LUNAR HOUSING SIMULATOR

To maintain man on the moon for periods of extended duration, a Lunar Housing facility must be a closed ecological (self-sustaining) system. To attain this objective in the Lunar Housing Simulator (LHS), ~~three~~ ~~two~~ three basic problems must be solved:

1. Development of a self-sustaining atmospheric control system.
2. Development of a self-sustaining food supply.

3. Dev. of adeq. waste proc. syst

The research program necessary to solve these problems requires the following steps:

1. Develop workable system hardware at ambient pressures for O_2/CO_2 balance, food production, waste utilization, etc.
2. Test developed subsystems under reduced pressures as elements of a complete system.
3. Develop integrated system within cubage limitations of simulator at both normal and ambient pressures, and at reduced pressures.
4. Develop structural erection and maintenance techniques at both normal ambient pressures and in a vacuum.

Design criteria for a basic LHS are dictated by four major considerations:

1. Physical environment at the Lunar site; e.g. atmosphere, pressure, temperature, g, etc.
2. Human range of physiological adaptability; e.g. limits for atmospheric partial pressures, temperature, humidity, g, food and waste treatment techniques, etc.
3. Logistics: transport and activation; weight and volume.
4. Mission of lunar station; tasks, mobility, etc.

Criteria for the Closed Ecological System

1. Designed around the 95 percentile man.
2. Selection of components to provide economical use of available energy.

LHS Configuration

Shape: sphere, optimal volume.

Useable volume: maximized by multifloor interior. To accommodate life support systems and necessary instrumentation, 3400 cub. ft./man or 17000 cub ft for 5-man crew.

LHS Limitations

1. No radiation.
2. No meteor showers
3. No lunar temperature simulation.
4. No lunar g simulation.

LHS General Characteristics

1. To house 5-man crew plus accompanying plants, animals, and equipment to provide a self-sustaining system.
2. Internal spherical pressurized shell will be enclosed in an outer vacuum chamber.

Structural Description

Insulated, welded steel sphere, 32 ft in diameter, supported by steel columns attached to equatorial ring-girder. Vertical axial cylindrical core structure supported from this ring-girder by radial beams. Median deck supported by these radial beams. Upper and lower level decks supportd by cantilevered beams attached to core structure. Central core contains electric lift and serves as utility well. Core extends to base of sphere and connects with air-lock entry chamber. Entire assembly enclosed in spherical welded steel shell approximately 62 ft diameter and 50 ft high; adjacent to conventional construction operational support building.

Operational Description

Two operational phases:
Initial phase: ambient pressure followed by reduced pressure of 7.35 psi or lower (approx. 18,000 ft., 12 psi).
Later phase: evacuation to pressure of 8 mm Hg (approx. 100,000 ft.), equivalent to lunar pressure conditions.

Production of plant and animal food source on median and top decks. Hydroponics method for plant growth. Advantages of lessened weight requirements better control of growing conditions, and most efficient use of cubage.

Photosynthetic gas exchange system also located on one or both of these decks.

LABORATORY RESEARCH APPLICATIONS

1. Artificial atmosphere research. Necessary control systems and effects on human crew.
2. Photosynthetic gas exchanger research.
3. Investigation of optimal wast utilization techniques.
4. Task analysis: crew size and assignments.
5. Work-rest, exercise-recreation schedules.
6. Development and test of LHS hydroponic systems.
7. Human engineering investigations of instruments, controls, task equipment, and personal gear.
8. Development of emergency procedures.
9. LHS structural investigations.

Fink
6-17-59