

Lunar Settlement Calculations

Location, Step 1

Mt. Malapert & Scott Massif

Tom Riley

18-Jan-14

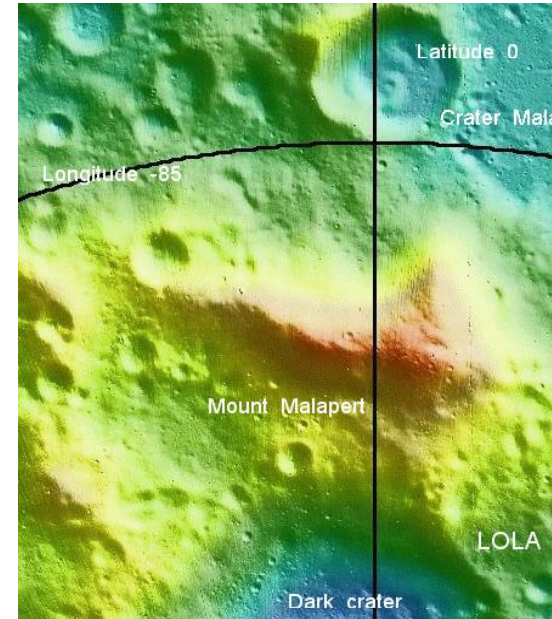
File: BMDLocationCalExcelmddy.xlsx

Beta Version

Purpose: This spreadsheet was used in writing the short story, "The Big Moon Dig" and the lite game, Location, Step 1

1. Physical constants for Moon

Earth Radii/Diameter	6371	km	12742	km
Earth Moon Distance	384399	km		
Moon Radius/Dia	1737	km	3474	km
Moon Circumference	10914	km		
Orbital period	29.2	Days		
Lunar Disk	0.009037	rad	0.52	degree
Degree Longitude	30.316	km		
Mean inclination to orbit to ecliptic	5.14	degree		
Min inclination to orbit to ecliptic	4.99	degree	-0.15	degree
Max inclination to orbit to ecliptic	5.30	degree	0.16	degree
Moon Orbit inclination	5.15	degree		
Moon axis tilt	1.55	degree		
Earth Sun Distance	148348276.00	km		
Sun Diameter	1392684.00	km		



Solar Disk	0.009388	rad	0.54	degree
Speed of Light	299792	km/sec		
Geostationary orbit	35,786	km		

2. Human Rules of Thumb

Width of Hand	8.0	cm	3.3	(inches)
Width of Finger	1.5	cm	0.6	(inches)
Length of arm	60.0	cm	24.5	(inches)
inch/cm	0.4	units		
Finger at arms length	1.4	degree		
Hand at arms length	7.7	degree		

3. Data on Mt. Malapert

Crater Malapert Lat/log	84.9	degree	12.9	degree	South
Malapert Lat/Longitude	85.8	degree	-3.1	degree	South
Malapert Alt	5.3	km			Estimate
Malapert to pole	127.3	km	4.2	degree	
Haworth Alt	2.1	km			Alti
Delta Alt	3.2	km			

4. Data on Scott Massif

Crater Scott A Lat/log	-88.1	degree	44.9	degree	South
Scott Lat/Longitude	-84.7	degree	34.0	degree	South
Scott Alt	7.0	km			Higher than Malapert
Scott to pole	160.7	km	5.3	degree	

5. Data on South Pole-Aitken Basin

Depth	-5.175	km			at -45, 180
Diameter	2500	km			

Total Avantage	10.475	km				
Advantage angle Mt + basin	6.29	degree	-83.71	degree	191	km
Advantage angle Mt only	4.47	degree				approximant
Advantage angle Mt only	4.42	degree				

5. Calculations of apparent size & angle of Earth

Moon Disk from Earth	0.009	rad	0.518	degree	0.4	finger
Earth Disk from Moon	0.033	rad	1.899	degree	1.3	finger
Ratio E/M	3.67	units				
Lunar Eclipse time	347	Minutes	5.79	Hr		Max

6. Angle of Earth as seen from Mt. Malapert

Earth above H mean	8.67	degree	4.56	E disk	1.13	hands
Earth above H lowest	8.52	degree	4.49	E disk	1.11	hands
Earth above H highest	8.83	degree	4.65	E disk	1.15	hands

7. Calculations of apparent angle of Sun

High Noon:

Sun to North, mean	13.81	degree	7.27	E disk	1.80	hands
Sun to North, lowest	3.38	degree	1.78	E disk	0.44	hands
Sun to North, highest	13.97	degree	7.36	E disk	1.82	hands

Midnight:

Sun to south, mean	-3.05	degree	-1.61	E disk	-0.40	hands
Sun to South, lowest	-3.20	degree	-1.69	E disk	-0.42	hands
Sun to South, highest	-2.89	degree	-1.52	E disk	-0.38	hands

8. Rock Shadow

Max

Min

Sun angle	13.81	degree	0.246	rad	0.237	rad			
Earth Angle	8.67	degree	0.258	rad	0.224	rad			
			Sun Shadow		Earth Shadow				
Height of rock	1.00	m	3.99	4.15	0.159	3.80	4.38	0.584	

9. Communication Delay

Earth/Moon one way	1.28	sec		
Earth/Geo one way	0.12	sec		
Electronic Delay, typical	0.004	sec	9.00	typical
Typical Earth/Moon Trip	1.44	sec		
Typical Earth/Moon two way	2.88	sec		

10. Attitude and longitude to km

Longitude Degree		30.316	Km/degree					
			East-West					
	Long	Long	Delta	km	Lat	Lat	Center	Delta
Malapert Small	-3.50	-2.00	-1.50	3.212	-85.90	-86.00	-85.95	0.10
Malapert Site	-9.00	2.80	-11.80	26.200	-85.60	-86.00	-85.8	0.40
Malapert Area	-18.00	23.00	-41.00	70.467	-85.50	-88.00	-86.75	2.50
Scott Site	25.00	43.00	-18.00	50.406	-84.40	-85.00	-84.7	0.60
Scott core	36.00	38.00	-2.00	5.284	-84.80	-85.20	-85	0.40
Scott Area	16.00	65.00	-49.00	126.887	-84.40	-85.80	-85.1	1.40
Marius Hills	-56.50	-49.00	-7.50	221.320	9.50	17.00	13.25	-7.50
Marius Site	-56.60	-56.00	-0.60	17.646	13.80	14.30	14.05	-0.50
Aitken bottom	179.5	180.50	-1	21.437	44.50	45.50	45	-1.00

11. Summation

From the top of the Mt. Malapert:

1. The sun disk is 3.7 times as big as the lunar disk from Earth
2. The sun disk never gets more than 1.75 hand widths above the horizon
3. The sun disk never quite goes completely below the horizon

Notes:

1. "Orbit of the Moon" (Wikipedia, Internet) http://en.wikipedia.org/wiki/Moon_orbit
http://en.wikipedia.org/wiki/Moon_orbit



m

North-South

km

3.032

12.127

75.791

18.190

12.127

42.443

227.373

15.158

30.316