4.0 Site Selection

Precursor missions provide extensive reconnaissance aiding in the final determination of the site, Taurus Littrow. This site has been comtemplated as one of four possible lunar outpost sites. These sites have been suggested by the Solar System Exploration Division at JSC (Alred, et al., 1989). The selection of Taurus-Littrow addresses the variety necessary to support geologic science, future ISRU, investigation of the surrounding topography, and a sophistication of the already emplaced experimentation from the Apollo missions (Figure 4.0-1).

The Apollo 17 landing at Taurus-Littrow celebrated the sixth and final human mission to the Moon in December 1972. The planning for this site was probably the best of any Apollo mission due to previous experience and extensive orbital data from Apollo 15. Mission objectives included photography, sample return, radiation environment study, soil mechanics, surface-based geophysics, selenodesy measurements, and meteroid studies.

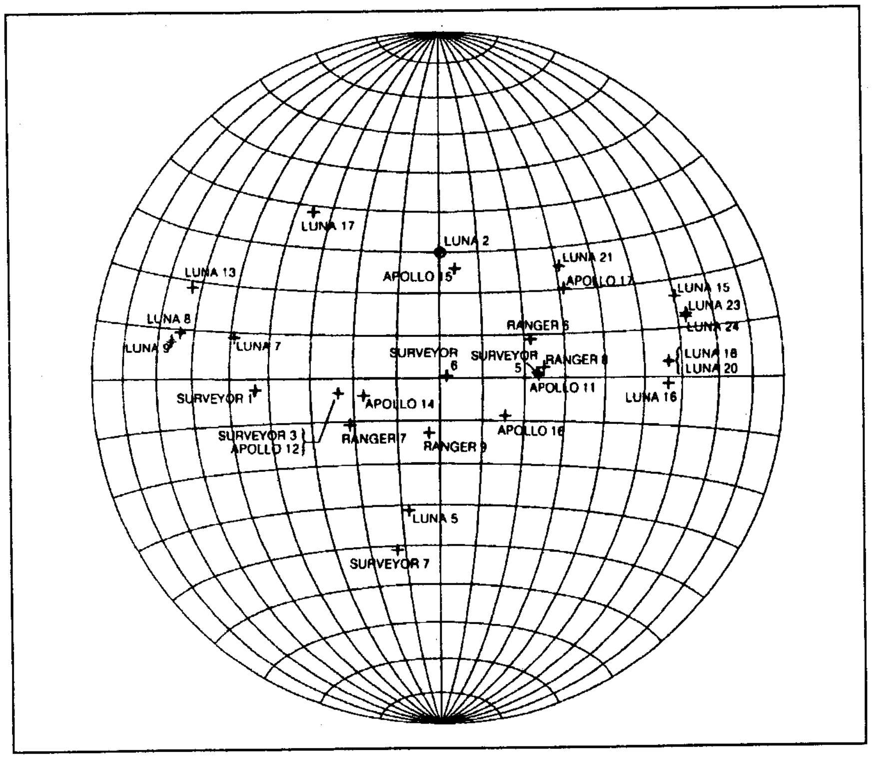

Figure 4.0-1. Landing sites on the lunar surface (Heiken, Vaniman, & French, 1991).

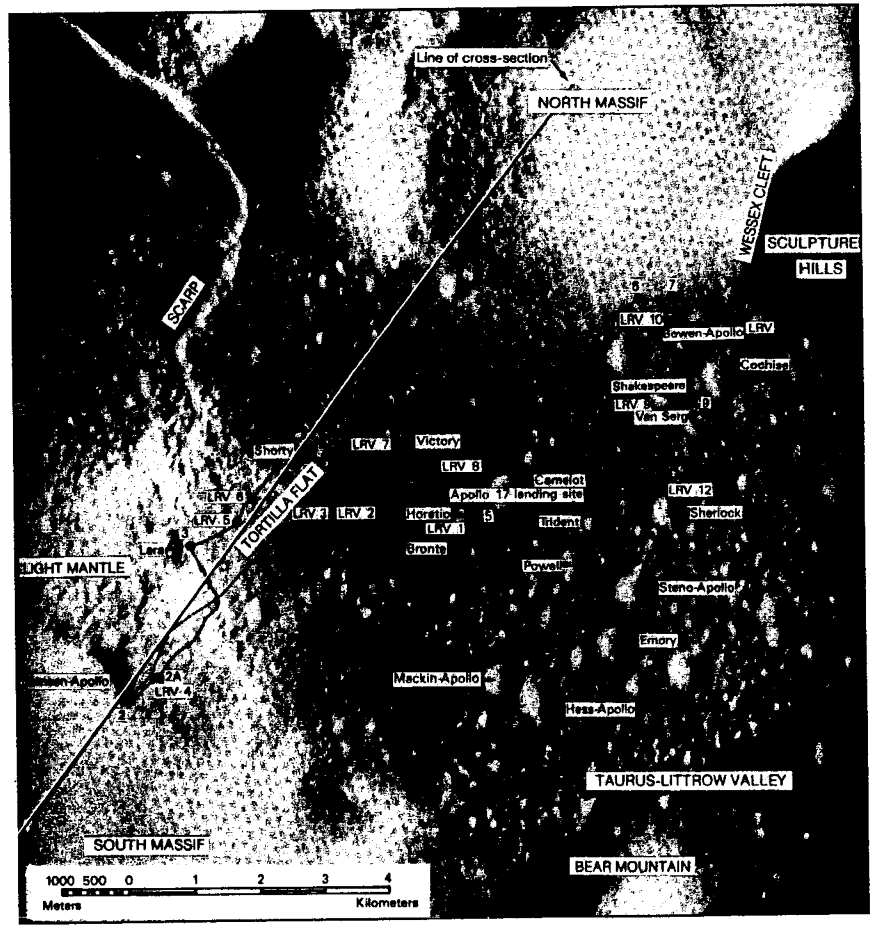

Figure 4.0-2. Apollo 17 Site Traverse Map (Heiken et al., 1992).

Figure 4.0-2 shows the Apollo 17 site traverse map. The solid line indicates the known travel path; the dotted line are estimated pathways. The cross-section line is shown in Figure 4.0-3 and indicates the results of the lunar geologic processes. The traverse map shows a variety of geologic formations and materials. The cross-section further delineates the complex boundaries between the older highlands and younger mare basalt flows (the numbers indicates samples returned) (Heiken, Vaneman & French, 1991).

Problematic issues concerning lunar surface missions are intense radiation, meteroid impact, great temperature extremes and regolith

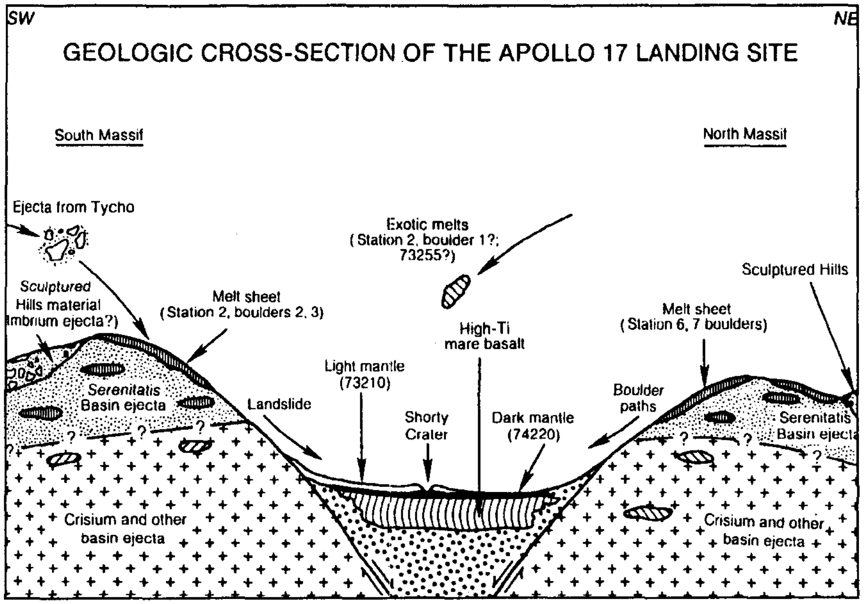

Figure 4.0-3. Cross-section of geologic region of Taurus-Littrow Valley (Heiken, et al,1991).

(dust) contamination. The radiation penetrates the surface having permanent, distinct, and depth-dependent effects (Heiken, et al., 1991). The depth of penetration ranges from micrometers to several meters. Solar wind ions can penetrate the surfaces of grains and are thought to be the source of certain volatile elements. The heavy nucleii in GCR's and resultant neutrons in the regolith necessitate the use of shielding for humans and equipment.

Figure 4.0-4 illustrates major impact basins on the Moon. These areas continue to assist scientists in the determiniation of the Moon's origin. They also suggest a portion of the historic chain of events. Table 4.0-5 indicates seismic events. These experiments over a several-year period have recorded over 1700 meteroid impacts. Of those, 95 are considered major events (Heiken, et al., 1991).

Temperature extremes ppose concerns for human life as well as material and experiment survival. Surface temperature estimates are exhibited in Table 4.0-6. At the Taurus-Littrow site, the temperatures fall into a middle lattitude range. At the Apollo sites, the mean temperatures recorded below the surface (at 35 cm) are 40-45 K above the temperatures at the surface (Lanseth & Keih, 1977 as cited in Heiken, et al., 1991).

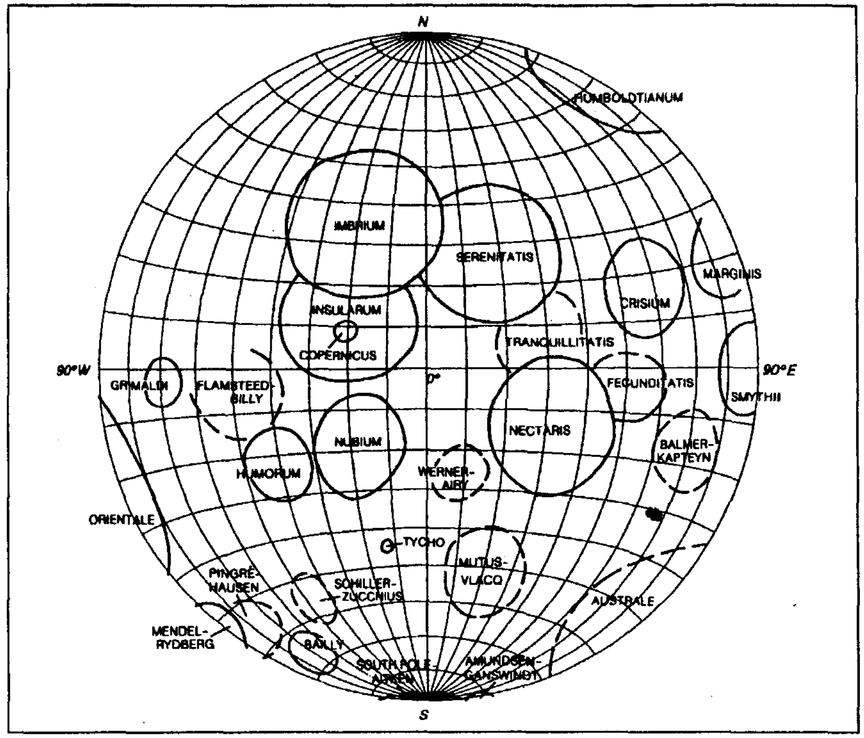

Figure 4.0-4. Impact basins on the Moon's surface (Heiken, et al., 1991).

Period of Observation		
1 station (July-August, November 1969 - February 1971)		1.27 yr
2 stations (February 1971 - July 1971)		0.48 yr
3 stations (July 1971 - April 1972)		.73 yr
4 stations (April 1972 - September 1977)		5.44 yr
Total		7.92 yr
Number of Seismic Events Detected		
	Total	Major Events
Artificial impacts	9	5
Meteoroid impacts	1700	95
Shallow moonquakes (HFT)	32	7
Deep moonquakes		
confirmed	973	9
unconfirmed	1800	2
Unclassified events	7300	0
Total	11,800	118

Fig. 4.0-5. Lunar seismic experiment recordings (Heiken, et al., 1991).

	Shadowed Polar Craters	Other Polar Areas	Front Equatorial	Back Equatorial	Typical Mid-Latitiudes
Average Temperature	40 K	220 K	254 K	256 K	220<T<255 K
Monthly Range	none	±10 K	±140 K	±140	±110

Fig. 4.0-6. Lunar surfact temperature estimates (Heiken, et al., 1991).

Thermometers emplaced 80 cm below the surface have recorded no day/ night cycle temperature change influence.

Dust contamination causes concern for sensitive scientific equipment, spacecraft components and human life. Astronaut Alan Bean and his fellow crewmembers reported great amounts of dust floating in the spacecraft cabin post-liftoff. "This dust made breathing without a helmet difficult, and enough particles were present in the cabin atmosphere to affect our vision. The use of a whisk broom prior to ingress would probably not be satisfactory in solving the dust problem, because the dust tends to rub deeper into the garment rather than brush off" (Bean, et al., 1970, as cited in Heiken, et al., 1991). Necessary protection of any item on the surface was further necessitated by the examination of the Surveyor 3 robotic lander during Apollo 12. Discoloration, dust accumulation, and pitting damaged the lander and optical mirror. "Sandlblasting" effectsw occurred from the Apollo 12 landing module (LM) exhaust gases. Apollo 12 landed 183 m away from Surveyor 3.

The Apollo 17 site selection, at 20.2 degrees North lattitude and 30.8 degrees E longitude, possesses great potential for further mission and surface operations. Given the information from recorded Apollo missions and the greater amount of knowledge regarding the locale, it was chosen for consideration for *Domus I* and *Dymaxion.*