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A Lagrangian community?

It seems that it may be economically feasible, within the limits of the technology of this decade, to establish at one of the Lagrange libration points of the Earth-Moon system (called here L_5) a habitat capable of supporting and maintaining some 10,000 people. Projections indicate that this habitat, using free solar energy and the rich mineral resources of the lunar surface, could construct a still larger habitat, in a progression leading, possibly within 30 yr from now, to communities of from 10^5 to 10^7 people. These communities could be as comfortable as the most desirable parts of the Earth, with natural sunshine, controlled weater, normal air, apparent gravity and complete freedom from pollution. Replication of these communities could lead to the exponential growth of new land area, with a growth rate more rapid than that of the total human population.

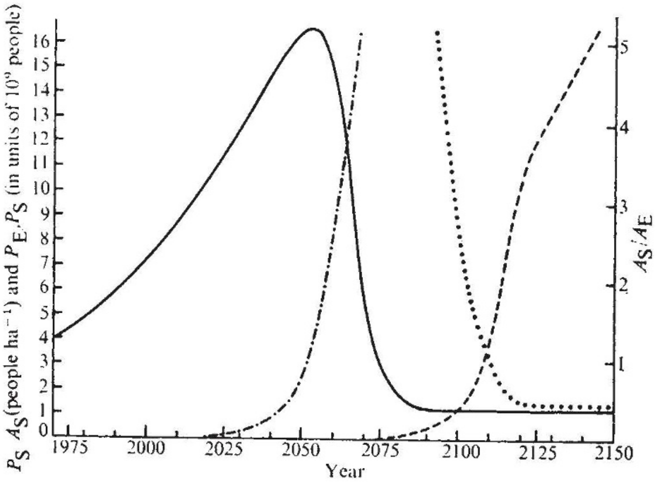

Fig. 1 A graph, technically realisable in my opinion, showing that most industry could be removed from the biosphere of the Earth within a century. The graph is based on a "worst-case" assumption: no reduction of the population growth rate either on earth or in the space communities. P_E is the population on earth, P_S the population in space, A_S/A_E the ratio of land area in space (all usable) to the total land area of Earth. Changes within wide limits in the assumed input numbers do not affect reaching a solution stable in P_E and P_S/A_S. The final stable value of P_E (1.2 × 10^9 people) is equivalent to the 1910 value. —, P_E; —·—·, P_S; ....., P_S/A_S; – – –, A_S/A_E.

A technically possible time-development is shown in Fig. 1, not as a prediction but as an illustration of the power of the technique.

Economic feasibility is defined here as the achievement of an overall cost less than or equal to that of the Apollo project. A reduction in the design size of the first habitat, with a corresponding reduction in the size of its population, would result in some further reduction in the estimates.

The solutions to several problems were necessary in order to achieve this feasibility:

(*a*) Geometry: A physical arrangement has been found which would allow the use of natural sunlight for industry, farming and the maintenance of an attractive, earthlike environment with normal day/night and seasonal cycles.
(*b*) Transport from the earth to L_5: A reconfiguration of hardware already under development for the space-shuttle (to be operational by 1980) seems adequate to transport the necessary minimum of materials from earth.
(*c*) Water: The combination, at L_5, of hydrogen from the earth with oxygen from the abundant oxides of the lunar surface effects an important saving of a factor 9 in the mass of material needed from earth per unit mass of water at L_5.
(*d*) Materials: Obtaining nearly all the mass of the habitat from the moon appears essential for economy. Two alternative designs have been studied for the acceleration of lunar materials to the 2.4 km^{-1}s escape velocity of the moon. Both designs depend on the vacuum environment of the moon. Neither is conventional, but the technology of the present decade would suffice for either.

The ultimate benefits of this new possibility depend on the production of successively larger communities by a workforce which is housed, fed and maintained within the communities rather than on earth, and so to the eventual achievement by the communities of the ability to sustain their own growth by the construction of new lands and production facilities from lunar and asteroidal material.

These studies have been discussed in lectures at a number of universities during the past 18 months. Knowledge of the work has therefore spread, additional people have joined the effort, and recent progress has been rapid. On May 10, 1974, the first public meeting on this topic was held at Princeton University.

Detailed information on these studies will be found in forthcoming publications in *Physics Today* and in *Icarus*.

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Intensity of the near infrared OH airglow

The OH airglow was studied from the balloon-borne telescope Thisbe on three flights launched in 1971 and 1972 from the NCAR balloon flight station, Palestine, Texas (32°N, 95°W). The principal goal of these flights has been the measurement of the zodiacal light in the near infrared[1] with the airglow as a troublesome foreground contribution which had to be determined carefully.

The measurements have been performed from a float altitude of 32 km at wavelengths $\lambda = 0.82$, 2.1, and 2.4 µm with half power bandwidths $\Delta\lambda = 0.023$, 0.1 and 0.1 µm respectively. For the shorter wavelengths a straightforward photometer with a multiplier as detector has been used. The larger wavelengths were measured by a dry ice cooled PbS-photometer. The field of view of both photometers was 2° in diameter. The 0.82 µm photometer was calibrated by observations of 33 stars. The PbS-photometer was calibrated before the flight by a 240 K blackbody and during the flight by the star α-Ori

$$(I_{2.1\ \mu m} = 1.9\times10^{-12}\mathrm{W\ cm^{-2}\ \mu m^{-1}};$$
$$I_{2.4\ \mu m} = 1.3\times10^{-12}\mathrm{W\ cm^{-2}\ \mu m^{-1}}).$$

The airglow intensity was determined from several elevation scans. As an example Fig. 1 shows the result of an elevation scan at $\lambda = 2.1$ µm.

A van Rhijn curve for an emission altitude of 92 km was fitted to the data. The resulting zenith intensities at all measured wavelengths are listed in Table 1.