1.0 Objectives and Procedure

The University of Wisconsin-Milwaukee School of Architecture and Urban Planning (SARUP) and its NASA/USRA ADP strives annually to contribute to a currently-evaluated program at NASA. With the Johnson Space Center as our mentor division, we are afforded the opportunity to consult with engineers, architects and technical personnel establishing criteria for future exploration projects. A continuing area of research and evaluation is the conceptualization and ultimate implementation of a lunar base. A final decision and design have as yet to be determined. Open to a wide variety of conceptual suggestions, NASA looks to internal ideas as well as those from industry and academia. At this starting point, UW-Milwaukee and the SARUP hope to make an impact. Students play the pivotal role participating in an educational process resulting in aerospace design.

The program strives to integrate architecture, engineering, planning, human factors, environment-behavior studies, natural resource utilization, and advanced construction technology.

1.1 Objectives of Lunar Base Proposals

In the broadest sense, the priority of a lunar base proposal is to provide a safe, productive environment to sustain human habitation and experimentation. To achieve this end, materials should be of near-term technology requiring minimal extravehicular activity (EVA) time for crewmembers. A lunar base represents humankind’s ability to expand its own horizons, challenges technology that currently exists, and pushes that same technology to address unique situations. There is potential, as has been demonstrated by shuttle missions, of utilizing new advances to better life on Earth. Also, many feel that within the first decade of the new century, the goal of achieving a permanent settlement on another celestial body is within reach.

In addition to the construction of living and working environments for the astronauts, the following requirements detail the goals for extraterrestrial habitation:

- habitation supporting a crew of 12 international astronauts
- utilization of a First Lunar Outpost (FLO) as a commencement point for construction of the permanent facility
- addressing psychological and sociological issues related to long-term isolation and confinement
- construction technology exhibiting advancements in material design, weight reductions and compactability for transport
- advancing scientific knowledge with on-site laboratories and human participation
- studying effects of a lesser gravitational field, and protective measures against temperature extremes, environmental vacuum, and radiation hazards

1.2 Project Goals

The specific goals for this current ADP project included the aforementioned list. Attention was directed toward a permanent lunar base for an international crew of 12, providing laboratory facilities to support investigation in plant growth, microbiology, life sciences, health maintenance, physical sciences, geomorphology and telerobotics. To specifically support the crewmembers, areas to sleep and perform personal hygiene would be designed. Areas supporting activities such as eating, food preparation, recreation, exercise and social interaction would also be addressed in the design.

1.3 Design Methodology

Background investigation was an integral component of the semester ADP. The approach began by a comparative analysis of numerous lunar base proposals and construction methods. The relative strengths and weaknesses were evaluated according to ease of construction, simplicity of design, near-term technology, volumetric allowances for specific functions, EVA involvement, and number of facility components.

By process of elimination, proposals that appeared most favorable were investigated further. One proposal and one construction method fulfilled the criteria and were selected for a feasibility study. The result were two parallel studies for design consideration.

Consistent throughout the semester were design reviews and critiques. The bulk of the design work was completed using AutoCAD. The resulting final product was a complete lunar base facility, supporting habitation and scientific functions.
One study was delivered as a complete AutoCAD slide program, rendered in Animator-Pro and 3-D Studio programs. An animated fly-through provided a brief overall perspective of the base exterior and interior components. The second parallel study was delivered using only AutoCAD drawings without animation.