.75	- 100.0	+ 182.5	- 46.0	+ 84.2
	+ 0.91	- 1988.9	+ 111.5	- 1749.6	- 1.3

Residuals with Hayns Corrections

	O		C	O - C
1	- 9	+ 36 - 12 =	+ 24	- 33
2	+ 27	+ 83 - 11 =	+ 72	- 45
3	+ 134	+ 150 - 6 =	+ 144	- 10
4	+ 248	+ 170 - 2 =	+ 168	+ 80
5	+ 159	+ 174 - 0 =	+ 174	- 15
6	+ 232	+ 169 + 3 =	+ 172	+ 60
7	+ 89	+ 154 + 6 =	+ 160	- 71
8	+ 47	+ 83 + 11 =	+ 94	- 47
				+ 140 - 221
				Average = 43

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Moon's Center

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Conditional Equations

	a	b	c		c	c - c
1	-0.42	-2.00	= +37	+ 40 - 31 =	+ 9	+ 28
2	-0.98	-1.79	= +27	+ 94 - 28 =	+ 66	- 39
3	-1.76	-1.05	= +171	+ 168 - 16 =	+ 152	+ 19
4	-2.00	-0.41	= +129	+ 191 - 6 =	+ 185	- 56
5	-2.05	-0.05	= +177	+ 196 - 1 =	+ 195	- 18
6	-1.99	+0.48	= +342	+ 190 + 8 =	+ 198	+ 144
7	-1.81	+0.95	= +135	+ 173 + 15 =	+ 188	- 53
8	-0.98	+1.79	= +102	+ 94 + 28 =	+ 122	- 20
						+191 - 186

Average = 47

Normal Equations

$$\begin{aligned}
 &+20.63 + 00.91 = -1989 \quad (-1750) \\
 &+ 0.91 + 12.83 = +112 \quad (-1) \\
 &- 0.91 - 0.04 = + 88 \quad (+77) \\
 &\quad + 12.79 = +200 \quad (+76) \quad b = +15.65 \quad (+5.9) \\
 &+20.63 = -1989 - 14 = -1975 \\
 &\quad (-1750 - 5 = -1755) \quad a = -95.6 \quad (-85.1)
 \end{aligned}$$

arc covered = 140°

$$\frac{pc}{m} = 0.11$$

average(c - c) = +1

$$\frac{+1}{0.11} = 0.09 \quad \Delta n = +0.1$$

2752

Innovative Center

18

Conditional Equations

	a	b	c		c	0-c
1	-0.42	-2.00	+3.7	+ 40 - 31 =	+ 9	+ 28
2	-0.98	-1.79	+2.7	+ 94 - 28 =	+ 6.6	- 3.9
3	-1.76	-1.05	+1.71	+ 168 - 16 =	+ 15.2	+ 1.9
4	-2.00	-0.41	+1.39	+ 191 - 6 =	+ 18.5	- 5.6
5	-2.05	-0.05	+1.77	+ 196 - 1 =	+ 19.5	- 1.8
6	-1.99	+0.48	+3.42	+ 190 + 8 =	+ 19.8	+ 1.94
7	-1.81	+0.95	+1.35	+ 173 + 15 =	+ 18.8	- 5.3
8	-0.98	+1.79	+1.02	+ 94 + 28 =	+ 12.2	- 2.0
						-191 - 186

Average = 47

Normal Equations

$$\begin{aligned}
 +20.63 + 0.091 &= -19.89 \\
 +0.91 + 12.83 &= +11.2 \\
 -0.91 - 0.04 &= +8.8 \\
 +12.79 &= +20.0 \\
 +20.63 - 19.89 - 14.5 &= -19.75
 \end{aligned}$$

$$A = +15.65$$

$$B = -9.56$$

Arc covered = 140°

$$\frac{PC}{\pi} = 0.11$$

Average $\Delta z = +1$

$$\frac{1}{0.11} = 0.09 \quad \Delta z = +0.1$$

2752 Libos (mean position (1913.0))

$$\begin{array}{rcl}
 X_0 & = & 18.9800 \checkmark \\
 \Delta a & = & -48 \checkmark \\
 \hline
 & & 18.9752 \checkmark \\
 \text{Hayn} & (18.9757) & \\
 Y_0 & = & 21.0470 \checkmark \\
 \Delta b & = & +8 \checkmark \\
 \hline
 & & 21.0478 \checkmark \\
 & & (21.0473)
 \end{array}$$

$$\begin{array}{rcl}
 \text{from Plate Constants } X & = & 19.2818 \checkmark \\
 & & (19.2823) \\
 Y & = & 20.6709 \checkmark \\
 & & (20.6704)
 \end{array}$$

$$\begin{array}{rcl}
 \bar{z} & = & +1.2818 \checkmark \\
 & & (+1.2823) \\
 \eta & = & -1.3291 \checkmark \\
 & & (-1.3296)
 \end{array}$$

$$\begin{array}{rcl}
 \log \bar{z} & = & 0.10782 \checkmark \\
 \dots \cos \delta & & 9.95746 \checkmark \\
 \dots \cos \alpha & & 8.50724 \checkmark \\
 \log \tan \delta & = & 9.6687 \checkmark \\
 \delta^2 & = & 0.2156 \checkmark \\
 \hline
 & & 7.0534 \\
 & & 6.9377 \checkmark
 \end{array}$$

$$(X-A) = 1.64312 \checkmark (1.64329)$$

$$X - A = +43.97 \checkmark (43.98)$$

$$A = 40016 \checkmark$$

$$\alpha_0 = 40059.97 \checkmark (59.98)$$

$$\text{Red} = +0.45 \checkmark$$

$$\alpha' = 40100.42 \checkmark (00.43)$$

$$\eta_1 = +9 \checkmark$$

$$\eta_0 = -1.3300 \checkmark (-1.3305)$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.12385 \checkmark \\
 & & 7.33115 \checkmark
 \end{array}$$

$$(d-D) = 2.79270 \checkmark (2.79286)$$

$$d-D = -1020.4 \checkmark (207)$$

$$D = +250706 \checkmark$$

$$\delta_0 = +2456456 \checkmark (45.3)$$

$$\text{Red} = +11.1 \checkmark$$

$$\delta' = +245656.7 \checkmark (56.9)$$

2752 Lincoln's Head Position (1913.0)

$$X_0 = 18.9800$$

$$Y_0 = 21.0470$$

$$\begin{array}{r} - 48 \\ \hline 18.9752 \end{array}$$

$$\begin{array}{r} + 8 \\ \hline 21.0478 \end{array}$$

From Plate Constants $X = 19.2818$ $Y = 20.6709$

$$Z = +1.2818$$

$$\eta = -1.3291$$

$$\log Z = 0.10782$$

$$\log S = 9.95746$$

$$\log \eta = 8.50724$$

$$\log \tan S = 9.6687$$

$$\log \eta = 0.2156$$

$$7.0534$$

$$6.9377$$

$$(X-A) = 1.64312$$

$$X-A = + 43.97$$

$$A = 4 \quad 00 \quad 16$$

$$X_0 = 4 \quad 00 \quad 59.97$$

$$\eta_1 = + 9$$

$$\eta_0 = -1.3300$$

$$\log \eta_0 = 0.12385$$

$$7.33115$$

$$\text{Red} = + 0.45$$

$$(d-D) = 2.79270$$

$$\alpha' = 4 \quad 01 \quad 00.42$$

$$d-D = -10 \quad 20.4$$

$$D = +21 \quad 07 \quad 06$$

$$S = +24 \quad 56 \quad 45.6$$

$$\text{Red} = + 11.1$$

$$S = +24 \quad 56 \quad 56.7$$

2752

Red. ad locum affr

20

 $S_0' = +24^\circ 57'$

$$H + \alpha \quad 0 \quad 27'' = 6^\circ 45'$$

$$H \quad 20 \quad 26$$

$$\alpha \quad 4 \quad 01$$

$$\alpha \quad 18 \quad 55$$

$$G + \alpha \quad 22 \quad 56 = 344^\circ$$

$$\log \cos(G + \alpha) \quad 9.9828$$

$$\delta \quad 0.9767$$

$$\sin \dots \quad 9.4403m$$

$$\tan \delta \quad 9.6677$$

$$\frac{1}{\tan} \quad 8.8239$$

$$\dots (g') \quad 0.9595$$

$$(g) \quad 89086m$$

$$f \quad +0.36$$

$$\delta \quad -0.08$$

$$h \quad +0.17$$

$$\quad +0.45 \checkmark$$

$$\log \cos S \quad 9.9575$$

$$i \quad 0.8284m$$

$$\dots (i) \quad 0.7859m$$

$$\log \sin S \quad 9.6251$$

$$\cos(H + \alpha) \quad 9.9970$$

$$h \quad 1.2861$$

$$\sin \dots \quad 9.0702$$

$$\sec S \quad 0.0420$$

$$\frac{1}{\tan} \quad 8.8239$$

$$(h') \quad 0.9082$$

$$(h) \quad 92222$$

$$g' \quad +9.11$$

$$g' \quad +8.10$$

$$i \quad -6.11$$

$$\quad +11.10 \checkmark$$

2752

Red ad locum after

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So + 29° 57'

$$H + \alpha \quad 0 \quad 27^\circ = 6^\circ 45'$$

$$H \quad 20 \quad 26$$

$$\alpha \quad 4 \quad 01$$

$$G \quad 18 \quad 55$$

$$G + \alpha \quad 22 \quad 56 = 344^\circ$$

$$\log \cos(H + \alpha) \quad 9 \quad 9 \quad 8 \quad 2 \quad 8$$

$$\delta \quad 0 \quad 9 \quad 7 \quad 6 \quad 7$$

$$\sin \quad 9 \quad 4 \quad 4 \quad 0 \quad 3 \sim$$

$$\tan \delta \quad 9 \quad 6 \quad 6 \quad 7 \quad 7$$

$$\sec \delta \quad 8 \quad 8 \quad 2 \quad 3 \quad 9$$

$$(g') \quad 0 \quad 9 \quad 5 \quad 9 \quad 5$$

$$(g) \quad 8 \quad 9 \quad 0 \quad 8 \quad 6 \sim$$

$$f \quad + 0.36$$

$$\delta \quad - 0.08$$

$$h \quad + 0.17$$

$$+ 0.45$$

$$\log \cos S \quad 9 \quad 9 \quad 5 \quad 7 \quad 5$$

$$i \quad 0 \quad 8 \quad 2 \quad 8 \quad 4 \sim$$

$$(i) \quad 0 \quad 7 \quad 8 \quad 5 \quad 9 \sim$$

$$\log \sin S \quad 9 \quad 6 \quad 2 \quad 5 \quad 1$$

$$\cos(H + \alpha) \quad 9 \quad 9 \quad 9 \quad 7 \quad 0$$

$$h \quad 1 \quad 2 \quad 8 \quad 6 \quad 1$$

$$\sin \quad 9 \quad 0 \quad 7 \quad 0 \quad 2$$

$$\sec S \quad 0 \quad 0 \quad 4 \quad 2 \quad 0$$

$$f \quad 8 \quad 8 \quad 2 \quad 3 \quad 9$$

$$(h') \quad 0 \quad 9 \quad 0 \quad 8 \quad 2$$

$$(h) \quad 9 \quad 2 \quad 2 \quad 2 \quad 2$$

$$g' \quad + 9.11$$

$$g' \quad + 8.10$$

$$i \quad - 6.11$$

$$+ 11.10$$

2752 ~~Red~~ Lunar Parallax.

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$$\alpha' = 4^h 01^m 00.42^s \checkmark \text{ (00.43) } \text{Hagen}$$

$$\theta = A \quad 37 \quad 06.4^{\circ} \checkmark$$

$$G - \alpha' = +36 \quad 06^{\circ} \checkmark$$

$$= +9^{\circ} 01^{\circ} 30^{\circ} \checkmark$$

$$+ \quad \quad \quad 3 \quad 40^{\circ} \checkmark$$

$$+ \quad 8 \quad 57 \quad 50^{\circ} \checkmark$$

$$9.95727^{\circ} \checkmark$$

$$0.00000$$

$$0.00534^{\circ} \checkmark$$

$$9.96261^{\circ} \checkmark$$

$$y = 42 \quad 32 \quad 12^{\circ} \checkmark$$

$$24 \quad 56 \quad 57^{\circ} \checkmark$$

$$17 \quad 35 \quad 15^{\circ} \checkmark$$

$$9.82640^{\circ} \checkmark$$

$$8.22171^{\circ} \checkmark$$

$$748024$$

$$0.17001^{\circ} \checkmark$$

$$769836^{\circ} \checkmark$$

$$S - S' = +17. \quad 09.9^{\circ} \checkmark$$

$$S = +25 \quad 14 \quad 06.6^{\circ} \checkmark \text{ (06.3) } \alpha = 4 \quad 01 \quad 29.81^{\circ} \checkmark$$

$$(29.82)$$

$$\text{Hant Allen. } S = +25 \quad 14 \quad 04.5^{\circ} \checkmark$$

$$\alpha = 4 \quad 01 \quad 28.86^{\circ} \checkmark$$

$$O - C$$

$$+ \quad 2.1^{\circ} \checkmark$$

$$+0.95^{\circ} \checkmark$$

$$\text{with Hagen correction } (+ \quad 1.8)$$

$$(+0.96)$$

2752 ~~Red~~ Lunar Parallax

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$$\alpha' = 4^h 01^m 00^s.42$$

$$\theta = 4 \quad 37 \quad 06.4$$

$$G - \alpha = +36 \quad 06. \\ + 9^{\circ} \quad 01' \quad 30''$$

$$+ \quad \quad \quad 3 \quad 40$$

$$+ \quad 8 \quad 57 \quad 50$$

$$9.95727$$

$$000000$$

$$000534$$

$$\hline 996261$$

$$\gamma = 42 \quad 32 \quad 12$$

$$24 \quad 56 \quad 57$$

$$17 \quad 35 \quad 15$$

$$9.82640$$

$$8 \quad 221711$$

$$948024$$

$$017007$$

$$\hline 769836$$

$$S - \delta = +17 \quad 09.9$$

$$S = +25 \quad 14 \quad 06.6$$

$$\text{Hantken } S = +25 \quad 19 \quad 04.5$$

$$O - C$$

$$=$$

$$27$$

$$S' = +24^{\circ} 56' 56''.7$$

$$\pi = 57' 16''$$

$$986913$$

$$822171$$

$$919552$$

$$004355$$

$$\hline 732999$$

$$\alpha - \alpha' = +7' 20.90$$

$$= +29.39$$

$$\alpha = 4 \quad 01 \quad 29.81$$

$$\alpha = 4 \quad 01 \quad 28.86$$

$$+0.95$$

