

For Further Reading

The series of *Papers on the Lunar Settlement* is intended to summarize information relevant to the Lunar Settlement Plan, and to serve as a statement of work and a basis of discussion. The Papers are available on the Web site in HTML and PDF, and by mail upon request. Each is assigned a six-digit hexadecimal sequence number, consisting of three two-digit groups denoting category, topic, and revision.

00 — General Topics

- 01 Prolegomenon
- 02 Overview
- 03 Location
revision 0, 2007-191

01 — Life Support and Life Cycle

- 01 Atmosphere
revision 0, 2007-120

02 — Engineering

- 01 Structure
- 02 Illumination
revision 0, 2007-120
- 03 Ventilation
- 04 Thermal Management
- 05 Dust
revision 0, 2007-183
- 06 Pressure Suits
revision 0, 2007-201
- 07 Excavation
revision 0, 2007-201
- 08 Launch Vehicles
revision 0, 2007-213
- 09 Vacuum Cementation
- 0A Communications
- 0B Extraction Processes

03 — Logistics

- 01 Space Transportation
revision 0, 2007-196
- 02 Lunar Transportation

Moon Phases

New	25 February 01:36 GMT
First Quarter	4 March 07:45 GMT
Full	11 March 02:37 GMT
Last Quarter	18 March 17:49 GMT
New	26 March 16:08 GMT
First Quarter	2 April 14:34 GMT

Answering the Unanswerable

The message of the Luna Project tends to evoke many questions, of various kinds and levels of difficulty, requiring different approaches to answer.

Questions of fact are straightforward, even when the answer is not definitely known, since the evidence can be brought out, and conclusions weighed.

Won't mining the Moon affect the tides? Luna is small only by planetary standards, and even at the enormous rate of a billion tonnes a year, moving one per centum of the mass would require three-quarters of a billion years. The effects of any credible operation would be swamped by natural phenomena such as secular recession.

Where will you get food, water, and air? Oxygen is the most abundant component of the lunar rocks, and by far the most important element for supporting life, and its extraction yields byproducts such as aluminum. Sources of lesser components such as hydrogen are known, and horticulture in lunar soil has been demonstrated.

What about the effect of low gravity on health? Weightlessness causes physiological changes of medical concern, such as loss of bone and muscle mass, which become most important upon return to Terra. Good data on the effects of low gravity are not available, but there is reason to believe that they would be much less severe, and animal studies can be conducted early on. Adaptive changes should be more tolerable to settlers than they would be to rotating crews, but corrective measures, such as centrifuge conditioning, can be taken if necessary.

Some knottier questions can best be answered from the standpoint of intent.

Wouldn't robots be cheaper? For what? Automata and teleoperated machines are useful but limited tools, dependent upon human intervention, and cannot propagate the human race.

What about Mars? The red planet is not yet definitely within our grasp. Even if it were, an establishment there could not easily contribute to the broader space development effort.

Why spend all that money on space, with so many problems to solve on Earth? The cost of the Lunar Settlement Plan is relatively small, and few problems on Earth are left unsolved purely for lack of funds. Space

development may even be the only good solution to some of them.

What is the economic case? Things are often justified purely by the willingness of people to pay for them, which should initially suffice for the Lunar Settlement Plan. In the longer term, the expected material benefits are immense, and economic systems, after all, exist to serve human needs.

Then there are the hard questions, the ones we strain to answer. *What is to stop us making a mess of other planets as we have of Earth? Shouldn't the Earth be enough for us? Does humanity deserve to survive?* If life, especially active, rational, loving life, is not one of the most precious things in the universe — what? If we, who have ever looked with longing upon the hills, the sea, the next horizon, shrink from the stars and seek at last to remain at home — what? If the cosmos does not give us a chance for a fresh start under conditions which drive us to new ways of living and understanding, and to mend the damage we have done by taking the 'easy way' and expecting overindulgent mother Terra to clean up after us — what? What answer can be made, or even contemplated, to these terrible hypotheticals? Only the affirmation, loud and unashamed, of life, of joy, of humanity ascendant — ***We are going!***

Luna City or Bust!

PART 3

We have called for immediate, permanent human settlement in Luna, and further called upon everyone interested in space development to support this goal as the best first step toward the realization of their ultimate aims. This message requires some justification, which we mean to present under this title.

Most scenarios for near-term human lunar activity have been couched in terms of a modest scientific outpost. Even the most ambitious proposals have been limited to a mining base, or a research station which might ultimately develop, over the course of decades, into a colony. We, on the other hand, expect to realize significant advantages by putting settlement first.

This objective, and more particularly
(continued on other side)

Medallic Art

The original Luna Project medalets, struck in August 2008, are essentially uniface : a token-style obverse in bilevel relief, incorporating the familiar rocket logo, is paired with a starburst-pattern reverse from a stock die furnished by the minting firm. This arrangement was chosen partly to limit the cost of an uncertain venture, and partly for want of a design which would justify the creation of a second die. Even with more than eight hundred pieces remaining from the production run of one thousand, it may not be too soon to consider future steps in the medalet program.

Changes contemplated for a new issue include substituting cupronickel (used for U.S. five-cent coins) for nickel-plated brass, increasing the thickness, and marking the edge with a groove to facilitate use in jewelery. The resulting product should be much more satisfactory, at a moderately greater cost per piece. Most importantly, we intend to have a reverse die cut, preferably of the fully-sculpted type. This calls for suitable artwork, and the usual approach is to hold a competition, the prize being some combination of cash and finished specimens.

We require, then, contest judges, formal rules, contact with potentially interested artists, and seed money (which may come partly from pre-orders). The general guidelines are simple enough : the design must be attractive, express the spirit of the Luna Project and the concept of the extension of human activity into space, and be circular and suitable for reduction to low relief in a diameter of twenty-five millimeters (one inch, slightly larger than a U.S. quarter-dollar). The sketch below, of a neoclassical design employing an allegorical figure of Luna, illustrates one possible approach ; it should not be taken as definitive, and is probably not a suitable model for imitation.



Executed using Higgins Black Magic drawing ink & Post ruling pens on K+E Albanene tracing paper. Clearly, I need a Rapidograph.
(The figure on the shield is meant for a rabbit.)

(continued)

the goal of a self-supporting community serving as the anchor for future space development, furnishes an organizing principle for our efforts and a basis for selecting among alternatives. It has repeatedly happened in the space field that the component or capability vital to the ultimate purpose of a project has been eliminated, in the face of budget constraints, in order to make the project possible at all. The result is a dead end, which is criticized as a waste of money (leading to further budget cuts), and a stall in progress. The ambitious statement that we are sending no-one to Luna who intends to return should help us, not only to guard against such failures of vision, but to capture the public interest vital to our success.

Settlement is also favourable on a cost basis. Attaining the necessary level of self-sufficiency demands a large initial importation of capital equipment, but the consumables required by an outpost would amount to as much within a few years. Furthermore, while our approach avoids the cost of return transportation associated with rotating crews, the growing population means a constant increase of capabilities, which are basically static for a base with a fixed crew size. As a result, even with most of the activity of the colony devoted to subsistence and expansion, all the functions of such a base can be served.

The same advantage obtains with respect to space industrialization. The most thoroughly worked out proposals to date have called for a lunar mining base paired with processing facilities in high terrestrial orbit, to secure the full advantage of microgravity and constant sunlight. This requires the delivery of thousands of tonnes of equipment to the lunar surface (the mass-driver needed to move the raw material accounting for the largest fraction), and thousands more to the high orbitals, before any production can begin. Under our plan, by contrast, all the operations are located together, so that comparable levels of activity can be achieved with comparable lead time but a far smaller payload requirement, by employing the output from pilot plants to build larger facilities in 'bootstrap' fashion.

Finally, the settlement is a permanent foothold for Man in the cosmos. It may be an exaggeration to say that the birth of the first lunar child will secure the future of humanity, but a living community beyond Earth would be strong insurance against a future hiatus in space activity. Even in such a case, the facilities at least would (unlike a space station in decaying orbit) remain for the use of posterity.

As the dates show, I composed most of the completed papers in one burst of activity, while working out the concept which became the Luna Project, and they all need revision, some badly. Further, several papers (shown in italic type) have been defined but not completed, and numerous additional topics need addressing. There is an area for the Papers on the Web forum, and drafts or comments can be submitted to the *luna_discussion* list, or to me by post or e-mail.

—Christopher Carson
(publius)

Events

ConDFW¹², Dallas, 20-22 February
Lunacon¹, New York, 20-22 March
Space Access Conference, Phoenix, 2-4 April
Conestoga†, Tulsa, 24-26 April
FiestaCon (Westercon)†, Tempe, 2-5 July
Anticipation (Worldcon)†, Montreal, 6-10 August

Completed

Definite

Under Consideration

¹Table

²Advertisement

†Lodging not yet secured

This list would be much improved by the addition of events at which someone other than myself will represent the Project, and of Project-sponsored events.

—publius

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