

BUILDING EARTH'S ARK TO MARS- ANOTHER STRATEGY FOR THE MARS SOCIETY

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ABSTRACT

The Mars Society has established an organization in structure and strategy that is a blend of the Cousteau Society, The National Space Society, and a scientific/ engineering technical society. Its members are from all walks of life and its membership is loosely organized in geographically dispersed chapters. While much society effort has been placed on lobbying for increased government funding for Mars focused projects, and some projects (notably the Flashline Mars Arctic Research Station) undertaken with private and sponsor funding, the specific talents of all individual members are not as yet effectively tapped within the current strategy and organizational structure of the Mars Society.

The right and ability to settle Mars is a powerful incentive for establishing a critical mass of talented individuals whose concentrated and coordinated efforts will assure the timely exploration and settlement of Mars. It is perhaps a stronger inducement to a focused settlement of Mars than those currently pursued, e.g. for political or business reasons.

This paper presents an approach to organizing for Mars settlement based on establishing a covenant (a contract) among members who pledge to guarantee the right and ability of members to emigrate to Mars. For purposes of discussion the organization is called "The Builders of the Ark." Membership is established and maintained by a "tithing" of member labor, not money.

The secret to the success of the Builders will be the recruitment and registration of members' experience and capabilities and the establishment and coordination of Builder's projects to which members will volunteer their labor. The projects will involve not only the building of the arks to Mars, but also the technical and cultural issues of exploration and establishment of self-sustaining settlements on Mars.

***We go for humanity... as life's messenger... bringing life to Mars and Mars to life...
(Founding Declaration of the Mars Society 1998)***

INTRODUCTION

The first two conventions of the Mars Society (MARS 98, MARS 99) have seen much discussion of how to lead and fund a series of expeditions to Mars with the long range intent of

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establishing permanent settlements on Mars. The debate is particularly strident in a decision as to whether government, commercial or private funding offers the best route to accomplishing a near term Mars expedition. The status quo is represented by the current NASA science-focused set of missions projected to send humans to Mars at an undefined date in this century. There are others who believe that the leadership and mission management of these explorations should be assigned to a non-profit corporation that can offer a better forum for incorporation of science and business interests (Chris Cowlin MARS 98 Abstr. and Justin Talbot-Stern et al. MARS 99 Abstr.).

There is general agreement that NASA with Presidential backing (ala JFK in 1960) is the best hope for a near term series of exploration missions to Mars, but there is justifiably a concern that a permanent settlement of Mars will not be a goal of such a program. Furthermore, a significant fraction of our politicians sense that the American people would rather spend \$30-60 Billion on a limited threat missile defense system than spend an equivalent amount on the Mars Expeditions. There remains a hope that a government prize for a series of milestones in reaching Mars will be sufficient incentive for businesses to absorb the expedition costs (R. Zubrin - 96). Such a prize could be sweetened by offering property rights to first explorers and settlers (A. Waser MARS 98-036). But there are others (D. M. Livingston MARS 99 Abstr.) who believe that the business payoffs are too long-range and the amount of money and financial risks too great for any one or several investors to take on.

A larger category of private and commercial funding options has also been proposed. The first is what I will term the "Bill Gates" solution. The hope is that Bill (or some other billionaire) will decide that the Gates Expedition to Mars would be a fitting footnote in history and potentially a profitable undertaking in the long run and that he would fund the whole thing. I worry that this as an elitist approach, but it is certainly a pragmatic one.

There have been many who describe an incremental approach to humans in space that is funded by space tourism (for example D. Livingston MARS 98-034), but I don't think a tourist ride to Mars is going to be practicable for at least a century. In the near term, the concentration of effort and profits to be made will be in near earth orbit, but the development of low cost heavy launchers to support that industry could greatly reduce the cost of human missions to Mars.

Several authors have proposed the establishment of trading companies ala The East India Company (J. Coston MARS 98-031 and B. Smith MARS 99 Abstr.) and the selling of long term bonds (R. A. Brown MARS 98 Abstr. and T. A. Olson MARS 99 Abstr.) to support them. But the trading company concept worked because there already existed a people and product to exploit. On Mars those must be established. The up-front costs to develop a Mars-Earth trade and even the items of trade are not defined sufficiently to attract investment in the short-term.

The selling of sponsorships has been proposed (M. Bosch MARS 98-030). This has already proven very effective in support of FMARS, the first of the Mars Society projects (see Mars Society web site), recently in support of a commercial mission to the Moon (Transorbital) and in partially funding the Russian launching of the Zvezda component of the International Space Station. There is clearly a large segment of the Mars Society excited with the concept of substantially funding the Mars expeditions as entertainment for the masses (see papers by D.

Livingston, J. Cameron, and G. Martin MARS 99 Abstr.). One can envision a John Ford-like Valles Marineris backdrop for Marsnaut movies, a MTV like 24 hr cam in the Marshab, viewer controlled orbital fly-over cams, and a reality based, Marsnaut Survivor show, but the fact is that the entertainment industry doesn't need Mars to make money. It can afford to wait until someone else ponies up the money to establish a Mars expedition and then hitchhike along as a sponsor.

There is a growing segment of small industries founded by space enthusiasts (Space Enterprise Symposium.2000) that have been established to develop commercial products/services involving space. Some have acted (Transorbital) and others (Transplanetary) are planning to fund these space products by parallel development of earth products and profits from sales. However, focus on the space technology spin-off business is a roundabout way to pay for trips to Mars. It diverts effort and money and extends the time needed for space product development.

Certainly charitable contributions can be made to non-profit organizations such as the Mars Society for the funding of society projects. To date these contributions have been sparse. I have asked myself why I haven't made one myself. For me the issue has been one of limited credibility of my contribution being well spent. Success on FMARS and Mars Society future projects enhances the credibility and these contributions should increase. But I have to ask myself, "If I were to enter a Walkathon for Mars would I find many of my friends willing to support that walk... or one for leukemia, instead." I have concluded that I don't plan to contribute substantial amounts of my money to someone else going to Mars. But, I would be more than willing to pay for myself to go.

In attending last years' Mars Convention I was hopeful that some sort of commercial and/or private funding strategy would become evident during the discussions at the conference. I was disappointed but not disillusioned that there was no easy route identified. However, I discovered that the focus on finding funding is part of an implicit assumption that it is capital, not labor, will, or skills of people that drives the success of this mission to Mars.

After one year of membership in the Mars Society, my greatest disappointment has been the lack of effective organization and utilization of the membership of the Mars Society. Some of this is entirely on purpose, to allow bottom up stewing of organizational purpose and structure to occur. Furthermore, The leadership is moving forward effectively with a series of projects to enhance the credibility of the Mars missions. Still, I sense that most of its members are only peripherally involved. The specific talents of all individual members are not as yet effectively tapped within the current strategy and organizational structure of the Mars Society. I tried to put these feelings into words at local chapter meetings and sensed that I was not alone in these thoughts. There were limited activities for members of a chapter to work on, e.g. carrying the case for Mars to the public and lobbying our representatives in Washington D.C. I'm an engineer, but the Society doesn't even ask to know that. It occurred to me that there is a substantial opportunity being missed - a strong personal involvement of all members in the ultimate goal - humans to Mars.

Then, one day I opened up my copy of Zubrin's Entering Space (Zubrin 99). On the frontispiece was my answer. For there scrawled in bold handwriting was "To Frank Crossman,

See you on Mars! ...R.Z.” Several months earlier I had been really pumped when Robert had signed my book in that way. Now I realized that what I wanted to see on that frontispiece was, “...See you on Mars, I guarantee it!” with the conviction of those Men’s Wearhouse ads.

I thought to myself, “Who will benefit most from settlement of Mars? The settlers will.”

- Suppose the central focus of the organization was on the settlement of Mars, not just its exploration?
- Suppose that all its members organized themselves into personally supporting a set of projects/demonstrations that would establish beyond reasonable doubt the ability to set up self-sustaining settlements on Mars?
- Suppose that the organization would pledge to guarantee that members could go and settle Mars?

Would the members be willing to spend a significant amount of their personal time to support these projects?

...Yes... I judged that most current members of the Mars Society are doers, not willing to be just voyeurs of others going to Mars. But how would we be able to attract 10 or 100 times these numbers and especially those people with critical skills in accomplishing the proof of self-sustaining settlements on Mars? This line of thought was the genesis for the ideas to be presented in the rest of this paper.

THE BUILDERS OF EARTH’S ARK TO MARS - PURPOSE

This paper presents an approach to organizing for Mars settlement based on establishing a covenant (a contract) among members who pledge to guarantee the right and ability of members to emigrate to Mars. For purposes of discussion, the organization is called “The Builders of the Ark.” The Ark is, of course, an allusion to Noah’s Ark - a Biblical reference and a symbolic construct identifying the mission of the Builders as the construction of the transportation system to Mars, the carrying of life’s necessities on the Ark including a biodiversity for populating Mars with Earth’s biological progeny. The Ark is also symbolic of a long, risky journey with implicit purpose. In the Biblical narrative, Noah is chosen by God to re-establish life after the Great Flood, and Noah builds the ark while others around him scoff at the need for such a project. In the 21st century, the Builders act for the living Earth, Gaia, in seeding the nearby universe with Gaia’s progeny and thus contribute to ensuring the spread of Earth’s life beyond its origin. Settlement of Mars with Earth’s life goes far beyond carrying of food crops, humans and pets to Mars. It includes the bacteria in our digestive system and the mites on our skin, as well as Ark rats and insects. It certainly includes biological schemes for terraforming the planet over time frames of a century to a millennium. The pitfalls of introducing life forms into new environments should not be taken lightly (P.T. Riddell, Apple of Eden), nor should decisions about pre-existing life on Mars, but the Builders will need to establish positions (for example, see the side bar on the next page) on this and other topics that most of its members support.

THE BUILDERS OF EARTH’S ARK TO MARS - FIRST STEP

The Builder's mission is to carry Earth's life to other planets and establish colonies of Earth's life on them. The first step is the establishment of a self-sustaining human settlement on Mars. Self-sustaining Settlement means that; (1) the settlement can survive for many years without outside (Earth) aid, and (2) it has the ability to grow through trade of Martian and outer solar system products for those of Earth.

Why is establishment of a Self-sustaining Settlement on Mars so important? Except for some excellent science fiction scenarios, no one has answered in detail how that can be accomplished. For example, at last year's Mars Society Convention, a call for papers was circulated for the Year 2000 International Space Development Conference in Tucson requesting papers for a special symposium on Self-Sustaining Mars Settlement. At the time of the conference I learned that there had been no papers submitted. That is worrisome; but it is more likely that potential authors perceived the issues as complex enough to warrant several conferences on that subject alone.

BUILDERS OF EARTH'S ARK TO MARS - MEMBERSHIP

Membership in the Builders requires a tithing of labor, not money. What is significant about a tithing of labor? It recognizes that most people spend a major portion of their waking hours working to assure a decent life for themselves and family. Historically tithing has come to mean a contribution of a 10th of earnings or crops to a church or government, but it can also be delivered in the form of labor.

A person is a member of the Builders if he/she commits 10% of her/his time to fostering the organization's goal. This commitment is a volunteering of time spent in labor. There is no reimbursement of labor in money, but members may choose to barter their time in service for that of others as projects evolve. There are between 12-14 hours per day not allocated to sleeping, eating and personal hygiene. Leaving one day of rest for family, friends, or personal renewal that amounts to 6x12 or 6x14 hours (72-84 hrs per week). A tithe of labor contributions of 8 hours per week, or 400 hours per year, are required for membership. Any person who can meet the definition of membership can be a member. There are no limitations to membership based on sex, religion, ethnicity, country of

A Position on the Hierarchy and Sanctity of Life

Higher life that is exemplified by animals with varying degrees of consciousness and self-awareness must be preserved. Lower life and inanimate matter are important, but the Gaian Goal is the expansion of consciousness and life to other planets and on to the stars. Lower life and inanimate matter may be exploited at the expense of higher life, just as lower life such as bacteria and viruses may infect higher life in order to multiply. But establishment of parks/reservations for pools of lower and higher life to thrive must be maintained to ensure biodiversity and the ability of life to survive unforeseen but inevitable local catastrophes and mass extinctions. Any pre-existing life on Mars must be examined and preserved in part, but does not constitute reason for not settling Mars, unless it is judged to be life of higher order and possessing a high level of consciousness, self awareness and world view.

origin, cultural or individual preferences, etc. only on the amount of time necessary to contribute to the organization.

BUILDERS OF EARTH'S ARK TO MARS - THE RIGHT TO EMIGRATE

In recognition of the labor of active members over a significant period of time a member will become vested and placed on a list of members who have earned the gratitude of their fellow Builders and the right to emigrate with the full support of the Builders organization. Vested members are those members who complete 5 years of volunteer labor or 2000 total hours. Project leaders and a log-in system tabulate these hours. Verification of labor by random audit may be necessary. There is no monetary equivalent to hours worked to attain vested member status. Some training will be required: (1) in project structure and organization, (2) in organization culture/history/operation, and (3) in core organization beliefs (see Purpose and Membership) which include encouragement of diversity in language, customs, and origins.

The organization will honor and promote the right of all vested members to emigrate to Mars and to future settlements. This is the primary value of being a vested member of the Builders. It is the Builders' prime duty to members to establish means for members to exercise their right. The Builders is a fraternity or brotherhood, not a loosely structured society. There is common purpose, and members in the Builders must view their prime duty as a solemn agreement among members to act on that duty. This is a covenant, not a legally binding contract. It is enforced by the trust among members, not by the law.

It is also recognized that some vested members may for health or personal reasons choose not to emigrate to Mars. Transfer of the Rights of Vested Members will be a right of Vested members. A member may transfer her/his right to emigrate to another person chosen by the member. Or the member may will this right to another in the event that it is not exercised during his/her lifetime.

BUILDERS OF EARTH'S ARK TO MARS - MEMBERS DUTIES TO OTHER MEMBERS

Besides their prime duty to help other members attain their ability and right to emigrate, members must be active in leading and/or contributing to organization-run projects that focus on the design, building and populating of Arks and self-sufficient planetary settlements. To do so they must to register their abilities and experience with the organization.

BUILDERS OF EARTH'S ARK TO MARS - PAYING FOR EMIGRATION TO MARS

Vested members are also responsible for funding their own passage to Mars. The Builders will establish a Mars Trust fund for ISAs - Individual Settler Accounts. These accounts are strictly for individuals and are not tapped for organization needs. A vested member may also choose his/her own trust fund to establish and manage the members account. The Mars Trust

account will be invested conservatively to provide for income growth in order to accumulate sufficient funds for emigration or sending someone else at the choice of the vested member. Robert Zubrin (Zubrin 96) estimates that \$320K in 1996 dollars will be needed for one way passage of settlers to Mars.

Does this member-pay policy seem to contradict the desire for a diverse group of emigrants from all socio-economic levels? Not with the ability to transfer vested rights to future generations. Consider this. At an effective 7 percent growth rate of interest, dividend or stock, an investment will double in value every 10 years. If \$320K is needed to emigrate, how many years earlier than liftoff do we need to invest some amount to ensure the needed \$320K. The answers are \$160K held in trust for 10 years, \$80K for 20 years, \$40K for 30 years, \$20 K for 40 years, \$10 K for 50 years, \$5K for 60 years, \$2.5K for 70 years, \$1.2K for 80 years, \$0.6K for 90 years, \$0.3K for 100 years. I believe there are very few potential members of the Builders on this earth who would not be able to afford to set aside some money for a guarantee of right to emigrate 100 years from now. There will be others who see this Trust Fund as a very useful hedge fund for their child, grandchild, etc. Perhaps you don't agree with Zubrin's estimate of \$320K. If you want to double it, just add 10 more years in the Trust Fund. The problem isn't lack of money; it's obtaining a priority position on the Builders' emigration waiting list.

BUILDERS OF EARTH' ARK TO MARS - ORGANIZATION OF PROJECTS

In the Biblical narrative, God chose Noah because he had a good heart, a good family, and most importantly because he could work with wood to build an ark to God's design. Earth's Arks to Mars will be much more complex and will have to be designed by many Architects chosen by the Builders membership on the basis of good works, good organization and good hearts. On a given project Members can be volunteers who contribute their time and skills to support the project or they may be the Architect or leader of the project itself. Also, a member may be a Builder on one project and an Architect on another simultaneously. On technical projects, Architects are project designer/managers, not just systems engineers, although the ability to track the hierarchy and subproject interactions via systems engineering tools is a critical building block in this organization. The interested reader can examine the work breakdown structure of the Artemis Project (ARTEMIS web site) to see at least the top level structure of a project with similar goals - in this case a permanent settlement on the Moon.

A HIERARCHY OF ARCHITECTS AND THEIR RESPONSIBILITIES

Project Architects are self selected project leaders who have proven they can define a project, assemble a project team, and complete the project in a timely manner with reasonable expenditure of labor resources.

Architects of the Arc provide overall integration of projects. They are selected by their peers, fellow project architects, to that position.

Initially Architects of the Ark are chosen from those who have already proven their ability to lead projects. Their responsibilities are to establish and manage a top-down mapping and integration of projects is necessary to establish credence for self-sustaining Mars settlements. Some Builders will focus on: (1) the hierarchical management of projects; (2) a data base for members skills, abilities, experience, interests; (3) an arm of the Builders focused on obtaining monetary donations, component donations, sponsors, etc.; or (4) an arm of the Builders for recruiting people with critical skills on existing projects and people who can act as project architects on projects identified as crucial in establishing a credible technical, cultural, or organizational solution that enhances the self-sufficiency of the settlement.

What kinds of people should be actively recruited for Builders?

- Not just those who believe someone should go to Mars, but those who want to go themselves.
- Those who believe that the means is available to make their journey safe and their life as settler safe and see their contributions as helping to prove future success.
- Those that think the current approaches are too slow or insufficient to guarantee a short-term success.
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Builders are needed to address issues such as government and law, philosophy, and culture in addition to the technical matters (stressed in this paper) of surviving the voyage and sustaining a settlement in a hostile Mars environment.

CRITERIA FOR ESTABLISHING PROJECTS AND PROJECT HIERARCHY

While projects are proposed and staffed by project architects, there is a need for top down thinking in organizing and coordinating projects. Initially there will be many projects that could be envisioned as important to accomplish but which have no project architect or established project design. Projects that help establish the self-sufficiency of the settlement of Mars are as important as the means of exploring Mars. In Chapter 5 of *The Case for Mars* (Zubrin 96), Zubrin deals effectively with “killing dragons” that might stand in the way of human missions to Mars. I believe that it is critical to slay the biggest dragon still standing - The doubt in the ability of a Mars settlement to be self-sustaining. The slaying must be done by application of sound science, engineering heuristics and physical demonstrations of capability not just plans, e.g. an FMARS- like project, not an Artemis-like planning document. One can find detailed lists of projects that will help in slaying the biggest dragon in *The Case for Mars* (examples: bricks; domes; manufacturing of plastics, ceramics, glass, steel, and aluminum; power by wind and solar; conversion of CO₂ to CH₄; crop culture; etc.), and in plans for the Artemis Project (ARTEMIS), but it will be even more important and challenging to demonstrate how to rapidly reproduce the “high tech of earth” in silicon, biological and nanotechnology “foundries” on Mars using only Mars resources.

SOME CLOSING THOUGHTS

Is success driven by access to Capital or Labor? Is this a “chicken or egg” paradox? I have chosen an approach here that will be criticized as both idealistic and inconsistent with how the world economy now operates. Its focus has been to better organize the labor with the belief that the capital (money) needed to accomplish the physical instantiation of the project will be found. From personal experience I know that the largest fraction of the cost of aerospace products is in the labor of people, not in the materials or electronics that are assembled. The more labor that is contributed to the Builders projects, the less capital will be required to complete the project. Additionally, the Builders will be just as active in soliciting capital contributions through sponsorships, etc. as the currently organized Mars Society has been. It will be no more or less difficult for the Builders to attract capital. The difference is that it will have an army of qualified laborers who have volunteered their time to accomplish the project.

Others will say that this is a radically different approach that requires a high degree of cooperation among project members who are geographically dispersed. The “virtual corporation” only works effectively with a lot of face-to-face interaction. Agreed. It is clear that members will have to make a significant effort to meet face-to-face on most projects. The Internet is just a convenient mode of communication in multimedia, not the best way to organize all things, but the Internet offers new opportunities for organization of complex projects and geographical dispersed people that have not existed before in the history of humanity.

How many people are needed to guarantee success? Most of us in the Mars Society believe that, if the President and Congress allocated \$50B over 10 years, that a series of explorations could be accomplished. It would require the full support of NASA’s 18,000 employees and several times that number of contract or company employees in support of NASA - perhaps 500,000 person-years at \$100k per person-year. Some Mars Society speakers have suggested that a privately funded “Bill Gates” mission of similar scope would cost substantially less (on the order of \$10-20B) and would involve substantially fewer people. So one can estimate that there is a critical mass of 10,000 to 50,000 people with the right stuff to accomplish the Builder’s mission of building arks and self -sustaining settlements. I submit that finding these people is a far easier task than convincing the public at large to support, above so many other earthly priorities, the Mission to Mars. The challenge is in the organization of these people. The benefit is a global cooperation of people (not governments) that is built into this approach.

If the Mars Society were to investigate the utility of the Builder approach, what should it do first? The important first step is to put out call for registration of members’ abilities and experience. The Mars web site can be that forum. Defined contributions should be solicited from members. On receipt of this information, the Society should evaluate the responses to determine whether a critical mass of people with requisite skills is available and map out the existing skills against a first-cut at perceived needs to accomplish the Builder. It will be important to determine the mix of contributors by age, work status (students, workers, and retirees), country, and all other categories defined to ensure adequate diversity of the membership. An evaluation of this information base will be crucial in deciding tactics for broadening the membership base and the recruitment of critical skills.

CONCLUSION

Did the founders of United States of America know with certainty that the Declaration of Independence and Constitution would work to underpin what would be the greatest country in the 20th century? No.... but they believed it would.

Do we, the potential Builders of the Ark, know that this organization will lead the way to Mars and beyond? No.... But we can believe that it will.

If enough people believe, then in 5 or 10 or 20 years from now, the Builders will have the greatest level of knowledge of any organization on Earth regarding the transportation to and settling of Mars and beyond. That is why individuals will be motivated to contribute. With a little hard work and some patience in watching a nest egg grow for payment of passage, anyone can be guaranteed a ticket to Mars.

REFERENCES

The Artemis Project, <http://www.asi.org/>

The Mars Society, <http://www.marssociety.org/>

MARS 98 - Proceedings of the Founding Convention of the Mars Society, Aug 13-16, 1998, University of Colorado at Boulder, ed. R. M. Zubrin and M. Zubrin, Univelt Publ. San Diego Ca, 1999

MARS 99 - Collected Abstracts of the Second International Mars Society Convention, August 12-15, 1999, University of Colorado at Boulder. The Mars Society, <http://www.marssociety.org/>

Paul T. Riddell, The Apple of Eden -As More than a Metaphor, <http://www.eventhorizon.com/sfzine/commentary/riddell/pages/1299.html>

The Silicon Valley Space Enterprise Symposium, June 10, 2000, San Jose CA, cosponsored by the Space Frontier Foundation, http://www.space-frontier.org/Events/SPACE_ENTERPRISE/

TransOrbital, Inc, <http://www.transorbital.net/>

Transplanetary Inc, <http://www.transplanetarycorp.com/corporate.asp>

Robert Zubrin with Richard Wagner, The Case for Mars- A Plan to Settle the Red Planet and Why We Must, Simon and Schuster Publ., New York, 1996

Robert Zubrin, Entering Space - Creating a Spacefaring Civilization, Penguin Putnam Inc. Publ, New York, 1999