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## Export Products from the Moon

by Gordon Woodcock

*Editors Note: A necessary condition for any long-term, large-scale human presence on the Moon beyond a scientific basis is an export product to pay for imports from Earth.*

The apparent discovery of water ice in cold traps at the lunar south pole has increased attention to future uses of the Moon much as discoveries of evidence of possible past microbial life on Mars have increased attention to exploration of that world.

These two planets (the Moon is large enough to be considered a planet) are interesting for different reasons. Mars seems to offer the greatest scientific return, although astrophysicists might debate that. The Moon, by virtue of being much nearer and having a lesser gravity well, seems to offer the greatest economic return. Both statements, of course, are highly uncertain.

Central to the idea of economic return are export products. In the case of an extraterrestrial body like the Moon, exports might be placed in three categories:

1. Products with export value by reason of their scarcity elsewhere, e.g., helium-3.
2. Products having value by reason of their location relative to point of use, e.g., lunar materials or manufactured products for use in manufacture of solar power satellites or other

space products in geosynchronous orbit.

3. Products with export value due to value added, e.g., by lunar settlers or lunar investment capital. Products may be material or could be energy or data.

One might also think of economic return through investment in the Moon leading to economic growth on the Moon and increased value of the investment. However, in the long run, if value is to be taken out of a lunar economy, the lunar economy must earn that value in the first place by (a) export products, or (b) selling real property to outside investors.

One must also consider the point-of-use principle. For a space-produced product, the closer the point of use is to the point of production, the more likely the product is to be economic.

This derives from the high cost of space transportation. Almost all investigators find that lunar oxygen produced on the Moon and used on the Moon will be economic. Production of lunar oxygen on the Moon for train-shipment to low Earth orbit, upon critical examination, appears uneconomic.

Lunar products have a reasonable chance of being economic if used in geosynchronous orbit or in the lunar vicinity.

A final point: If a product



## Land Grants as an Incentive for Space Development

Guest Editorial by Alan Wasser

Bob Zubrin should be very proud of the wonderful cover story about Mars that *Newsweek* published September 23rd. It illustrates the tremendous power of his brilliant vision for human settlement of Mars in the near future.

Also in September, a meeting of National Space Society directors adopted a Mars policy statement supporting Bob's vision. That statement said: "An exploration program based upon a permanent human presence on the Red Planet will not only unlock the secrets of possible past life there, but will also establish the rich promise of a human future on Mars." The statement also "calls upon the Administration and Congress to set a clear goal of establishing human explorers on Mars by the end of the first decade of the 21st Century."

Unfortunately, in the same month, the White House moved in the opposite direction. It issued a new space policy document which almost seemed to be a deliberate rebuttal to *Newsweek* and the rest of the groundswell of support for Bob's vision, saying, in effect: "not with the taxpayers' money, you don't!"

The NSS Mars policy avoids specifying funding details, instead stating optimistically "cost is not really the central issue." But the truth is taxpayers' money is currently our only suggestion, whether directly or through a tax-funded prize.

Our proposals should include some way to pay at least part of the cost of settlement from something other than taxes; an option that might still produce a settlement on

Mars or the Moon even if we fail to get full government funding. We should call for U.S. recognition of extra-terrestrial land claims as a reward for private investment in a settlement and a space-line going to and from that settlement.

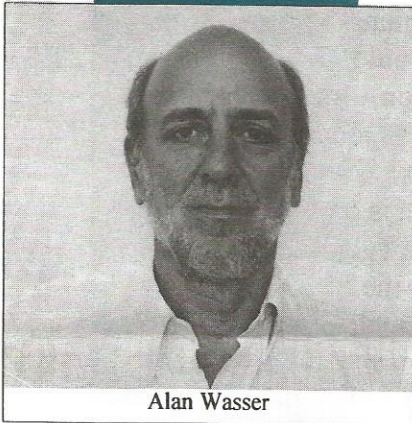
Although often forgotten, the international law created by the 1967 Outer Space Treaty is not the historical norm. The right to claim newly settled property has always provided an economic incentive for human expansion (Would Europeans have settled America if they couldn't claim ownership of the land they settled?).

In this case, immediately re-saleable property deeds are the only possible "product" that can be profitably brought back from space at currently foreseeable launch costs.

There could be privately-funded settlements on Mars or the Moon, if we could restore the historically normal condition by establishing a rule-of-law something like this:

*Any private entity (presumably a consortium of companies) which establishes a permanently inhabited base on Mars, the Moon or an asteroid, with guaranteed regular transportation shuttling between the base and the Earth, open to any paying passenger, immediately acquires full legally recognized and saleable title to hundreds of thousands of square miles around the base.*

The land grant for the first such base on the Moon would need



Alan Wasser



to be no less than the size of Alaska which, at even \$10 an acre, would be worth almost four billion dollars. That should be big enough to allow the winning consortium to begin earning back its expenditure immediately by selling off pieces of it, but would still be less than 4% of the Moon's surface.

On Mars, the land grant would have to be the size of the United States, worth about 23 billion dollars at \$10 per acre. If those turn out to be insufficient to pay for settlement, there is plenty of room to enlarge the grants.

Of course, the establishment of a space transport service, which would enable the consortium to win the land grant in the first place, would dramatically increase the value of the land by making it accessible. As with the land grants that paid for building America's transcontinental railroads, vast wealth would be created (out of thin vacuum, so to speak) by giving formerly worthless land real value and an owner.

There are many ways in which extra-terrestrial property rights might be instituted. The easiest would be to get a member of Congress to introduce legislation saying that, while the U.S. makes no claim of national sovereignty, until and unless a new treaty on outer space property rights is adopted, all U.S. courts are to recognize and defend the validity of a land claim by any pri-

vate company (or group of companies) which met the specified conditions.

The legislation should urge other countries to adopt similar laws, and instruct the State Department to try to negotiate a new treaty making the same rules international law. The U.S. law could encourage other nations to pass similar laws by limiting the recognition of claims to entities based in countries which offer reciprocity to U.S. companies. The law could pledge to defend extra-terrestrial properties by imposing sanctions against aggressors. Since it would not require any appropriation, such legislation might pass as a minor revision of property law without much publicity, which is probably best, considering the "giggle-factor" problem. After the law is enacted we could start publicizing it, probably by getting someone to announce an attempt to meet the conditions and make a claim.

That White House space policy document, which removed support for a taxpayer-funded human Mars mission, did offer something that helps the land grant idea. It said: "The United States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof ... The United States considers the space systems of any nation to be national property."

Although it is not talking about land, this supports the legal principle that there can be "property" in space, even without a claim of "national sovereignty". This is a necessary legal premise for establishing the right of set-



tlers to claim private ownership of extra-terrestrial land, without the need to amend or violate the 1967 treaty, which prohibits "national sovereignty," but says nothing at all about "land ownership."

The framers of the 1967 treaty understood that perhaps it should not be permanent. They allowed any nation to opt out on one year's notice. Some suggest the U.S. should exercise that right, for the whole treaty or just the "national sovereignty" provision. While I would be happy to see that happen, many people love the treaty for its other provisions, and it is not worth fighting them.

A better alternative would be the opposite approach; to accommodate the provision by requiring that claimants be groups of companies (or citizens) from several different countries. To bring the UN on board, it could be required that at least one of the partners in each consortium be from a developing country.

If we could get something like this enacted into U.S. -- and preferably international -- law the space race would quickly resume, this time among a consortium of private companies. After the first announcement of an attempt to set up a lunar base, others all over the world, would say: "We can't let THEM claim the Moon. WE must get there first." Fear of competitors is still the best motivation.

Although neither has realized it yet, such a law would be a huge plum Congress could give the aerospace companies, without costing the taxpayers anything. Imagine, if it led to a consortium of respected companies, headed by KKR or Mitsubishi, asking Boeing, Lockheed Martin and McDonnell Douglas for bids on a rocket capable of shuttling back and forth to the Moon or Mars.

Once competition began, companies all around the world would seek their governments' help and investment, perhaps reestablishing a healthy spirit of national competitiveness in space, despite the ban on national sovereignty.

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