Atmosphere Control

The basic problem in this area will be to maintain a gaseous atmosphere in the simulator suitable for normal crew respiration. This involves maintaining optimum levels with respect to oxygen, carbon dioxide, and carbon monoxide and other toxic gases or vapors. Humidity and temperature are of course facets of this control.

The primary portion of this problem will be the exchange system of oxygen/carbon dioxide, accomplished by means of a suitable photosynthetic system, probably using algae as the active agent. A secondarily important exchange will be contributed by the food plants in the system.

The basic symbiosis between animals, of which man is a special case, and plants, of which algae are a special case, holds true with respect to both respiration and nutrient. Animals consume plants and utilize their gaseous wastes, while plants utilize animal wastes, both liquid and gaseous.

Sources of carbon dioxide secondary in importance to the exhaled breath of man and animals will be those resultant from the controlled combustion of methane from the waste digesters, from incinerated non-liquefied wastes, and various minor sources. This carbon dioxide will be fed directly to the algal system.

The simulator atmosphere will be continually re-cycled through the regeneration system. This atmosphere will carry a certain amount of oxygen, carbon dioxide, inert gases, water, and minor amounts of odors and toxic gases such as carbon monoxide. At appropriate stages

in the system, carbon dioxide will be removed and oxygen will be added. This will occur chiefly in the algae exchange system, and secondarily through the growth of the food plants.

Water will be removed from the atmosphere by means of freezing in conjunction with the removal of heat generated within the simulator. Prior removal of odors and toxic gases or vapors having been accomplished by treatment with activated carbon, the ice formed will present a source of pure water for general use. A continual humidification of the simulator atmosphere will occur naturally through transpiration in the growing plants, plus moisture expired and perspired by men and animals. Proper routing of the circulating air system will provide acceptable atmospheric conditions throughout the simulator.

It is planned to conduct initial research in the simulator under ambient (12 psi) pressure while establishing a preliminary balanced ecology. Later, operation at reduced pressures is planned, in keeping with the concept of lessened structural requirements for a satellite or lunar base operating under external vacuum in space. The composition of the reduced pressure atmosphere in the simulator may be altered in keeping with physiological data available at that time. Preliminary chamber experiments will necessarily have indicated the plant and animal varieties capable of optimal functioning under these special conditions.