

KG

11366

v.924

Volume XLVIII



Plates



1957

1963

196A

Harvard Lunar Plates

Measures and Reductions

Mary Towler

Volume XLVIII

Plate No	Date	Page
1957	1912 Aug. 27	1
1963	1912 Aug 29	10
1964	1912 Aug 29	20

1
9-
19

3
21
27

3
24
11

1957

Star-measures.

1913 Nov. 28.

1

	d	y	v	d	x	v
1	16891	16405		17317	15106	
9.2	14020	8280		9372	1603138	
19.2	10	77		7570	36	
	10	09		15	00	
	<u>14.1878</u>	<u>1871</u>		<u>9.2057</u>	<u>2070</u>	
3						
21.6	16156	15425		15229	16143	
27.6	960000	1179092		1120090	1016171	
	00	00		91	70	
	68	40		28	40	
	<u>27.6564</u>	<u>6564</u>		<u>21.5965</u>	<u>5974</u>	
3						
14.128	14820	10780		11589		
24.04	1207782	688181		8080	1120060	
11.3	76	7581		10382	00	
	32	36				
	<u>17.2051</u>	<u>2046</u>		<u>24.0398</u>	<u>0389</u>	

Grade 3.

1957

1913 Nov. 28

1

Starm - measures

	d	y	v	d	x	v
1	16891		16405	17317		18106
92	15020		828080	9372		1603138
192	10		77	7570		36
	10		09	15		00
	<u>19.1878</u>		<u>1871</u>	<u>92057</u>		<u>2070</u>
2						
4.6	16156		15425	15229		16143
27.6	960060		1199092	11200		1016171
	00		00	9190		70
	68		40	28		40
	<u>27.6564</u>		<u>6564</u>	<u>215965</u>		<u>5974</u>
3						
	14128		14820	10780		11589
24.01	1207782		688181	8080		1120000
113	76		75	10382		00
	32		36			
	<u>17.2051</u>		<u>2046</u>	<u>24.0398</u>		<u>0389</u>

Grade 3.

1957 moon-measures

2

1	14 658	19504
17.2	681023	17352
16.8	19	5526
min	20	14
if	16.7850	7848

2	19610	19522
18.0	1057055	1858181
16.9	55	70
	16	20
	16.9056	9055

3	scratch			
18.6	18422	18611	17600	19509
17.4	1471011	1232029	1477060	1235552
	20	30	61	53
	34	15	00	10
	17.3713	3713	18.7164	7157

4				
19.1			1321001	14711
18.0			90	1353126
			12017	2126

19.1183	1182
---------	------

5	Remeasure	19301	16820	18117
19.2	direct	1179202	941101	15601
18.5		91	1301	0901
max		12	30	21
6		19.2486	19.2578	2514

19.2		16900	17141
18.0		919188	1483939
		9588	31
		02	49
		19.2289	2307

1957

moon-measures

2

1	14658	19504
17.2	6810 ₂₃	17352
16.8	19	55-56
min	20	14
$\bar{y}$	<u>16.7850</u>	<u>7848</u>

2	19610	19522
180	10570 ₅₅	18581 ₈₁
16.9	55	70
	16	20
	<u>169056</u>	<u>9055</u>

3	scratch.	
18.6	18422	18611
17.4	14710 ₁₁	12320 ₂₉
	20	30
	34	15
	<u>17.3713</u>	<u>3713</u>

4
19.1
18.0

17600	19509
14770 ₆₀	12355 ₅₂
61	53
00	10
<u>18.7164</u>	<u>7157</u>

13210 ₀₁	14711
90	13531 ₈₆
12017	21

19.1183 1182

5	Remeasure	19301
19.2	direct	11792 ₀₂
18.5		91
max		12
$\bar{y}$		<u>19.2486</u>

16820	18117
9411 ₀₁	15601
130	0501
30	21
<u>19.2578</u>	<u>2519</u>

6
19.2
19.0

16900	17141
9191 ₈₈	14839 ₃₉
95	31
02	49
<u>19.2289</u>	<u>2307</u>

1957 Snow Measures

3

	d	1	d	2	w
7	15083	16215			
19.0	839209	1292121			
19.6	90	38			
	93	35			
	<u>19.6693</u>	<u>16705</u>			

oblique

8	~~15534~~
14.7	
20.0	indistinct
	front.

15534	16989
13100	942692
5418	20
48	93
<u>14.7585</u>	<u>7579</u>

9	19148	16083
18.0	1398178	1122025
20.6	79	10
	52	03
	<u>20.5171</u>	<u>.5125</u>

Remains y direct
= 20.5153

10	19170	15058
17.3	1286268	1139491
20.6	59	96
max	90	75
	<u>20.6389</u>	<u>.6329</u>

1957 known measures

3

	d	μ	d	μ
2	15083	16215		
19.0	839209	129215		
19.6	90	3821		
	93	35		
	<u>19.6693</u>	<u>16705</u>		

oblique

8 ~~15534~~
 14.7
 w.o. indistinct
 front.

15534
 13100
 5418
 48
18.7585

16989
 942692
 20
 93
7579

9	19148	16083
18.0	1398178	11220
w.o.	79	10
	52	03
	<u>205171</u>	<u>.5125</u>

Remeasure μ direct
 = 20.5153

10	19170	15058
17.3	1286268	1139491
w.o.	19	96
max	90	75
	<u>20.6389</u>	<u>.6329</u>

1957	Times etc.							
Exp. total	1912 Aug 27	22	52 ^m		-23 ^m	04 ^m		
Unknown		22	58	10.2 ^v	-22	58	10.5 ^v	
clock slow			1	04.3 ^v				
H. Sid T.		22	59	14.65 ^v				
H. long		4	44	31.05 ^v				
G. Sid T.		27	43	45.70 ^v				
Sid T. unknown		10	21	24.51 ^v				
Interval		17	22	21.19 ^v				
Reduction			2	50.76 ^v				
G. M. T.		17	19	30.43 ^v				
					$\theta - \alpha = +0^{\circ} 13^m$			

From bank Allen. R.G. Koch.
 Moon 17^h 22^m 45^m 303.58 - 11 01 40.1
 Motion in 1.8275^v 13.400
 " " 19.5072^v + 35.65 + 4 21.4
 Tabular place 22 46 0623 - 10 57 18.7

Moon's age 15 days
 - parallax = 54' 23.0" ✓
 - semidiameter = 14 50.7" ✓
 $934 - 9.4 = 924.6$
 $891 - 8.6 = 882.4$
 $R = 890.7$ ✓
 Augmentation + 8.6" ✓
 Translative (5) - 0.7" ✓
 $R = 898.6$ ✓
 $R = 1.9263$ ✓
 $a = -1.7$
 $(1+a) R = 1.9260$ ✓
 $R^2 = 3.7095$ ✓

1957 Times etc.

h ₀ telan	1912 Aug 27	22	52		-23	04	
known		22	58	10.2	-22	58	10.5
clock slow			1	04.3			
H. Sid T		22	54	1465			
Whomp		4	44	31.05			
G. Sid T		27	43	4570			
Sid T known		10	21	2451			
Interval		17	22	21.19			
Reclination			2	50.76			
G. M. T.		17	19	3043	$\theta - \alpha = +0^{\circ} 13''$		

From hant Alam.		R.G.		Recl.	
known 17	22	45	30.58	-11	01.40.1
known 1.8275				13.400	
19.5072			+35.65		+4 21.4
Tabular place	22	46	06.23	-10	57 18.7

knowns age 15 days

parallax	= 54	23.0
semidiameter	14	50.7
R		890.7
amplitude		+ 8.6
in altitude		- 0.7
R		898.6
R		19263
$a = 1.7$	$(1+a) R$	19260
	R^2	37095

1957

Plate Conalant

5

$$\begin{array}{rclcl}
 x = & 9.2064 & 21.5970 & 24.0394 \\
 y & 9.4343 & 21.7983 & 24.2970 \\
 x - y & -2279 & -2013 & -2576
 \end{array}$$

$$\begin{array}{rclcl}
 y & 19.1874 & 27.6564 & 18.2048 \\
 x & 20.4914 & 29.0118 & 12.5557 \\
 y - x & -1.3040 & -1.3554 & -1.3509
 \end{array}$$

$$\begin{array}{rclcl}
 x - y & -344 & +1.7x & +2916 \\
 -2279 - 652 & = -2931 & +162 & = -2915 & = +1 \\
 -2013 - 940 & = -2953 & +37 & = -2916 & = 0 \\
 -2576 - 381 & = -2957 & +41 & = -2916 & = 0 \\
 17.3282 & - 636 & +29 & & = 17.5591
 \end{array}$$

$$\begin{array}{rclcl}
 y - x & +35.9x & +8.1y & +1.2559 \\
 -1.3040 + 331 & = -1.2709 & +1.56 & = -1.2553 & = +1 \\
 -1.3554 + 775 & = -1.2779 & +224 & = -1.2555 & = -1 \\
 -1.3509 + 863 & = -1.2646 & +91 & = -1.2555 & = -1 \\
 18.7098 & + 622 & +1.52 & & = 20.0426
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tablen } a = 0.0 & c = -5.4 & a - c = +5.4 & b + d = -0.8 \\
 \text{Obs } a = -1.7 & c = -8.1 & a - c = +6.4 & b + d = -1.9
 \end{array}$$

$$\begin{array}{rclcl}
 & +2.7 & -1.0 & +1.1
 \end{array}$$

1957

Plate Conclusions

$x =$	92064	21.5970	240394
y	94343	21.7983	242970
$z =$	-2279	-2013	-2576
u	191874	27.6564	182048
v	204914	29.0118	125557
$u-v$	-13040	-1.3554	-1.3509

$$\begin{array}{rclcl}
 u - 3 & -344 & & +1.72 & +291.6 \\
 -2279 - 652 & = -2931 & +1.6 & = -291.5 & = +1 \\
 -2013 - 940 & = -2953 & +3.7 & = -291.6 & = 0 \\
 -2576 - 381 & = -2957 & +4.1 & = -291.6 & = 0 \\
 173282 - 636 & & +2.9 & & = 17559.1
 \end{array}$$

$$\begin{array}{rclcl}
 u - v & +35.92 & & +8.14 & +1.2554 \\
 -13040 + 381 & = -12709 & +1.56 & = -1.2553 & = +1 \\
 -13554 + 775 & = -12779 & +2.24 & = -1.2555 & = -1 \\
 -13509 + 863 & = -12646 & +9.1 & = -1.2555 & = -1 \\
 187098 + 622 & & +1.52 & & = 20.0426
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables } a = 0.0 & c = -5.0 & a - c = +5.0 & b + d = -0.8 \\
 \text{Obs } a = -1.7 & c = -8.1 & a - c = +6.4 & b + d = -1.9
 \end{array}$$

lt.	pos. $\angle$	residual
1	180.0	-4
2	159.5	0
3	134.0	+103
4	111.7	-10
5	90.0	-162
6	51.4	-91
7	60.0	+82
8	48.0	+28
9	20.5	+10

1957

Moon's Center

6

	y	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - c$	
1	17.3249	0.0000	0.0000	3.7099	+	4
2	18.0000	+0.6751	0.4557	3.7148	+	53
3	18.7160	+1.3911	1.9352	3.7292	+	197
4	19.1182	+1.7933	3.2159	3.7206	+	111
5	19.2500	+1.9251	3.7060	3.7060	-	35
6	19.2298	+1.9049	3.6286	3.7128	+	33
7	19.0000	+1.6751	2.8059	3.7283	+	188
8	18.7582	+1.4333	2.0544	3.7201	+	116
9	18.0000	+0.6751	0.4557	3.7148	+	53
10	17.3249	0.0000	0.0000	3.6995	-	100
Comp R^2				3.7095		

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	16.7849	-1.9251	-10	3.7099
2	16.9056	-1.8044	-9	3.2591
3	17.3713	-1.3387	-7	1.7940
4	18.0000	-0.7100	-4	0.5047
5	18.7100	0.0000	0	0.0000
6	19.0000	+0.2900	+1	0.0842
7	19.6699	+0.9599	+5	0.9224
8	20.0000	+1.2900	+6	1.6657
9	20.5144	+1.8044	+9	3.2591
10	20.6324	+1.9224	+10	3.6995

Approximate Center

$$x = 18.0 \quad y = 16.9056$$

$$20.5144$$

$$37.4200$$

$$Y_0 = 18.7100$$

$$18.7100$$

$$y - \min = 16.7849$$

$$y - \max = 20.6324$$

$$R = 1.9251$$

$$R = 1.9224$$

$$x - \max = 19.2500$$

$$X_0 = 17.3249$$

$$\text{Appr Center } \begin{cases} X_0 = 17.3249 \\ Y_0 = 18.7100 \end{cases}$$

1957

Lunar's Center

6

	y	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - c$
1	17.3249	0.0000	0.0000	3.7099	+ 4
2	18.0000	+0.6751	0.4557	3.7148	+ 53
3	18.7160	+1.3911	1.9352	3.7292	+ 197
4	19.1182	+1.7933	3.2159	3.7206	+ 111
5	19.2500	+1.9251	3.7060	3.7060	- 35
6	19.2298	+1.9049	3.6286	3.7128	+ 33
7	19.0000	+1.6751	2.8059	3.7283	+ 188
8	18.7582	+1.4333	2.0544	3.7201	+ 116
9	18.0000	+0.6751	0.4557	3.7148	+ 53
10	17.3249	0.0000	0.0000	3.6995	- 100

Comp $K = 3.7095$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.7849	-1.9251	-10	3.7099
2	16.9056	-1.8044	-9	3.2591
3	17.3713	-1.3387	-7	1.7940
4	18.0000	-0.7100	-4	0.5047
5	18.7100	0.0000	0	0.0000
6	19.0000	+0.2900	+1	0.0842
7	19.6699	+0.9599	+5	0.9224
8	20.0000	+1.2900	+6	1.6657
9	20.5144	+1.8044	+9	3.2591
10	20.6324	+1.9224	+10	3.6995

Approximate Center

$$x = 18.0 \quad y = 16.9056$$

$$\underline{20.5144}$$

$$37.4200$$

$$y_0 = 18.7100$$

$$18.7100$$

$$y_{\text{min}} = 16.7849$$

$$y_{\text{min}} = 20.6324$$

$$K = 1.9251$$

$$K = 1.9224$$

$$x_{\text{max}} = 19.2500$$

$$x_0 = 17.3249$$

$$\text{Approx Center } \begin{cases} x_0 = 17.3249 \\ y_0 = 18.7100 \end{cases}$$

Formation of Normals.

	ab	an	bm
1	- 0.00	+ 0.0	- 7.7
2	- 1.22	+ 36.0	- 95.4
3	- 1.86	+ 273.8	- 264.0
4	- 1.27	+ 198.7	- 78.8
5	+ 0.00	- 17.3	- 0.0
6	+ 0.55	+ 62.7	+ 9.6
7	+ 1.60	+ 315.8	+ 180.5
8	+ 1.84	+ 165.9	+ 149.6
9	+ 1.22	+ 36.0	+ 95.4
	<u>+ 0.86</u>	<u>+ 1071.6</u>	<u>- 10.8</u>

丁

$$+ 16.40 + 0.86 = + 1072$$

$$+ 0,86 + 15,20 = -11$$

$$-0.86 - 0.04 = -0.90$$

$$+ 1516 = -67$$

$$b = -4.4$$

1 0 0 4 - 0.8 6 = + 1

$$+1634 \qquad = +1073$$

$$a = 465.7$$

1957 Moon's Center
Conditional Equations

7

	a	b	0		c	0-c
1	0.00 - 1.93 =	+4.	+	0+	8 = +8	-4
2	+0.68 - 1.80 =	+53	+	45+	8 = +53	0
3	+1.39 - 1.39 =	-1.97	+	1.88+	6 = +94	+103
4	+1.79 - 0.71 =	+1.11	+	1.18+	3 = +121	-10
5	+1.93 + 0.00 =	-35	+	1.27-	0 = +127	-162
6	+1.90 + 0.29 =	+33	+	1.25-	1 = +124	-91
7	+1.68 + 0.96 =	+1.88	+	1.10-	4 = +106	+82
8	+1.43 + 1.29 =	+1.16	+	94-	6 = +88	+28
9	+0.68 + 1.80 =	+53	+	45-	8 = +37	+16
10					Average: 55	

Normal Equations

$$+16.40 + 0.86 = +1072$$

$$+ 0.86 + 15.20 = -11$$

$$- 0.86 - 0.04 = -56$$

$$+ 15.16 = -67$$

$$b = -4.4$$

$$- 0.05 - 0.86 = +1$$

$$+ 16.35 = +1073$$

$$a = +65.7$$

Red. ad. loapp.

$$\begin{array}{rcl}
 H+u & 6 & 36 = 99^\circ \\
 h & 7 & 50 \\
 u & 22 & 46 \\
 a & 21 & 28 \\
 G+u & 20 & 14 = 303^\circ 30'
 \end{array}$$

$$\begin{array}{rcl}
 l \cos(G+u) & 9 & 7419 \\
 q & 1 & 1777 \\
 \sin & 9 & 9211 m \\
 \tan S & 9 & 3155 m \\
 \frac{1}{\tan} & 8 & 8239 \\
 \\
 \delta' & 6 & 9196 \\
 \delta & 9 & 2382
 \end{array}$$

$$\begin{array}{rcl}
 f & + & 1.81 \\
 s & + & 0.17 \\
 h & + & 1.28 \\
 \hline
 & + & 3.26
 \end{array}$$

$$S = -11^\circ 41'$$

$$\begin{array}{rcl}
 l \cos S & 9 & 9909. \\
 i & 0 & 8655 \\
 (l) & 0 & 8574
 \end{array}$$

$$\begin{array}{rcl}
 l \sin S & 9 & 3064 m \\
 " \cos(G+u) & 9 & 1943 m \\
 h & 1 & 2811 \\
 \sin & 9 & 9946 \\
 \sec S & 0 & 0091 \\
 \frac{1}{\sin} & 8 & 8239 \\
 \\
 h' & 9 & 7818 \\
 h & 0 & 1087
 \end{array}$$

$$\begin{array}{rcl}
 \delta' & + & 5.31 \\
 h' & + & 0.61 \\
 i & + & 7.20 \\
 \hline
 & + & 16.12
 \end{array}$$

1957 hrvorishia au Position (1912.0)

8

$$\begin{array}{rcl}
 X_0 = 17.3249^\circ & Y_0 = 18.7100^\circ & \\
 \frac{1}{2}a = +33^\circ & \frac{1}{2}b = -2^\circ & \\
 \hline
 17.3282^\circ & 18.7098^\circ &
 \end{array}$$

From Plate Constants $X = 17.5591^\circ$ $Y = 20.0426^\circ$

$$\begin{array}{rcl}
 z = -0.4409^\circ & & \\
 \log z = 9.64434^m & & \\
 \log S = 9.99090^m & & \\
 \log t = 8.50724 & &
 \end{array}$$

$$(X-A) = 114620^m$$

$$X-A = -14.00^\circ$$

$$A = 22.4608^\circ$$

$$Y_0 = 22.4554.00^\circ$$

$$\text{Red ad l. app.} + 3.26^\circ$$

$$X' = 22.4557.26^\circ$$

$$\eta = -1.9574$$

$$\begin{array}{rcl}
 \log \tan \delta = 7.0534^\circ & & \\
 \log \tan \delta = 9.3650^m & & \\
 \log \tan \delta = 9.2887^\circ & & \\
 \eta_1 = 56571^m & &
 \end{array}$$

$$\begin{array}{rcl}
 \log \eta_0 = 0.29168^m & & \\
 \log \eta_0 = 7.3311^\circ & &
 \end{array}$$

$$(Y-D) = 296053^m$$

$$S-D = -15.13.1^\circ$$

$$D = -11.2608^\circ$$

$$S_0' = -1.14121.1^\circ$$

$$\text{Red ad l. app.} + 16.1^\circ$$

$$S' = -11.4105.0^\circ$$

1957 *hypothesis* (Posthum (1912.0))

$$X = 17.3249 \quad Y = 187100$$

$$a = +33 \quad b = -2$$

$$173282 \quad 187098$$

From Plate Constants $X = 17.5591 \quad Y = 20.0426$

$$z = -0.4409$$

$$\log z = 9.64434m$$

$$s = 9.79091$$

$$w = 8.50724$$

$$(X-A) = 114619m$$

$$X-A = -14.00$$

$$A = 224608$$

$$X_0 = 224554.00$$

$$\text{Red adl. app.} + 326$$

$$X' = 224557.26$$

$$\eta = -19574$$

$$\log \tan \delta = 9.3450m$$

$$\log \eta = 9.2887$$

$$\eta = 56571m$$

$$\log \eta_0 = 0.29788m$$

$$w = 733115$$

$$(d-b) = 296053m$$

$$S-D = -1513.8$$

$$D = -112608$$

$$S_0' = -114125.8$$

$$\text{Red adl. app.} + 16.1$$

$$S' = -114105.0$$

1957 Lunar Parallax

$$\begin{aligned}
 \alpha' &= 22^{\circ} 45' 57.26'' \\
 \delta &= 22^{\circ} 59' 14.65'' \\
 &+ 13' 17.39'' \\
 &= +3^{\circ} 19' 20.8''
 \end{aligned}$$

$$+ 1' 11.2''$$

$$+ 3' 18' 09.6''$$

$$\begin{aligned}
 &9.95727'' \\
 &0.00000 \\
 &0.00072'' \\
 \hline
 &9.95799''
 \end{aligned}$$

$$42^{\circ} 14' 00''$$

$$-11' 41' 05''$$

$$53' 55' 05''$$

$$\begin{aligned}
 &9.82640'' \\
 &8.19917'' \\
 &9.90751'' \\
 &0.17253'' \\
 \hline
 &8.10561''
 \end{aligned}$$

$$+ 43' 50.6''$$

$$\delta = -10^{\circ} 57' 14.9'' \quad \alpha = 22^{\circ} 46' 06.76''$$

$$\text{Am Eff } \delta = -10^{\circ} 57' 18.7'' \quad \alpha = 22^{\circ} 46' 06.23''$$

$$O-C \quad + 43'' \quad + 0.53''$$

$$\delta' = -11^{\circ} 41' 05.0''$$

$$\pi = 54' 23.0''$$

$$\begin{aligned}
 &9.86913'' \\
 &8.19917'' \\
 &8.76309'' \\
 &0.00799'' \\
 \hline
 &6.83438''
 \end{aligned}$$

$$\alpha - \alpha' = + 2' 22.50''$$

$$= + 09.50''$$

1957 Lunar Cavallaro

$$\alpha' = 22^{\circ} 45' 57.26$$

$$\delta = 22^{\circ} 59' 14.65$$

$$+ 13' 17.39$$

$$= + 5^{\circ} 19' 20.8$$

$$+ 1' 11.2$$

$$+ 3' 18' 09.6$$

$$9.95727$$

$$0.00000$$

$$0.00072$$

$$9.95799$$

$$42^{\circ} 14' 00''$$

$$- 11' 41' 05.9$$

$$53' 55' 05.7$$

$$982640$$

$$819917$$

$$990751$$

$$017253$$

$$810561$$

$$+ 43' 50.6$$

$$\delta = -10' 57' 14.4 \quad \alpha = 22' 46' 06.76$$

$$\text{Am Eff } \delta = -10' 57' 18.7 \quad \alpha = 22' 46' 06.23$$

$$0-0$$

$$+ 4.3$$

$$+ 0.53$$

$$\delta' = -11^{\circ} 41' 05.9$$

$$\pi = 54' 23.0$$

$$986913$$

$$819917$$

$$876309$$

$$000799$$

$$683438$$

$$\alpha - \alpha' = + 2' 22.50$$

$$= + 09.50$$

1963

Stars - Measures

1913 Dec. 1

10

	d	N
1	1 8952	19005
12.9	16110	11862
15.3	00	63
	69	19
	<u>15.2850</u>	<u>.2848</u>

	d	N
	13065	949791
	12300	90
	00	8730
	<u>12.9236</u>	<u>.9239</u>

	d	N
3	17805	17500
16.6	918181	16130
31.8	71	226
	10	20
	<u>31.8631</u>	<u>.8624</u>

	d	N
	17753	18595
	13729	1262021
	31	21
	62	19
	<u>16.5975</u>	<u>.5988</u>

	d	N
3	17458	19840
29.9	1461108	12688
13.3	09	8790
	65	50
	<u>13.2851</u>	<u>.2841</u>

	d	N
	10640	1328988
	10279	90
	78	12920
	<u>29.9637</u>	<u>.9631</u>

Grade 3 or 4.

1
12
15

1963

Stars - measures

1913 Dec. 1

10

	α	δ
1	1 89 52	19 00 5
129	1 61 10	11 86 26
153	00	63
	69	19
	<u>15.2850</u>	<u>2848</u>

	α	δ
	1 30 65	9 9 29
	1 23 00	9 0 1
	00	87 30
	<u>12.9236</u>	<u>9239</u>

	α	δ
2	1 78 05	17 50 0
166	9 18 18	1 61 30
318	71	21 26
	10	20
	<u>31.8631</u>	<u>8624</u>

	α	δ
	1 77 53	18 59 5
	1 37 29	12 6 20
	31	21
	62	19
	<u>16.5975</u>	<u>5988</u>

	α	δ
299	1 74 58	19 84 0
133	1 46 10	12 6 8
	09	87 90
	65	50
	<u>132851</u>	<u>2841</u>

	α	δ
	1 06 40	13 28 9
	1 02 79	90
	78	129 20
	<u>299637</u>	<u>9631</u>

Grade 3 or 4.

1963

Moon-measures

21

d

y

v

d

x

w

1 scratch

18.8 15790
 17.2 1395161
 69
 08

17.1834

2

19.0 15780
 17.4 1163220
 20
 90

17.4160

3

19.3
 18.0

17912
 976060
 5560
 28

1833

19840
 14011
 1820
 48

4171

1730.1
 1477080
 6980
 14

18.7468

13646
 716061
 50
 51

13646
 716061
 50
 51

19.3508

18180
 1300000
 97
 80

19.4824

17141
 1182940
 31
 59

19.4682

16296
 883820
 30
 80

7451

20150
 1661008
 9098
 54

3553

19200
 1436555-
 5755-
 06

4846

18230
 1352039
 3139
 40

4705

4
 19.5
 18.6
 max

in
 x

5
 19.4
 19.0

6
 19.0 12514
 20.04 1237360
 71

20.0146

12390
 9595-
 12275

0118

1963

Moon - measures

21

d

y

v

d

v

1 scratch

188 15790
 172 139516
 69
 08

17.1834

17912
 9.76060
 5560
 28

18.33

17301
 1477080
 69
 14

18.7968

16296
 883830
 30
 80

7451

190 15780
 174 1163220
 20
 90

17.4160

19840
 14011
 1820
 48

4171

13646
 716061
 50
 51

3
 193
 18.0

13646
 716061
 50
 51

19.3508

20150
 16670
 9098
 59

3563

4
 195
 18.6
 19.4
 19.0

18170
 1300000
 97
 80

19.4824

19200
 1436555
 51
 06

4846

17141
 1182940
 31
 59

19.4682

18230
 1352038
 31
 40

4705

6
 19.0 12514
 2004 1237360
 71

20.0146

12390
 9595
 12275

0115

1963 Moon - Measures

13

7	d 4	~	d	x	w
18.0	16059		17681		
20.6	991412		1382007		
	10		17		
	75		90		
	<u>20.6157</u>		<u>.6130</u>		

8					
17.5	16086		17640		
20.7	941002		1432020		
max	09		29		
"	00		52		
8	<u>20.6689</u>		<u>.6679</u>		

9	15123		16602		
17.0	9190		12550		
20.6	9084		48		
	37		18		
	<u>20.5945</u>		<u>.5941</u>		

possibly in termination.

1963 Moon Measures

1.2

Z	d	4	~	d	~	~
18.0	16059			17681		
20.6	9919	12		13820	07	
	10			17		
	71			90		
	<u>20.6157</u>			<u>6130</u>		

8						
17.5	16086			17640		
20.7	9410	02		14320		
max	09			29	20	
	00			52		
Y	<u>20.6689</u>			<u>6679</u>		

9	15123			16602		
17.0	9190			12550	20	
20.6	90	84		44		
	37			18		
	<u>20.5945</u>			<u>1741</u>		

possibly a terminator

1963

Tunies etc.

13

Cyhtslam 1912 Aug 29 22^h 30^m ✓ - 22^h 42^m ✓
 --- known 22 35 32.9^h 22 35 33.1^h
 clock slow 1 02.9^h ✓

H. J. d. T. 22 36 35.9^h ✓
 H. hong 4 44 31.05^h ✓
 G. lid T. 27 21 06.91^h ✓
 S. T. Th. won 10 29 17.62^h ✓
 Interval 16 51 49.33^h ✓
 Reduction 2 45.76^h ✓
 G. m. T. 16 49 03.57^h G-d = - 1^h 35^m ✓

From Kant. Alm. P. A. local.
 known 17^h 0^h 11^m 57.94^h + 0^h 19^m 36.5^h ✓
 motion in $\alpha = 1.7996^h - 14.677^h ✓
 ... - 0.9405^h - 19.69^h - 2 40.6^h ✓
 tubular place 0 11 38.25^h + 0 16 55.9^h ✓$

Moon's age = 17 days.

- Parallax = 55' 01.9^h ✓- Semidiameter = 15' 01.3^h ✓R = 9 01.3^h ✓Augmentation + 9.9^h ✓Irradiation - 0.7^h ✓R = 9 10.5^h ✓R = 1.9528 1.9518^h ✓

a = - 2.6

(1+a)R = 1.9523 1.9513^h ✓R² = 3.8115 3.8076^h ✓

931 = 10.65^h
 901 = 9.9^h

1963

Taurus etc.

13

Substation 1912 Aug 29 22^h 30^m - 22^h 42^m
 known 22 35 32.9 22 35 33.1
 clock slow 1 02.9

H. Sid T 22 36 35.9
 H. long 4 44 31.05
 G. Sid T 27 21 06.95
 S. T. 2. known 10 29 17.62
 Interval 16 51 49.33
 Radiation 2 45.76
 G. M. T. 16 49 03.57 G-X - 1' 35"

From Nant. Obs. R. G. black
 known 17^h 0^h 11^m 57.94 + 0^h 19' 36.5"
 motion = 1.7996 - 14.677
 - 0.9405 - 19.69 - 2 + 0.6
 Nant. black place 0 11 38.25 + 0 16 55.9

Known age 17 days.

Parallax 55' 01.9

Circumference 15' 01.3

H = 9 01.3

Amplitude + 9.9

Inclination - 0.7

R = 9 10.5

R = 1.9528 1.9518

1 + a/R = 1.9523 1.9513

R = 3.8115 3.8076

139 - 10.61
 501 - 9.9

a = -2.6

1963

Platen constants

$\bar{x}$	$\bar{y}$	$R.A.$	$Decl$
12.9238	15.2849	0 10 19	-0 47 31
16.5982	31.8628	0 12 09	+1 21 40
29.9634	13.2846	0 19 10	-1 01 46
3 59.49	60.43	0 41 38	-0 27 37
19.83	20.14	0 13 53	-0 09 12
-1.8	-2.2	- 57	+14 25
1.83	1.86	0 12 56	+0 05 13
31	465		
57 ³	14' 25"		

$$A = 0^h 12^m 56^s$$

$$D = +0^\circ 05' 13''$$

$$\begin{array}{rclcl}
 x - \bar{x} & -98.54 & +2.6x & +1899 & \\
 -427 & -1506 & -1933 & +34 & = -1899 \\
 +1197 & -3138 & -1941 & +43 & = +1 \\
 -669 & -1309 & -1978 & +78 & = -1 \\
 175397 & -1844 & +46 & & = 175498
 \end{array}$$

$$\begin{array}{rclcl}
 y - \bar{y} & +96.82 & +3.6y & -1993 & \\
 +686 & +1251 & +1937 & +55 & = +1992 \\
 +271 & +1607 & +1878 & +115 & = +1993 \\
 -955 & +2900 & +1945 & +48 & = +1993 \\
 187175 & +1698 & +67 & & = 187947
 \end{array}$$

Tables	$a = -0.5$	$e = -3.4$	$a - e = +2.9$	$b + d = +2.5$
Obs	$a = -2.6$	$e = -3.6$	$a - e = +1.0$	$b + d = +1.7$

1963

Plate constants

x	y	R	Q	W	U
12.9238	15.2844	0	10	19	-0
16.5982	31.8628	0	12	09	+1
29.9634	13.2846	0	19	10	-1
35.949	16.043	0	41	38	-0
19.83	20.14	0	13	53	-0
18	22			57	+14
183	186	0	12	56	+0
31	465				
57 ³	14'25"				

$$A = 0^h 12^m 56^s$$

$$D = +0^0 05' 13''$$

$$\begin{aligned}
 x - 5 &= -98.54 & +2.62 & & +1899 \\
 -427 &= -1506 & -1933 & +34 &= -1899 & = 0 \\
 +1197 &= -3138 & -1941 & +43 &= -1898 & = +1 \\
 -669 &= -1309 & -1978 & +78 &= -1900 & = -1 \\
 175399 &= -1844 & +46 & & &= -175498
 \end{aligned}$$

$$\begin{aligned}
 y - 4 &= +96.42 & +3.64 & & -1993 \\
 +686 &= +1251 & +1937 & +55 &= +1992 & = -1 \\
 +271 &= +1607 & +1878 & +111 &= +1993 & = 0 \\
 -955 &= +2900 & +1945 & +48 &= +1993 & = 0 \\
 187186 &= +1698 & +67 & & &= -186947
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a &= -0.5 & a &= -34 & a &= -0.2 & +2.9 & b+a &= +2.5 \\
 \text{Obs } a &= -2.6 & a &= -3.6 & a &= -2 & +1.0 & b+a &= +1.7
 \end{aligned}$$

1963

Standard Coordinates

15

Cape W. 22 mp 85				Cape W. 28 mp 7.3				Cape W. 42 mp 8.9			
C	0	09	42.57	0	11	31.80		0	18	33.16	
L			60			80				27	
E			65			76				19	
mean	0	09	42.61	0	11	31.79		0	18	33.21	
Proc		+	36.86		+	36.89			+	36.84	
X	0	10	19.47	0	12	08.68		0	19	100.5	
A	0	12	56	0	12	56		0	12	56	
A-A	-	2	36.53	-	0	47.32		+	6	14.05	
S(A-A)		-	156.53		-	47.32			+	374.00	
log		2.194459	m		1.67504	m			2.57287		
cos		9.999996			9.999988				9.999993		
S		0.70179	m		0.18216	m			1.08004		
S		-5.0326			-0.5211				+12.0238		
S		-	9		-	4			+	65	
S		12.9665			16.4785				30.0303		
X		12.9238			16.5982				29.9634		
X-B		-	427		+1197				-	669	
C	-0°	51'	31.0	+1°	17'	39.9		-1°	05'	44.2	
L			31.8			40.7				43.6	
E			31.7			40.3				44.9	
mean	-0	51	31.5	+1	17	40.3		-1	05	44.2	
Proc		+	4		+	4			+	3	
S	-0	47	31.2	+1	21	40.5		-1	01	46.3	
D	+0	05	13	+0	05	13		+0	05	13	
S-D	-0	52	44.2	+1	16	27.5		-1	06	59.3	
S(A-D)		-	316.44		+	4588.3			-	4019.8	
log		3.50029	m		3.66165	m			3.60421	m	
log		0.83144	m		0.99280	m			0.93536	m	
tan S		8.1406	m		8.3759	m			8.2546	m	
S		14036			03643				21601		
tan		6.5976	m		5.7936	m			7.4681	m	
tan		-6.7833			+9.8356				-8.6170		
tan		-	4		+	1			-	29	
tan		15.2163			31.8357				13.3801		
tan		15.2849			31.8628				13.2846		
tan		+	686		+	271			-	955	

1963

Standard Coordinates

15

Cape No. 22 mp 85				Cape No. 28 mp 73				Cape No. 42 mp 59			
C	0°	09"	42.57	0°	11"	31.80		0°	18"	33.16	
L			60			80				27	
B			65			76				19	
mean	0	09	42.61	0	11	31.79		0	18	33.21	
Proc		+	36.86		+	36.89			+	36.84	
X	0	10	19.47	0	12	08.68		0	19	100.5	
A	0	12	56	0	12	56		0	12	56	
x-A	-	2	36.53	-	0	47.32		+	6	14.05	
S(x-A)		-	156.53		-	47.32			+	374.00	
log			2.19459~			1.67504~				2.57287	
cos			999996			999988				999993	
S			070179~			0.18216~				1.08004	
S			-5.0326			-0.5211				+12.0238	
S ₁			-9			-9				+	65
S			12.9665			16.4785				30.0303	
X			12.9238			16.5982				29.9634	
x-B			-427			+1197				-	669
C	-0°	51'	31.0	+1°	17'	39.9		-1°	05'	44.2	
L			31.8			40.7				43.6	
B			31.7			40.3				44.9	
mean	-0	51	31.5	+1	17	40.3		-1	05	44.2	
Proc		+	4		+	4			+	3	
S	-0	47	31.2	+1	21	40.5		-1	01	46.3	
D	+0	05	13	+0	05	13		+0	05	13	
S-D	-0	52	44.2	+1	16	27.5		-1	06	59.3	
S(x-D)			-31644			+45883				-4019.8	
log			3.50029~			3.66165~				3.60421~	
S			083144~			099280				093536~	
tan S			8.1406~			8.3759				8.2546~	
S ₁			14036			03643				21601	
S ₁			6.5976~			5.7936				7.4681~	
S ₀			-6.7833			+9.8356				-8.6170	
S ₁			-9			+				-	29
S			152163			31.8357				13.3801	
S			152849			31.8628				13.2846	
S-B			+686			+271				-	955

pt.	pos. C	resid
1	141.7	+29
2	131.8	+188
3	111.5	-42
$\frac{1}{2}$ 4	90.0	-292
5	81.7	-42
6	48.3	+37
7	13.7	+36
8	0.0	0
9	344.0	+81

1963

Moon - Center

16

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (x - x_0)^2$	$(x - x_0)^2 (x - x_0)^2$	$\sigma - c$
1	187460	+12080	+4	14603	38101	+25	
2	190000	+14620	+3	21383	38275	+199	
3	193530	+18150	+1	32946	38074	-2	
4	194835	+19455	0	37850	37850	-226	
5	194694	+19314	-1	37299	38107	+31	
6	190000	+14620	-3	21365	38200	+124	
7	180000	+04620	-5	02130	38184	+108	
8	175380	-00000	-5	00000	38134	+58	
9	170000	-05380	-5	02900	38195	+119	

Comp. $\Sigma^2 = 38076$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	171834	-15326	-3	23498
2	174166	-12994	-3	16892
3	180000	-07160	-1	05128
4	187169	00000	0	00000
5	190000	+02840	+1	00808
6	200132	+12972	+3	16835
7	206144	+18984	+4	36054
8	206684	+19524	+4	38134
9	205943	+18783	+4	35295

Approximate Center

$$x = 1909 = 17.4166$$

$$20.0132$$

$$374298$$

$$y_0 = 187149$$

$$y - \max = 20.6684$$

$$R = 19535$$

$$x - \max = 19.4835$$

$$x_0 = 17.5300$$

$$\text{Center } \begin{cases} x_0 = 17.5300 & 17.5380 \\ y_0 = 187149 & 187160 \end{cases}$$

1963

Unknown - Center

16

	x_i	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0) \cdot (y - y_0)$	$y - y_0$
1	18.7460	+1.2080	+4	1.4403	3.8201	+1.25
2	19.0000	+1.4720	+3	2.1383	3.8278	+1.99
3	19.3530	+1.8250	+1	3.2446	3.8074	-0.32
4	19.4835	+1.9455	0	3.7850	3.7400	+2.26
5	19.4694	+1.9314	-1	3.7299	3.8707	+3.31
6	19.0000	+1.4720	-3	2.1365	3.8200	+1.24
7	18.0000	+0.4720	-5	0.2130	3.8784	+1.08
8	17.5380	-0.0800	-5	0.0000	3.8134	+5.58
9	17.0000	-0.5380	-5	0.2900	3.8155	+1.19

 $\text{Compt. } K^2 = 3.80715$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.1834	-1.5326	-3	2.3498
2	17.4166	-1.2994	-3	1.6892
3	18.0000	-0.7160	-1	0.5128
4	18.7169	0.0000	0	0.0000
5	19.0000	+0.2840	+1	0.0808
6	20.0132	+1.2972	+3	1.6833
7	20.6144	+1.8984	+4	3.6034
8	20.6684	+1.9524	+4	3.8134
9	20.5943	+1.8783	+4	3.5295

Approximate Center

$$x = 19.09 = 17.4166$$

$$20.0132$$

$$3.74298$$

$$y_0 = 18.7149$$

$$y_{\text{max}} = 20.6684$$

$$R = 19.535$$

$$x_{\text{max}} = 19.4835$$

$$x_0 = 17.5300$$

$$\text{Center } \begin{cases} x_0 = 17.5300 & 17.5380 \\ y_0 = 18.7149 & 18.7160 \end{cases}$$

Formation of Normals

	av	an	bn
1	-1.87	+178.1	-223.4
2	-1.91	+539.5	-477.1
3	-1.29	+420.4	-164.0
4	+0.00	+121.1	+0.0
5	+0.56	+609.2	+91.1
6	+0.89	+87.0	+351.5
7	+1.91	+513.0	+453.7
8	+0.00	+0.0	+120.9
9	-0.24	-4.7	+17.3
	-1.95	+2363.6	+170.0

	cb	cn	cn
1	-1.85	+30.3	-38.2
2	-1.90	+290.5	-259.0
3	-1.30	-3.6	+1.4
4	+0.00	-113.0	-0.0
5	+0.54	+60.0	+8.7
6	+1.90	+181.0	+161.3
7	+0.87	+49.7	+205.0
8	+0.00	+0.0	+113.0
9	-1.02	-64.2	+229.0
	-2.76	+430.7	+416.2

1965

Moon's Center

17

Conditional Equations

a

b

c

c

0-c

1	+ 1.21 - 1.53 =	+ 25	+ 41 - 45 =	+ 1 - 4	+ 29
2	+ 1.46 - 1.30 =	+ 199	+ 49 - 38 =	+ 11	+ 188
3	+ 1.81 - 0.72 =	- 2	+ 61 - 21 =	+ 40	- 42
4	+ 1.95 + 0.00 =	- 226	+ 66 + 0 =	+ 66	- 292
5	+ 1.93 + 0.28 =	+ 31	+ 65 + 8 =	+ 73	- 42
6	+ 1.46 + 1.30 =	+ 124	+ 49 + 38 =	+ 87	+ 37
7	+ 0.46 + 1.90 =	+ 108	+ 16 + 56 =	+ 72	+ 36
8	+ 0.00 + 1.95 =	+ 58	+ 0 + 58 =	+ 58	+ 0
9	- 0.54 + 1.98 =	+ 119	+ 18 + 56 =	+ 38	+ 81

Average = 83

Normal Equations

$$\begin{aligned}
 + 15.16 - 1.95 &= + 2364 \\
 - 1.95 + 15.51 &= + 170 \\
 + 1.95 - 0.25 &= + 304 \\
 + 15.26 &= + 474 \\
 + 15.16 &= + 2364 + 68 = + 2425
 \end{aligned}$$

$$\begin{aligned}
 b &= + 31.0 \\
 a &= + 162.0
 \end{aligned}$$

Normal Equations

$$\begin{aligned}
 + 15.16 - 2.76 &= + 431 \\
 - 2.76 + 1.7.26 &= + 416 \\
 + 2.76 - 0.50 &= + 79 \\
 + 16.76 &= + 495 \\
 + 15.16 &= + 431 + 82 = + 513
 \end{aligned}$$

$$b = + 29.6$$

$$a = + 339$$

1963

Linear Center

17

Conditional Equations

	a	b	c	d	e	f	g	h		
1	+122	-153	=	+25	+146	=	45	=	+144	+29
2	+144	-130	=	+899	+249	=	38	=	+13	+788
3	+182	-072	=	+22	+261	=	21	=	+48	-242
4	+195	+000	=	-226	+166	=	0	=	+66	-2292
5	+193	+028	=	+31	+365	=	18	=	+78	-42
6	+149	+130	=	+124	+249	=	38	=	+87	+37
7	+046	+190	=	+108	+76	=	54	=	+72	+36
8	+000	+191	=	+58	0	=	55	=	458	-0
9	-054	+158	=	+159	=	18	+56	=	+38	+781
Average = 83										

Normal Equations

$$\begin{aligned}
 +1516 - 195 &= +2364 \\
 -195 + 1551 &= +170 \\
 +195 - 025 &= +340 \\
 +1526 &= +510 \\
 +1516 &= +2364 + 65 = +2429
 \end{aligned}$$

$$\begin{aligned}
 b &= +33.4 \\
 a &= +100.5
 \end{aligned}$$

Normal Equations

$$\begin{aligned}
 +1516 - 276 &= +431 \\
 -276 + 1726 &= +416 \\
 +276 - 050 &= +79 \\
 +1676 &= +495 \\
 +1516 &= +431 + 52 = +513
 \end{aligned}$$

$$b = +29.6$$

$$a = +339$$

1963 Red. ad. Coenum aff.

$$\begin{array}{rcl}
 H + \alpha_0 & 7^\circ 55' & = 118^\circ 45' \\
 H & 7^\circ 42' & \\
 \alpha_0 & 0^\circ 13' & < \\
 S & 21^\circ 28' & \\
 G + \alpha_0 & 21^\circ 41' & = 325^\circ 15'
 \end{array}$$

$$S_0 = -0^\circ 20' 29''$$

$$\begin{array}{rcl}
 \log i & 0.8732 & \\
 \cos & 0.0000 & \\
 \text{" (L)} & &
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos (G + \alpha_0) & 9.9147 & \\
 \log \sin (G + \alpha_0) & 1.1792 & \\
 \sin (G + \alpha_0) & 9.7559 m & \\
 \tan S_0 & 9.7752 m & \\
 \text{" (L)} & 8.8239 &
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S_0 & : & 7.7752 m \\
 \cos (H + \alpha_0) & 9.6821 m & \\
 \sin & 1.2801 & \\
 \sin (H + \alpha_0) & 9.9429 & \\
 \sec S_0 & 0.0000 & \\
 \text{" (L)} & = 8.8239 &
 \end{array}$$

$$\begin{array}{rcl}
 \log (g') & 1.0939 & \\
 \text{" (L)} & 7.5342 &
 \end{array}$$

$$\begin{array}{rcl}
 \log (h') & 8.7374 & \\
 \text{" (L)} & 0.0469 &
 \end{array}$$

$$\begin{array}{rcl}
 f & +1.83 & \\
 (g) & +0.00 & \\
 (h) & +1.11 & \\
 \text{Red in } \lambda & +294 & \checkmark
 \end{array}$$

$$\begin{array}{rcl}
 g' & +12.41 & \\
 h' & +0.05 & \\
 (L) & +7.47 & \\
 \text{Red in } S & +1993 & \checkmark
 \end{array}$$

1963

Moon's mean Position (1912.0)

18

$$\begin{array}{r} X_0 = 17.5380'' \\ \frac{1}{2}a = +17 \\ \hline 17.5397'' \end{array}$$

$$\begin{array}{r} Y_0 = 18.7160'' \\ \frac{1}{2}b = +15 \\ \hline 18.7175'' \end{array}$$

from Plate Constant $X = 17.5498''$ $Y_0 = 18.6947''$

$$\begin{array}{r} z = +0.4519 \\ \log z = 9.65504m \\ -\log 5 = 9.99999 \\ -\log 2 = 9.50724 \\ \hline (x-A) = 1.14781m \\ x-A = -14.05'' \\ A = 01256'' \\ \alpha_0 = 01241.95'' \\ \text{Red waff. place} + 2.94 \\ \hline \alpha' = 01244.89'' \end{array}$$

$$\begin{array}{r} z = -0.4502 \\ \log z = 9.65341m \\ -\log 5 = 9.99999 \\ -\log 2 = 9.50724 \\ \hline (x-A) = 1.14618m \\ x-A = -14.00'' \\ A = 01256'' \\ \alpha_0 = 01242.00'' \\ \text{Red} = +2.94 \\ \hline \alpha' = 01244.94'' \end{array}$$

$$\begin{array}{r} z = -3.3062 \\ \log |z| = 8.1170m \\ -\log 5 = 9.3101 \\ -\log 2 = 4.4805m \\ \hline \log \eta_0 = 0.51933m \\ -\log 2 = 7.33115 \\ \hline (y-D) = 3.18818m \\ y-D = -25'42.3'' \\ D = +0'05'13'' \\ \delta = -0'20'29.3'' \\ \text{Red waff. place} + 19.9 \\ \hline \delta' = -0'20'09.4'' \\ \eta = -3.3053 \\ \log \eta_0 = 0.51921m \\ -\log 2 = 7.33115 \\ \hline (y-D) = 3.18806m \\ y-D = -25'41.9'' \\ D = +0'05'13'' \\ \delta_0 = -0'20'28.9'' \\ \text{Red} = +19.9 \\ \hline \delta' = -0'20'09.0'' \end{array}$$

1963

Moon's mean Position (1912.0)

18

$$\begin{array}{r} X_0 = 17.5360 \\ + 19 \\ \hline 17.5349 \end{array}$$

$$\begin{array}{r} Y_0 = 18.7149 \\ + 15 \\ \hline 18.7145 \end{array}$$

from Plate Constant $X = 17.5498$ $Y_0 = 18.6948$

$$\begin{array}{r} z = -0.4519 \\ \log 3 = 9.65504 \\ \text{loss} = 9.99999 \\ \text{cont} = 9.50724 \\ (K-A) = 1.14781 \\ A-A = 14.05 \\ A = 01256 \\ \alpha_0 = 01241.95 \\ \text{Red waff. place} + 2.94 \\ \hline \alpha' = 01244.89 \end{array}$$

$$\begin{array}{r} z = -0.4502 \\ \log 3 = 9.65391 \\ \text{loss} = 9.99999 \\ \text{cont} = 9.50724 \\ (K-A) = 1.14618 \\ A-A = 14.00 \\ A = 01256 \\ \alpha_0 = 01242.00 \\ \text{Red} = + 2.94 \\ \hline \alpha' = 01244.94 \end{array}$$

$$\begin{array}{r} z = -3.3062 \\ \log 10^5 = 8.1170 \\ \text{loss} = 9.3101 \\ \text{cont} = 4.4805 \\ \log \eta_0 = 0.51933 \\ \text{cont} = 7.33115 \\ (K-D) = 3.18818 \\ S-D = 2542.3 \\ D = +00513 \\ S = -02029.3 \\ \text{Red waff. place} + 19.9 \end{array}$$

$$\begin{array}{r} z = -02029.4 \\ \eta = -3.3053 \\ \log \eta_0 = 0.51921 \\ \text{cont} = 7.33115 \\ (S-D) = 3.18806 \\ S-D = 2541.9 \\ D = +00513 \\ S_0 = +02028.9 \\ \text{Red} = + 19.9 \\ \hline S = -02009.0 \end{array}$$

1963

Lunar farallay

$$\begin{array}{rcl} \alpha' & = & 0^{\circ} 12' 44.94'' \\ \theta & = & 22' 36'' 35.9'' \\ G-A & = & -1' 36'' 09.1'' \\ & = & -24' 02' 15.1'' \end{array}$$

$$- \quad \quad \quad 8' 17.1''$$

$$- 23' 53' 58.1''$$

$$9.95727''$$

$$0.00000$$

$$0.03893''$$

$$\tan \gamma \quad 9.99620''$$

$$\gamma = 44^{\circ} 44' 57.1''$$

$$- \quad 0' 20' 09.4''$$

$$45' 05' 06.5''$$

$$9.82640''$$

$$8.20432''$$

$$9.85013''$$

$$0.15243''$$

$$\sin(\theta - \delta') \quad 8.03328''$$

$$\delta - \delta' = 137' 07.0''$$

$$\delta = +0' 16' 58.0''$$

$$\sin \text{ Eph. } \delta = +0' 16' 55.9''$$

$$O-C \quad \quad \quad + 2.1''$$

$$\delta' = -0^{\circ} 20' 09.0''$$

$$\pi = 55' 01.9''$$

$$9.86913''$$

$$8.20432''$$

$$9.60995''$$

$$0.00001''$$

$$\sin(\alpha - \alpha') = 7.58341''$$

$$\alpha - \alpha' = -16' 35.02''$$

$$= -1'' 06.33''$$

$$\alpha = 0' 11' 38.61''$$

$$\alpha = 0' 11' 38.25''$$

$$+0.36''$$

1963

Lunar parallel

$\alpha = 0^{\circ} 12' 44.5''$
 $\delta = 22^{\circ} 36' 35.9''$
 $\lambda = -1^{\circ} 36' 09''$
 $\mu = 24^{\circ} 02' 15''$

$\mu = 8^{\circ} 17'$

$\mu = 23^{\circ} 53' 58''$

995727

000000

003893

$\mu = 999620$

$\gamma = 44^{\circ} 44' 57.1''$

$- 0^{\circ} 20' 09.4''$

$45^{\circ} 05' 06.5''$

982640

820432

985013

015243

$\sin(\delta - \delta') = 843328$

$S - S' = 137^{\circ} 07.0''$

$S = +0^{\circ} 16' 58.0''$

$\sin \epsilon \mu S = +0^{\circ} 16' 55.9''$

$O - C = + 2.1''$

$S = -0^{\circ} 20' 09.9''$

$\mu = 55^{\circ} 01.9''$

986913

820432

960995

000001

$\sin(\alpha - \alpha') = 768341$

$\alpha = -16^{\circ} 35.02''$

$-1^{\circ} 06.33''$

$\alpha = 0^{\circ} 11' 38.56''$

$\alpha = 0^{\circ} 11' 38.25''$

$+0.36''$

1964	Stars	measures	1913 Dec. 2	20
d	4	n	d	n
1	10600	1217880	16672	18582
12.6	1020089	81	12573	1267071
140	90	11780	75	71
		70		89
	<u>14.0407</u>	<u>.0400</u>	<u>12.5901</u>	<u>.5915</u>
3	15256	16230	14526	14802
16.1	880908	1267075	5860	1347073
30.6	20	69	49	69
	51	40	22	00
	<u>30.6441</u>	<u>.6437</u>	<u>16.1333</u>	<u>.1331</u>
3	19390	18220	18458	16715
19.6	1755349	1004043	1491910	1023929
12.2	49	40	10	39
	80	15	44	06
	<u>12.1838</u>	<u>.1826</u>	<u>29.6460</u>	<u>.6473</u>

Grade 3.

1964	Stars - measures		1913 Dec. 2	
	d	v	d	v
1	10600	12178 ⁸⁰	16672	18582
126	10200 ⁸⁴	81	12573	12670
140	90	11780	75 ⁶⁹	71 ⁷¹
			70	89.
	<u>140407</u>	<u>0400</u>	<u>12.5901</u>	<u>5915</u>
3				
161	15256	16280	14526	14802
206	88090 ⁸	12670 ⁷⁵	5860 ⁶⁰	13470 ⁷³
	20	69	49	69
	51	40	22	00
	<u>306441</u>	<u>6437</u>	<u>161333</u>	<u>1331</u>
3				
196	19390	18220	18458	16715
126	17553 ⁴⁹	10040 ⁴³	14919 ¹⁰	10239 ²⁹
	49	40	10	39
	80	15	44	06
	<u>121838</u>	<u>1826</u>	<u>296460</u>	<u>6473</u>

Grade 3

1

1

18

16

2

19

16

3

19

17

4

19

18

14

5

19

19

6

19

19

1964

Moon Measures

21

1 Scratch
 18.7 16839 15143
 163 14259 7709 05-
 49 13
 43 47
162584 2563

2
 16372 14890
 13080 8260 95-
 80 05-
 78 90
18.6706 .6690

3
 190 16280 19953
 163 11381 14881 50
 80 49 50
 91 50
164906 4906

4
 194 15328 18968
 170 9308 14969 72
 25 69
 30 70
19.3989 3999

5
 196 14991 17965
 180 11396 14549 53
 11 43
 00 69
19.6412 .6419

6
 193 14761 16985
 190 8938 13552 36
 10 49
 68 80
19.3658 .2435

7
 193 18610
 190 12031 31
 33
 15
19.3419

8
 190 18957 19802
 194 14920 13794 05-
 11 09
 47 01
19.4039 4002

1
2
18
19
3
17
19
2
17
19

1964

brown-measures.

22

	d	n	d	n
2	18970	18811		
18.0	10161	1759889		
19.9	5957	13		
	60	09		
	<u>19.8803</u>	<u>.8787</u>		
17.8	17970	18808		
19.9	8960	1782091		
max	5159	00		
	70	05		
	<u>19.9013</u>	<u>.8996</u>		
9	17979	18810		
17.0	1024841	1655040		
19.7	41	45		
	81	10		
	<u>19.7737</u>	<u>.7735</u>		

possibly on
terminal

1964

brown measures

22

	α	δ	α	δ
2	18970		18811	
180	10161		17598	
199	59 ⁰ 7		13 ⁰ 9	
	60		09	
	<u>198802</u>		<u>8789</u>	

178	17970	18808
199	8960	1782091
max	5159	00
W	70	05
8	<u>199013</u>	<u>8996</u>

3	17979	18810
170	10248	16550
197	41	41-40
	81	10
	<u>197737</u>	<u>7735</u>

possibly on
terminal

1964

Tunies etc.

23

Exp to star 1912 Aug 29 $22^h 43^m$ - $22^h 55^m$
 ... known $22 49$ $23.1 - 22 49 23.4$
 Clock slow 1 02.9

H. Sid T. $22 50 26.15$
 Hong $4 44 31.05$
 S. Sid T. $27 34 57.20$
 S. T. M. known $10 29 17.62$
 Interval $17 05 39.58$
 Reduction $2 48.03$
 G. M. T $17 02 51.55$ $\theta - \alpha = -1^{\circ} 22'$

from bank Allen R.A. decl.
 known 17° $0^h 11^m 57.94$ $+0^{\circ} 19' 36.5$
 Motion in R 1.7997 14.678
 ... 2.8592 ± 5.15 $+ 42.0$
 Tabular place $0^h 12^m 03.09$ $+0^{\circ} 20' 18.5$

known age 17 days

954 = +10.9
 9014 = +10.2

parallax	55' 02.1
semidiameter	15' 01.4
R.	90 1.4
Augmentation	110.2
Irradiation (3)	- 0.7
R	9109
R	1.9526
(1+a) R	1.9521
R ²	3.8107

a - - 2.4

1964

Times etc.

23

Exposition 1912 Aug 29 22^h 43^m - 22^h 55^m
 known 22 49 23.1 - 22 49 23.4
 Clock slow 1 02.9

H. I. T. 22 50 26.15
 Phony 4 44 31.05
 S. S. T. 27 34 57.20
 S. T. M. W. 10 29 17.62
 Industrial 17 05 39.58
 Radiation 2 48.03
 G. W. T. 17 02 51.55 6-8- - 1' 22"

from hand table
 known 17^h 0' 11" 57.94 + 0' 19' 36.5
 known 17 1.7997 14.678
 2.8892 + 5.15 + 42.0
 Tabular place 0^h 12' 03.09 + 0' 20' 18.5

known age 17 days

Parallax 55' 02" 1
 Semidiameter 15' 01.4
 R. 90 1.4
 Cupmentation 11 0.2
 Transduction (S) - 0.7
 R 91 0.9
 R 195 2.6
 1 + R 195 2.1
 R 34 1.07

9.58 + 10.9
 9.58 + 10.2

a. - 2.6

1964

Plate Constants

24

	1	2	3
x	12.5908	16.1332	29.6466
y	12.9665	16.4785	30.0303
$x - \bar{x}$	-3757	-3453	-3837

y	14.0404	30.6439	12.1832
y	15.2163	31.8357	13.3801
$y - \bar{y}$	-1.1759	-1.1918	-1.1969

$$\begin{array}{rclcl}
 \bar{x} - \bar{y} & -18.84 & +2.6x & +3988 & \\
 -3757 - 264 & = -4021 & +33 & = -3988 & = 0 \\
 -3453 - 576 & = -4029 & +42 & = -3987 & = +1 \\
 -3837 - 229 & = -4066 & +77 & = -3989 & = -1 \\
 17.6954 - 337 & & +46 & & = 18.0651 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 y - \bar{y} & +13.24 & +6.8y & +1.1500 & \\
 -1.1759 + 164 & = -1.1595 & +95 & = -1.1500 & = 0 \\
 -1.1918 + 210 & = -1.1708 & +208 & = -1.1500 & = 0 \\
 -1.1969 + 385 & = -1.1584 & +83 & = -1.1501 & = -1 \\
 17.9500 + 230 & & +122 & & = 19.1352 \checkmark
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables} & a = -0.5 & e = -3.4 & a - e = +2.9 \\
 & a = -2.6 & e = -6.8 & a - e = +4.2 \\
 & & & b + a = +2.0 \\
 & & & b + a = +5.8
 \end{array}$$

1964

Plate Constants

49

	1	2	3
x	12.5908	16.1332	29.6466
y	12.9665	16.4785	30.0303
z	-3.757	-3.453	-3.837

4	14.0404	30.6939	12.1832
5	15.2163	31.8357	13.3801
4-5	-1.1759	-1.1918	-1.1969

$$\begin{aligned}
 x-3 & -1.884 & +2.6 & +3.988 \\
 +3.757 - 2.64 & = -4.021 + 3.3 & = -3.988 & = 0 \\
 -3.453 - 5.76 & = -4.029 + 4.2 & = -3.987 & = +1 \\
 -3.837 - 2.29 & = -4.066 + 7.7 & = -3.989 & = -1 \\
 17.6954 - 3.37 & & +4.6 & = 18.0651
 \end{aligned}$$

$$\begin{aligned}
 4-5 & +1.3 & +6.84 & +1.1500 \\
 -1.1759 + 1.64 & = -1.1595 + .91 & = -1.1500 & = 0 \\
 -1.1918 + 2.10 & = -1.1708 + 2.08 & = -1.1500 & = 0 \\
 -1.1969 + 3.85 & = -1.1584 + .83 & = -1.1501 & = -1 \\
 17.9100 + 2.30 & & +1.22 & = 19.1352
 \end{aligned}$$

Tables

$$\begin{aligned}
 b_1 & = -0.5 & a_1 & = -3.4 & c_1 - c_2 & = +2.9 & b_1 + a_1 & = +2.0 \\
 a_2 & = -2.6 & a_3 & = -6.8 & a_4 - a_5 & = +4.3 & b_1 + a_5 & = +5.8
 \end{aligned}$$

kt.	pos. L	resid.
1	15 0° 0	+ 51
2	13 7.9	+ 226
3	11 9 0	- 36
4	8 8.4	- 205
5	5 7.3	+ 53
6	4 2.1	- 2
7	9.1	+ 69
8	0.0	- 49
9	33 9.2	+ 5

1964.

Mooris Lentic

25

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	18.6698	+0.9768	+3	0.9547	3.8071	- 36
2	19.0000	+1.3070	+3	1.7090	3.8280	+ 173
3	19.3994	+1.7064	+2	2.9124	3.8077	- 30
4	19.6416	+1.9486	- 0	3.7970	3.7999	- 108
5	19.3427	+1.6497	- 2	2.7208	3.8321	+ 214
6	19.0000	+1.3070	- 3	1.7074	3.8282	+ 175
7	18.0000	+0.3070	- 4	0.0940	3.8344	+ 237
8	17.6930	0.0000	- 4	0.0000	3.8212	+ 105
9	17.0000	-0.6930	- 4	0.4808	3.8224	+ 117

Comp R^2 3.8107

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.2574	-1.6886	- 3	2.8524
2	16.4906	-1.4554	- 3	2.1190
3	17.0000	-0.9460	- 2	0.8953
4	18.0000	+0.0540	0	0.0029
5	19.0000	+1.0540	+2	1.1113
6	19.4020	+1.4560	+3	1.1208
7	19.8796	+1.9336	+4	3.7404
8	19.9004	+1.9544	+4	3.8212
9	19.7736	+1.8276	+4	3.3416

Approximate Center,

$$x = 19.0 \quad y = 16.4906$$

$$19.4020$$

$$35.8926$$

$$y_0 = 17.9463$$

$$y = \text{max} = 19.9004$$

$$R = 1.9541$$

$$x = \text{max} = 19.6430$$

$$x_0 = 17.6890$$

$$\text{Center} \begin{cases} x_0 = 17.6930 \\ y_0 = 17.9460 \end{cases}$$

1964

Known Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	18.6698	+0.9768	+3	0.9547	3.8071	-3.6
2	19.0000	+1.3070	+3	1.7090	3.8280	+1.73
3	19.3994	+1.7064	+2	2.9124	3.8077	-3.0
4	19.6916	+1.9486	-0	3.7970	3.7999	-1.08
5	19.3427	+1.6497	-2	2.7208	3.8321	+2.14
6	19.0000	+1.3070	-3	1.7074	3.8282	+1.75
7	18.0000	+0.3070	-4	0.0940	3.8344	+2.37
8	17.6930	-0.0000	-4	0.0000	3.8212	+1.05
9	17.0000	-0.6930	-4	0.4808	3.8224	+1.17

Comp R^2 5.8107

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.2574	-1.6886	-3	2.8529
2	16.9906	-1.4554	-3	2.1190
3	17.0000	-0.9460	-2	0.8953
4	18.0000	+0.0540	0	0.0029
5	19.0000	+1.0540	+2	1.1113
6	49.4020	+1.4560	+3	1.1208
7	19.8796	+1.9336	+4	3.7404
8	19.9004	+1.9544	+4	3.8212
9	19.7736	+1.8276	+4	3.3416

Approximate Center

$$x = 19.0 \quad y = 16.4906$$

$$19.4020$$

$$3.58926$$

$$y = 17.9463$$

$$y_{\text{max}} = 19.9004$$

$$R = 19.541$$

$$x_{\text{max}} = 19.6430$$

$$X = 17.6890$$

$$\text{Center} \begin{cases} X_0 = 17.6930 \\ Y_0 = 17.9460 \end{cases}$$

Formation of Wound

	ab	an	bn
1	- 1.66	- 35.3	+ 60.8
2	- 0.48	+ 56.8	- 62.8
3	- 1.62	- 51.3	+ 28.5
4	+ 0.02	- 52.9	- 1.1
5	+ 1.73	+ 353.1	+ 224.7
6	+ 1.91	+ 229.2	+ 255.5
7	+ 0.60	+ 73.5	+ 457.4
8	+ 0.00	+ 0.0	+ 204.8
9	- 1.26	- 80.7	+ 214.1
	- 0.76	+ 492.4	+ 1381.9

1964

Innovis Center

26

Conditional Equations

	a	b	0		c	0-c
1	+0.98	-1.69	= -36	+47	-134	= -87 +51
2 ^{1st}	+1.31	-1.46	= +173	+62	-115	= -53 +226
3	+1.71	-0.95	= -30	+81	-75	= +6 -36
4 ^{1st}	+1.95	+0.05	= -108	+93	+4	= +97 -205
5	+1.65	+1.05	= +214	+78	+93	= +161 +53
6	+1.31	+1.46	= +175	+62	+115	= +177 -2
7	+0.31	+1.93	= +237	+15	+153	= +168 +69
8	0.00	+1.95	= +105	0	+154	= +154 -49
9	-0.69	+1.83	= +117	-33	+145	= +112 +5

Average = 77

Normal Equations

$$\begin{aligned}
 &+11.62 - 0.76 = +492 \\
 &-0.76 + 17.94 = +1382 \\
 &+0.76 - 0.05 = +32 \\
 &\quad +17.89 = +1414 \\
 &+11.62 = +492 + 60 = +552
 \end{aligned}$$

$$b = +79.1$$

$$a = +47.5$$

1914

Luvous Center

26

Conditional Equations

	a	b	c		c	0-c
1	+0.98	-1.69	-3.6	+47-134	-87	+51
2	+1.31	-1.46	+1.73	+62-111	-53	+22.6
3	+1.71	-0.95	-3.0	+81-75	+6	-3.6
4	+1.95	+0.05	-1.08	+93+4	+97	-20.5
5	+1.61	+1.05	+2.14	+78+83	+161	+5.3
6	+1.31	+1.46	+1.75	+62+115	+177	-2
7	+0.31	+1.93	+2.37	+15+153	+168	+6.9
8	0.00	+1.95	+1.05	0+154	+154	-4.9
9	-0.69	+1.83	+1.17	-33+145	+112	+5

Average = 77

Normal Equations

$$\begin{aligned}
 &+11.62 - 0.76 = +4.92 \\
 &-0.76 + 17.94 = +13.82 \\
 &+0.76 - 0.05 = +3.2 \\
 &\quad +17.89 = +14.14 \\
 &+11.62 + 4.92 + 6.02 = +55.2
 \end{aligned}$$

$$b = +79.1$$

$$a = +47.5$$

Red. ad l. app

$$H + \alpha_0 = 7 \quad 55 = 118^\circ 45'$$

$$H = 7 \quad 42$$

$$\alpha_0 = 0 \quad 13''$$

$$G = 21 \quad 28$$

$$G + \alpha_0 = 21 \quad 41 = 325^\circ 15'$$

$$S = -0^\circ 17' 35''$$

$$\log i = 0.8737$$

$$\cos \delta_0 = 0.0000$$

$$\dots (i)$$

$$\begin{aligned} f &= +1.83 \\ (g) &= +0.00 \\ (h) &= +1.11 \\ &\hline &2.94 \checkmark \end{aligned}$$

$$\begin{aligned} (g') &= +12.41 \\ (h') &= +0.05 \\ (i) &= +7.47 \checkmark \\ &\hline &+19.93 \end{aligned}$$

$$\begin{aligned} \log \cos(G + \alpha_0) &= 9.9147 \\ &= 1.1792 \\ \sin(G + \alpha_0) &= 9.7559 \\ \tan S &= 8.7088 \\ \dots &= 8.8239 \end{aligned}$$

$$\begin{aligned} \log \sin \delta_0 &= 7.7088 \\ \cos(H + \alpha_0) &= 9.6821 \\ \dots &= 1.2801 \\ \sin(H + \alpha_0) &= 9.9429 \\ \sec \delta_0 &= 0.0000 \\ \dots &= 8.8239 \end{aligned}$$

$$\begin{aligned} \log (g) &= 7.4678 \\ (g') &= 1.0939 \end{aligned}$$

$$\begin{aligned} \log (h) &= 0.0469 \\ (h') &= 8.6710 \end{aligned}$$

1964

Moon's Mean Position (1912.0)

27

$$\begin{array}{r} X_0 = 17.6930 \\ \frac{1}{2}a = +24 \\ \hline 17.6954 \end{array}$$

$$\begin{array}{r} Y_0 = 17.9460 \\ \frac{1}{2}b = +40 \\ \hline 17.9500 \end{array}$$

From Plate Constants $X = 18.0651$ $Y = 19.1352$

$$\begin{array}{r} \bar{z} = +0.0651 \\ \log \bar{z} = 8.81358 \\ \log S = 9.99997 \\ \log \text{const} = 8.50724 \end{array}$$

$$\log(\alpha - A) = 0.30635$$

$$\alpha - A = +2.02$$

$$A = 0^h 12^m 56^s$$

$$\alpha_0 = 0^h 12^m 58.02^s$$

$$\begin{array}{r} \text{Red. ad l. aff.} + 2.94 \\ \alpha' = 0^h 13^m 00.96^s \end{array}$$

$$\eta_0 = -28648$$

$$\begin{array}{r} \log \eta_0 = 0.45709 \\ \log \text{const} = 7.33115 \end{array}$$

$$\log(\delta - D) = 3.12594$$

$$(\delta - D) = -22.164$$

$$D = +0.0513$$

$$\delta_0 = +0^{\circ} 17' 03.4''$$

$$\begin{array}{r} \text{Red. ad l. aff.} + 19.9 \\ \delta' = -0^{\circ} 16' 43.5'' \end{array}$$

1964

Innovis Mean Position (1912.0)

27

$$\begin{array}{r} X_0 = 17.6930 \\ \frac{1}{2}a = +24 \\ \hline 17.6954 \end{array}$$

$$\begin{array}{r} X_0 = 17.9460 \\ \frac{1}{2}b = +40 \\ \hline 17.9500 \end{array}$$

From Plate Constant $X: 18.0651 \quad Y: 19.1352$

$$\bar{z} = +0.0651$$

$$\log \bar{z} = 8.81358$$

$$\log z = 9.99999$$

$$\log z = 8.50724$$

$$(X-A) = 0.30635$$

$$\eta_0 = -2.8648$$

$$\log \eta_0 = 0.45709$$

$$\log \eta = 7.33115$$

$$(S-D) = 3.12594$$

$$A-A = +20.2$$

$$(S-D) = -22.769$$

$$A = 0^{\circ} 12' 56''$$

$$D = +0^{\circ} 05' 13''$$

$$X_0 = 0^{\circ} 12' 58.02''$$

$$S_0 = +0^{\circ} 17' 03.4''$$

$$\text{Red. and app.} + 2.94$$

$$\text{Red. and app.} + 19.9$$

$$X' = 0^{\circ} 13' 00.96''$$

$$S' = -0^{\circ} 16' 43.5''$$

1964 Lunar Parallax

$$\begin{aligned}
 \alpha' &= 0^h 13^m 00^s.96^v \\
 \delta &= 22^\circ 50' 26.15'' \\
 \alpha - \alpha' &= -1^\circ 22' 34.81'' \\
 &= -20^\circ 38' 42''
 \end{aligned}$$

$$\begin{aligned}
 &= 7' 12'' \\
 &= 20^\circ 31' 30''
 \end{aligned}$$

$$\begin{aligned}
 9.95727^v \\
 0.00000 \\
 0.02848^v
 \end{aligned}$$

$$\tan \delta \quad 9.98575^v$$

$$\begin{aligned}
 \gamma &= 4.44^\circ 03' 36.0'' \\
 &= 0^\circ 16' 43.5'' \\
 &= 44^\circ 20' 19.5''
 \end{aligned}$$

$$\begin{aligned}
 9.82640^v \\
 8.20434^v \\
 9.84441^v \\
 0.15776
 \end{aligned}$$

$$\sin(\delta - \delta') \quad 8.03291^v$$

$$\delta - \delta' = +37^\circ 05.1''$$

$$\delta = +0^\circ 20' 21.6''$$

$$\begin{aligned}
 \text{Cum Eph } \delta &= +0^\circ 20' 18.5'' \\
 &+ 3.1''
 \end{aligned}$$

$$\delta' = -0^\circ 16' 43.5''^{28}$$

$$\Pi = 55' 02.1''$$

$$\begin{aligned}
 9.86913^v \\
 8.20434^v \\
 9.54725^v \\
 0.00001^v \\
 \hline
 7.62073^v
 \end{aligned}$$

$$\begin{aligned}
 \alpha - \alpha' &= -14^\circ 21.30'' \\
 &= -57.42''
 \end{aligned}$$

$$\alpha = 0^h 12^m 03.54^v$$

$$\begin{aligned}
 \alpha &= 0^h 12^m 03.09^v \\
 &+ 0.45^v
 \end{aligned}$$

1964 Lunar Parallax

28

$$\delta' = -0^{\circ} 10' 43.5''$$

$$\Pi = 55' 02.1''$$

$$\begin{array}{r} 9.86913 \\ 8.20439 \\ 9.54725 \\ \hline 0.00001 \\ 762073 \end{array}$$

$$\chi - \chi' = -14 \quad 21.30$$

$$- \quad 57.42$$

$$\begin{array}{r} 995727 \\ 000000 \\ 002848 \\ \hline \end{array}$$

$$\text{long } 998575$$

$$\chi \quad 44 \quad 03 \quad 36.0$$

$$- \quad 0 \quad 16 \quad 43.5$$

$$44 \quad 20 \quad 19.5$$

$$\begin{array}{r} 9.82640 \\ 8.20434 \\ 9.84448 \\ \hline 015776 \end{array}$$

$$\text{sun } (\delta - \delta') \quad 803298$$

$$\delta - \delta' \quad - \quad 37 \quad 05.8$$

$$\delta = +0 \quad 20 \quad 21.6$$

$$\chi = 0 \quad 12 \quad 03.54$$

$$\text{Cum Eph } \delta = +0^{\circ} 20' 18.5''$$

$$\chi = 0^{\circ} 12' 03.09''$$

$$+ \quad 3.1$$

$$+ 0.45$$

