THE MARS QUARTERLY

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VOLUME 1, ISSUE 2 - SPRING 2009

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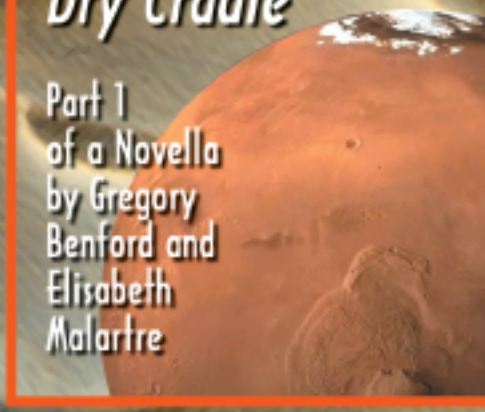

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In This Issue

Cover: "Martian Sand Ripples"
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From the Flight Deck

In these uncertain economic times, many of us in the Mars community are focused on mitigating the effects of downsizing, restrained budgets, and program cuts. This issue has several on point articles, stressing the importance of remaining focused on delivering the humans to Mars message in every way we can.

Also in this issue, is an article by Bruno D.V. Marino, PhD, a former Researcher in the Earth and Planetary Science Department at Harvard, and former Director of Science and Research at the Biosphere II project, with Columbia University, in Arizona in the 1990s. Dr. Marino proposes the creation of Biosphere **M** - a project that would contribute important ecosystem data toward the construction of a sustained human settlement on Mars and beyond. We hope to hear from Dr. Marino in future issues of TMQ regarding this exciting project.

We thank artists Jim Plaxco and Marilynn Flynn for their inspirational and provocative images that appear in this issue of TMQ. Look for more space art images in future issues of TMQ, from a variety of well-known and emerging artists.

Our next issue, scheduled for release on July 1, will be presented in both digital and print formats. Print copies will be available to all 2009 convention attendees, and will include a special insert of an entirely new image created by artist Greg Martin. You can see more of Greg's work at: http://gallery.artofgregmartin.com/. If you have not already done so, please register for the 12th Annual International Mars Society Convention today.

If you would like to take part in the debate on the latest controversies affecting the progress of humans to Mars, or share your views on a specific Mars project, please send us your comments. All submissions will be considered for inclusion in our new Readers' Forum. This issue we feature the thoughts of Jason Romanik, a space entrepreneur.

On to Mars!

Susan Holden Martin, Editor
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THE MARS QUARTERLY

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Succeeding in Troubled Times

By Chris Carberry

The last few months have been quite remarkable. In the United States, we inaugurated a new President; a U.S. Airways pilot successfully landed his plane in the Hudson River; and world-wide governments have continued to pour sums of money that would have seemed unfathomable a year ago.

In the midst of these events, a team of scientists from NASA and other institutions announced that they had detected methane in the Martian atmosphere. While evidence had been released in the past that suggested methane, this evidence was the most comprehensive yet presented. As most of the people reading TMQ already know, the source of this methane is either geological in origin or is a byproduct of life. Either way, this is a remarkable discovery. This comes just on the heals of the Mars Phoenix Lander uncovering water ice just inches from the surface of the Martian polar regions. Every closer look at Mars seems to create a thousand compelling questions. The need for a continuation of our successful robotic mission to Mars and a vastly accelerated timetable for sending humans to Mars have never been greater.

However, as Dr. Chris McKay alludes to in his article “The Case for Mars 2009”, we cannot assume that Mars will remain on the on the top of NASA's agenda. Despite the remarkable success, other agendas and other destinations may be gaining momentum. This isn't inherently a bad circumstance - Earth science and observation of planets and Moons beyond Mars is certainly important - but we must make sure that Mars remains the primary objective of human and robotic missions in this century.

It is time to make a bold statement. We hear our elected officials grasping for ways to stimulate the economy - to inspire society. I realize that I am preaching to the converted here, but we must let the decision makers know why we must invest in Mars exploration and why it could very well be one of the greatest stimulators to our society in which they could invest.

The Mars Society is trying new ways to get this message out and to expand our organization. We have started an ambitious advertising campaign which will place advertising in such magazines as Astronomy, Science News, and the AOPA magazine, Pilot. We are making full use of such online mediums as Facebook; and we are going to examine new ways to use video games and digital animation to promote our cause. In addition, we will soon be asking our members to send in short videos to explain why they joined The Mars Society and why they support humans to Mars. Over the next few months, The Mars Society intends to increase its advocacy efforts through the use of a variety of multimedia channels.

Have you ever wanted to make a direct statement in front of Congress in support of humans to Mars? Here is your chance...

This summer, we have another opportunity to make a powerful statement at The Mars Society Convention which will be just a few miles from Washington, D.C. I must say, I am getting pumped about the 2009 Mars Society Convention. Four months prior to the event, we already have one of the best lists of plenary speakers that we have ever had and our programming is extremely diverse.

We hope to bring in new audiences with programs such as "Exploration: An Historical Perspective:" which will compare and contrast the history of terrestrial exploration with the challenges of space exploration. We will look at the impact of art and space exploration as well as the impact that media can have to promote (or obstruct) exploration. And, unlike most conferences, we will not be confined to our conference venue hoping that government officials find their way to our event. On the contrary - we plan to visit some of these officials in the "Great 2009 Mars Blitz."

Have you ever wanted to make a direct statement in front of Congress in support of humans to Mars? Here is your chance. At the Mars Society Convention, we will be sending at least 150 convention goers up to Capitol Hill to meet with their members of Congress and their staff on the afternoon of July 30, 2009. To make this activity the colossal success that we hope it will be, we need your help. If you are coming to the Convention, please sign up for the Blitz as well. Even if you are not coming to the Convention and can spare some time on Thursday afternoon, July 30, 2009, please join us on Capitol Hill. For those of you who can't come to the Convention, we hope that you will set up meetings with the members of Congress in your congressional districts. And while we are up on the Hill on July 30th, we hope that you will make phone calls and send email and faxes to your members of Congress in support of a destination driven human space program.

Despite the gloomy economic situation, The Mars Society is on the move. If we want humans to Mars to happen, we can't sit back and hope circumstances will move in our favor by themselves - we must be the force of change. JOIN US!

The Case for Mars 2009

It is time to tie the Mars Program to human exploration

by Chris McKay, NASA Ames

The NASA Mars Program is at a turning point. Three factors converge to force a re-thinking of this program. The first factor is the delay and cost overrun of the Mars Science Laboratory mission. The second, and related, factor is the realization that the cost of future missions is going be ever higher as larger, more capable, missions must be considered. Mars missions have moved into the cost category of the 'flagship' missions to the Outer Solar System. The third and, in a way unexpected factor is that the worlds of the Outer Solar System, especially Titan and Enceladus, now compete with Mars as the primary target for Astrobiology. The search for a second genesis of life in our Solar System may still drive missions but these missions may not be to Mars.

The Mars Program was created in the late 90's as enthusiasm for the search for life beyond the Earth was at historic high. This interest was driven by the discovery of planets around other stars, the spacecraft data of the early history of the universe and the Hubble images of distant nebula and galaxies, and by the announcement of possible signs of life in the Martian meteorite ALH84001. While the evidence for life in the Martian meteorite was subsequently discounted it was compelling enough to generate a statement by the US President as to the importance of the search for life on other worlds. Given this background NASA created the Mars Program to benefit from this interest and be responsive to it.

The Mars Program has been a success. The orbiters, the rovers, and the Phoenix Lander have expanded our knowledge of Mars even if they have not provided much additional evidence supporting the possibility of life at the present or in the past. Indeed, the data from these missions suggests that Mars has a surface covered largely by un-weathered basaltic rocks. The massive carbonates that were expected based on theories of a thick early atmosphere have not been found. There is scattered evidence for liquid water throughout Martian history but the conditions may have been too salty or too acidic for life. No evidence for organics has been forthcoming. Furthermore, during this same decade it became clear that meteorite exchange between Mars and Earth could have resulted in life on both planets sharing a common origin. The report of methane on Mars has sparked astrobiological interest but these results are puzzling because they are at odds with our understanding of atmospheric chemistry and Mars' level of activity. Taken all together the exploration of Mars over the decade since the start of the Mars program has not strengthened our hope that life might have been present, and in fact has diminished it.

To advance our understanding of Mars will require ever more capable and hence expensive missions. The cost and schedule overruns of MSL illustrate the challenge of ever larger rovers. Deep drills to follow up on the Phoenix mission will also be costly. A few low-cost 'niche' missions to Mars such as the Maven aeronomy mission can still do useful science but larger and more costly missions are going to be required. Ultimately sample return missions will be needed setting a new level of cost and complexity.

As Mars missions become more costly they enter the cost realm of the flagship missions to the Outer Solar System. As Mars missions come to compete with Outer Solar System missions in terms of cost, they must also compete in terms of astrobiology science. Many have argued that the prime targets for astrobiology are now the organic-rich worlds of the Saturn System. Why scratch around on Mars for organics when they are being ejected into space in an ice stream from Enceladus?

Does this analysis suggest that the Mars Program is over and that Mars will recede into being just one of many targets for planetary missions? The answer to this question is yes, if the criteria is purely science - astrobiology or planetary.

Mars is a unique target for human exploration. It is the only world for which we can imagine sustained human activity.

Mars only retains a special place, and the justification for a well-funded separate program, when human exploration is considered. Mars is a unique target for human exploration. It is the only world for which we can imagine sustained human activity. A vigorous program of robotic exploration is needed to determine if Mars is a world in which humans can live and work and to prepare for human exploration. Orbiters, rovers, drills, and sample return missions are all needed to prepare for human exploration.

Although human exploration of Mars is decades away, the robotic precursors need to continue now. For example, it might require several sample return missions to address issues related to soil toxicity, planetary protection, back contamination, and site selection before human explorer set foot on Mars. And rover and orbital missions are needed to prepare for sample return. There is no time to lose.

I conclude that Mars should continue to be a special target for robotic exploration precisely because it will be the scene of extensive human exploration in the future.

Digital Outreach

By Patricia Czarnik, Director of Membership

In this issue I want to talk about digital outreach. In the past month we have initiated a drive for a significant presence on Facebook. To date we have pages for:

- The Mars Society
- The Mars Society Cause
- The Mars Project - Six Degrees of Separation
- The Mars Quarterly
- Robert Zubrin fan page
- Several individual Chapter pages

I want to thank Lucinda Weisbach for taking the lead on this and bringing us into the 21st century. Thanks also to Jason Romanik for his contributions on The Mars Project - Six Degrees of Separation. Facebook not only gives us an opportunity to get The Mars Society more recognition, but will also help us to reach the 18-35 year old demographic, a group that we NEED if we are going to see humans on Mars in our lifetime. I sent out a request to all chapter contacts about a month ago asking them to create a Facebook page for their chapter. Several chapters have responded and a big "Thank You" to all who responded to the call. We need more. If your chapter hasn't created one yet and you would like to take responsibility for this task, please let me and Lucinda know. For those members who do not have a chapter in their area, don't let that stop you from creating a Facebook page for your country, city or region. This is a great way to connect with other locals and get something started. If you want to get more involved on Facebook , contact Lucinda lucinda@marssociety.org and when you do create a Facebook page, please be sure to invite Lucinda Weisbach and Patricia Czarnik to join. This will give us notification of all TMS efforts on Facebook and we can add a link to the page on the Mars Society Chapter webpage.

Very shortly we will be adding a petition drive, 100K Want to Change the Pace for Space: Mars Now, on Facebook. The goal is to collect 100,000 signatures of people in support of Humans to Mars Now. Our target date for getting the 100,000 signatures is the 20th of July 2009. The petition will be presented to President Obama's administration during the Great Mars Blitz at this year's convention at the University of Maryland, College Park, July 30 - August 2, 2009). Even if you can't attend the convention, you can participate in the Blitz. More convention information at: http://www.marssociety.org/portal/c/Conventions/2009

As always I look forward to your comments and suggestions about membership and chapters. Hope you are having a great spring!

Contact Patt Czarnik via email at: Patt@MarsSociety.org

Getting to Mars will take leadership, a lot of leadership

by Michael Simpson, President, International Space University

The root of that leadership will be education. Amidst the debates over school budgets, curricula, infrastructure, access and performance standards, it is easy to forget that at its most basic, education is a form of leadership. The word itself is derived from the concept of leading someone into new opportunities through knowledge and the love of knowledge.

Although Higher Education will be the source of those graduates who can join our teams and forward our work immediately, the most important worksite for us is likely to be the primary and secondary schools that precede it.

Rare is the teacher of science or math who doesn't welcome a well informed volunteer to speak to a class...

While professionals will guide much of the evolution of education in our local communities, there remains much that we can and should do to ensure that the case for Mars provides both an inspiration and an exciting challenge for learners of every age. First and foremost among the tasks that fall to us is the investment of time.

Rare is the teacher of science or math who doesn't welcome a well informed volunteer to speak to a class about practical applications of technical skills. These presentations enliven textbook material and hold out the promise to students that there is both life and career opportunity beyond the hard work of learning. They also provide us with the chance to demonstrate the quantitative rigor behind the assertion that the goal of travel to Mars is attainable, sustainable, and worth the effort.

There is also much to do beyond the science and math classroom. In fact it is both beyond that classroom and in support of it that the real work of enhancing the educational foundation for planetary exploration may be the most important.

Ultimately, the critical decisions that will make possible the goal of humans reaching Mars with will be policy choices involving at least as many non-technical people as technical. Although curricula in social studies, literature, and languages are often very tightly scheduled by educational authorities, conversations with classroom teachers in these disciplines are likely to reveal places where we can contribute creatively. Below are a few ideas that could form the basis of synergy between the Mars Society, its members, and local schools.

• Work with local teachers to develop questions and problems in math and science that use Mars and the challenge of getting there as examples.
• Develop a list of research projects for social studies and literature classes that invite students to look at the human experience of Mars. One term paper done early in a high school career could affect a student's course for a lifetime. For each of these topics a teacher's guide could be prepared as well as a briefing sheet including a starting bibliography.
• Make use of the Society's international reach to generate brief discussions of Mars in many languages as tools for foreign language classes.
• Ensure the presence of an "essential collection on Mars" in school libraries, so that the teachers and students who work with us on projects have the tools they need close at hand.
• Develop in-school experiences ranging from fully designed experiments with supporting equipment to assemblies, simulations, and competitions. A mission-planning exercise based on the pattern of the very successful Model United Nations experiences could be particularly instructive and motivating for high school age students.
• Sponsor teacher development opportunities at both Mars Society facilities and elsewhere. The more comfortable teachers become with using the underlying concepts and facts, the more they will integrate material important to the future of Mars exploration into the examples they use in their classrooms.
• Support a teacher resource feature on the Mars Society website where the best practices for teaching about and with Mars-focused material is made available.

In all of this effort keep in mind a few reasonable and attainable goals.

• We can help make education better in partnership with classroom teachers.
• We can create simple, straightforward tools that can bring the Mars exploration message into a wide range of classrooms.
• By so doing we not only make our objectives better known, we help lead a new generation toward participation in the next pulse of human exploration.
• We can make the link between different kinds of subjects as we show that math has shaped history and history has shaped science and that to be able to communicate about all of them is to prepare for the greatest adventure of the 21st Century.

So how do we get all this done? Pick an idea or create one of your own. Implement it. Keep the Mars Society informed. Count on others to do the same.

It will take leadership: a lot of leadership; especially yours.

Finding New Communication Canali

by Miles O'Brien

Editor's note: Adapted from a speech delivered at JPL on January 2009, as they celebrated the fifth anniversary of the Mars Exploration Rovers (Still Going…).

I always look forward to my visits to Cal Tech's Jet Propulsion Laboratory. It is truly our gateway to the universe; one of the smartest (and most fun) places on our planet. Disneyland for Nerds nestled in the hills of La Canada, California.

Mars is my second favorite planet (gotta root for the home sphere first!) and the folks at JPL have made me feel as if I have been there. How cool is that? I salute them for the outstanding, far-flung, vicarious ride these past 40 years or so.

It's easy to take for granted that we are now awash in amazing high resolution, panoramic, microscopic, three dimensional images shot on the surface - or in orbit - at Mars.

Photo courtesy of Miles O'Brien from the CNN Collection

Miles O'Brien (right) and Matt Golombek, Chief Scientist of the Mars Pathfinder Mission, covering the 2004 Spirit rover landing at JPL (for CNN).

What we have found is a place that looks an awful lot like home (if you are from New Mexico) and I think that is part of the appeal. Looking at the Eagle crater, a human being can imagine being there in hiking boots.

It is truly a transformative experience. And when you consider all the proof we now have that this place was once warm and wet, you cannot help but look at those images and wonder about our place in the universe. How close we are to learning if we have some company?

How great is it to be alive at this time - when we just might learn the answer to that question? We are fortunate to live among people who know how to get an answer.

Of course we have been curious about this since cavemen looked at the night sky - and said "ugh" - or when they saw the spaceship land and the little green men build Stonehenge.

I hear there may be another Stonehenge underwater in Lake Michigan. Alien SCUBA divers? Who knew?

While we're on the subject of water and Mars - it is worth talking about the origins of our modern fascination with the Red Planet. It all begins with water - specifically Giovanni Schiaparelli and the canali that he wrote about.

He meant natural channels, but in this case something was gained in the translation and people assumed he was talking about canals - which implies some sort of Martian Corps of Engineers.

No one took the ball further and ran harder with that than the blue-blooded astronomer Percival Lowell. (You don't hear about many boys being named Percival these days, do you?).

Lowell was convinced the canals were built by smart beings who were running out of water.

This, of course, begat HG Wells *War of the Worlds* …which begat Edgar Rice Burroughs, Ray Bradbury and, ultimately, Marvin the Martian and Robinson Crusoe on Mars among other pop-culture oddities.

And for a long time there was nothing to stop the Martian train from rolling down the tracks. Then in 1964, the folks at JPL launched a series of spacecraft called Mariner.

Scan line by scan line, the "faxes" from Mars gave us a whole new view of the Red Planet, and as it turned out, it was not a good place to find or build some condos after all. So much for all the Martian fun. You could almost hear Percival from the grave: "Curse you, Mariner!!!"

But before we could get too depressed about our aloneness in the solar system, we had some astronauts on the moon to entertain us.

And then before too long, Mars came into focus as it never had before. In1976, the Viking Landers arrived on the surface and the crowd went wild. It was Mars in vivid color (do not adjust your set - it really is kinda sepia there, ladies and gentlemen…)

Viking did not find smoking gun proof of life on the Red Planet. Nor did it find any guns, for that matter.

But seriously, the data were kind of ambiguous and even today, as I understand it, scientists are not speaking with one voice on this (as they normally do).

Oh, did I hear you say scientists disagree at times?

Fast forward twenty years (now that is what I call a gap! Let's not do that again!) and Pathfinder: who could have predicted that one?

The Internet as a mass medium was new. Google was just a glint in Sergei and Larry's eyes - and there was Pathfinder on Mars - with JPL uploading pictures on the web almost as fast as they got into the hands of the science team. How cool was that? Millions of hits later, the first global Internet event was born. Mars was ready for its close-ups.

The missions that have followed have either built on this connection - or built on the suspense because they didn't make it. Each time we return to Mars we learn something new and see something cool - like those "blueberry" spheres that had to be formed by water. Or, more recently, we touched and tasted ice. And each time we share in a journey to the very edge of what is possible.

The Mars Rover team took the Pathfinder philosophy one step further - allowing all of us to see every image

the scientists see. Remarkable. Nothing like that has ever happened in the history science as far as I know.

No wonder Opportunity and Spirit are so beloved and so much a part of our pop culture. They are literally and figuratively - rock stars. The mission ranks number one on the public awareness scale - in TV we call it a Q-rating. If I had Opportunity's "Q", I'd still be at CNN.

I think the thread that connects Schiaparelli and Lowell to Opportunity and Spirit is the quest for life outside out planet. The science teams and those of us in the media (I guess I am now technically a recovering journalist) have done a good job setting the bar on what might or might not be found on Mars.

There are not many people left who are expecting to see Marvin the Martian or the ruins of an ancient civilization on Mars (even though some people are still fixated on that old "face" image captured by Viking and completely debunked by Mars Global Surveyor).

I guess I can now safely share with you an expression we use in the newsroom: "never let the facts get in the way of a good story" Or, alternatively: "this story is too good to check out."

But my sense is people would be pretty excited if you found a fossil. Matter of fact we have empirical proof of that given the DEFCON 1 media cluster - er- "event" surrounding the Alan Hills 84001 meteorite announcement.

It's not exactly what SETI's Jill Tarter has in mind as she soldiers on in her daunting effort to make Contact, but microbes on Mars would be enough to lure people away from American Idol for a while. I hope.

I think the moral of this is because we are among the living, we are generally interested in other living things. And this brings me to the other great narrative that plays out among the "Martians" who make Disneyland for Nerds tick: it really is their story as well.

I often wonder if the engineers and scientists who stage interplanetary space missions are big gamblers because what they do is such an all or nothing thing. In many cases nearly an entire career of hard work hinges on the success of six-minute plunge into an alien atmosphere.

Let's face it; this is as exciting as science can be. Sadly, we weren't there for the serendipitous moments when researchers stumbled onto Teflon or Velcro or Post-It Notes - and said, no doubt, "Eureka!" (before calling a patent lawyer).

But we are there when the Martians of La Canada see and hear the verdict from their unforgiving destination; when the all-in bet pays off - or not. In my (former) business, we call this good TV. It has all the best elements of a good story arc: suspense, reality, possible smoldering holes - everything but a vote to see who gets booted off the island - or a caustic critique by Simon Cowell (although both could be incorporated into future mission plans).

Steve Squyres and I did a special when the Phoenix landed. I gave all due praise to the gods of orbital mechanics when I learned the Earth Received Time of the landing was near the end of an hour when people in US time zones would be awake. And so I sold CNN on the notion of an hour-long special on Mars that culminated with the landing. It included some recorded pieces, a look at some of the most interesting images from the various missions over the past 30 years and, of course, frequent cuts to the control room live camera as the team endured the hellish final minutes of the long trip to the Fourth Rock.

It really was a nail biter - and even better - as Phoenix fell to Mars we had data the whole way. And then came the eruption: we could not have storyboarded an hour any better than that. The ratings were huge and the audience was global (and as the CNN signal radiates out in to the void at the speed of light, eventually universal, I suspect).

But the story was really not so much about a robot on Mars as it was the humans who made it happen.

So the human adventure of doing all of this is a great connection between the people smart and talented enough to make these missions a reality and those of us who only get a day pass to Disneyland for Nerds. Let's be honest: making this connection is not the strong suit for most scientists. But for whatever reason, JPL's Martians have been blessed with some great communicators over the years - from Sagan to Squyres.

So I bet your thinking if all this is so, why there isn't more coverage in the Mainstream Media of these great interplanetary adventures? You know the whiney refrain: in the good old days, it was different. The coverage was longer, better and deeper. The reporters were enthused - almost cheerleaders - and the whole world was watching! (Oh, and the women were more beautiful, the kids smarter and the beer tasted better too!).

So what has happened to the media? Why do we seem more interested in Britney Spears than Tony Spear?

How the hell should I know? I just got canned!

No seriously, a lot of this has to do with NASA's "no Buck Rogers - no bucks" philosophy. You may not like it, but there is probably some truth in that theory. Regardless of its merits, it remains the coin of the realm for the foreseeable future. And there is no doubt sending humans into the vacuum creates a vacuum for those who design and launch robots into space.

It is simply hard to compete with those operations in Houston and Florida. There is too much money there - and too many fights over how the money should be spent.

Shuttle launch coverage has degenerated into little more than a deathwatch for the astronauts and the space savvy press corps seems eagerly poised to pounce on the next gaffe.

The fact that CNN wiped out its entire (ahem, highly decorated) science and technology unit (including yours truly) should tell you a lot about where things stand right now in the mainstream media.

We are talking about plate tectonics here. The world is shifting beneath the media's feet. Once upon a time, we had healthy newspapers in this country - soon we will have nothing to line the birdcage or wrap the fish.

So what's the advice? Plastics! Oh sorry, there's a reference that carbon-dates me. Let me reboot: The advice is

THE MARS SOCIETY

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this: it's the Internet (stupid).

Seriously, what you, in a sense, started in 1997 with the Pathfinder web-aganza - has grown at a Moore's Law pace. Today - bloggers, Tweeters, Facebookers, random folks ranting with a DV camera and a Mac can (and do) compete with a globally deployed standing army of journalists with all their satellite trucks, camera crews, producers, reporters, anchors, makeup artists, caterers, entourages and fluffers (although the latter may have gotten the shaft - due to the hard times).

There are interested people out there but the mainstream media may no longer be the best way to reach them. The media landscape just looks a lot different than it did during those news conferences in the sixties and seventies.

So listen up Martian Nation: whatever you do, don't stop! Don't stop exploring of course - but also don't stop thinking of new ways to speak directly to your audience. I have seen the future - and it tweets (although by the time you read this, Twitter might be ancient history). But whatever the e-muse of the moment, my teenage kids are part of a generation that insists on the two-way transaction on most everything they do on line. If they can't be part of the adventure - they are outta there. Don't complain - you started it!

Indeed, the Martians of La Canada seem to relish in allowing the world to look over their shoulders as they work. Takes some big stones to be that transparent. But it is, after all, about exploration - about sharing the "Eureka" moment and finding new ways to engage the world in the quest for the answer to the Big Question.

It is important to always think of what is just over the horizon - whatever planet you inhabit. The worst thing that could happen is frustration. Those of us who care about this great adventure must never stop seeking new channels (or are they canali?) to tell the story. What would Percival say if we did?

Miles O'Brien is a freelance journalist living in New York City. For nearly 17 years he covered the space program for CNN. He can be reached at milesobrien@mac.com.

Readers' Forum

Funding Mars

by Jason Romanik, Entrepreneur

A manned mission to Mars is a giant puzzle of problems and solutions. Currently there are thousands if not tens of thousands of eager engineers and scientist who are ready to solve the assortment of technical difficulties associated with traveling to the Red Planet. However, the larger obstacle that few are looking at is that of financing. The biggest hurdle for a Mars Mission is a financial hurdle. How much money will be needed? Where will it come from?

Because this is our first [manned] trip to Mars, the estimated cost to set foot on the red planet is constantly debated and fluctuates depending on mission demands. At the high end of the spectrum is NASA's "Mars Semi Direct" mission, punching the cash register at a whopping $55 billion. At the bottom end is the "One Man One Way" mission proposed by Jim McLane. Price tag: $5 billion. Dr. Robert Zubrin's popular "Mars Direct" mission retails for $20 billion. While the price range is great, all efficient missions requiring 4-6 crew members to stay 2-4 months on the Martian surface will fall in the $15-25 billion range.

Who has the ability to pick up the tab for a successful expedition to Mars?

First and foremost is government. There is an A-list of four governments with the wallet and ambition to accomplish this mighty feet single handedly, US, Russia, China, and India. There is a B-list of 20 or so countries who would contribute to a collective effort, France and England among the notable. The advantage to government financing, whether it's one government or a consortium, is their wallets are deep and the mission would not be jeopardized because there was no funds. But with the positive of government sponsorship, comes the negative. Bureaucracy and political haggling would inflate the price tag considerably, sacrificing public opinion. And tax dollars will require oversight and unnecessary regulation. So while the government's money bucket is full, there is a lot of baggage attached to it.

Who has the ability to pick up the tab for a successful expedition to Mars?

To avoid political hassles, a pioneering entrepreneur might be able to find a billionaire or two to finance a low cost journey. Private money would be innovative, efficient and could take calculated risk, all of which are paramount for a successful voyage. Another advantage would be the spectacle of the trip. In 1969, one billion people either watched the lunar landing on TV or listened to it on the radio, more than one-quarter of the earth's population. Today that would translate into two billion viewers. A private company funded by a billionaire could leverage the mission using corporate sponsorship and advertising before, during and after the mission. While the mission's price probably wouldn't be covered by sponsorship alone, the cost would be slashed considerably. On the down side, there are only a handful of billionaires who have enough money to invest in a Mars Mission and rich people like to stay rich. However if a bright, energetic, pioneering individual could prove that a man's legacy is more important than his money, he would have his financing. History remembers the contributions of great men, while rich men who die without giving are forgotten quickly.

What if governments are busy using tax dollars elsewhere and no billionaire want to put their fortunes at risk? A fundraising campaign designed to generate excitement and invoke the imagination could inspire average Joe and Jane to make individual contributions. Habitat for Humanity raised $127 billion within months of Hurricane Katrina and $75 billion was raised in private donations to help victims of India's 2004 tsunami. In both instances people's emotions led to an outpouring of financial support. If the public became emotional about a Mars Mission, wallets would open up and their excitement would move mountains and build rockets. A mission to another planet would turn into our generation's legacy. With campaigning, marketing and advertising one man or a small group of men could trigger an emotional reaction and there would be enough money and energy to send a whole colony to Mars.

Above are three trees that bare the fruit of financing for a manned mission to Mars. Because of their advantages and disadvantages, one source might not be sufficient. Maybe the first successful mission plan will be the brain child of a private entrepreneur who has the ability to tap all three financial wells during the various stages of planning, developing and implementation.

We have the technical know how and money is floating out there waiting to be utilized. So whoever dreams big, has courage, and believes nothing is impossible, will conquer the funding hurdle of Mars.

Jason can be reached at:
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Interview with Dr. Steve Squyres

by Chris Carberry

February, 2009

Carberry: Can you give a little background on Spirit and Opportunity? Where did this concept come from?
Squyres: I began to realize that much of the science I was interested in on Mars was very difficult to do from orbit and we could accomplish it much better if we had some capability down on the surface. I think from my background in geology - I was a geology major as an undergraduate - I liked the idea of reading the story that rocks had to tell us. We couldn't do that kind of science from orbit. Then, in 1987 I began working on trying to bring about a mission of that sort. There was a period of ten years of writing a series of proposals to NASA. All of them of varying sophistication and quality, but each one of them rejected in turn for various reasons. It wasn't until 1997, on our fourth try, when we brought a proposal to NASA to provide a science payload for, at that time, a single rover that was going to go to Mars in 2001. There was another series of events, some of which I am sure you are familiar with: the loss of the Mars Polar Lander and the loss of the Mars Climate Orbiter. And a series of events resulted in our program being cancelled and brought back to life three times in about three years. That third resurrection became Spirit and Opportunity. In the summer of 2000, NASA decided to fly two rovers. Both would be identical to each other, using a landing system that was based on the successful Mars Pathfinder mission. They looked very much like the rovers we had designed a long time before, but redesigned to fit with the Pathfinder landing system - and that is essentially when they became Spirit and Opportunity.

Carberry: Was there anything in particular that happened in 2000 that tipped the balance?
Squyres: I think it was several things. In part, I think it was in response to the failures. We had two missions that failed rather spectacularly and it was clearly a huge setback for the program. Also, it turns out that all launch opportunities are not created equal. Some are more favorable than others - especially for surface missions that use solar power. A combination of factors about the amount of mass you can deliver at what time of year - for the vehicle to survive. The 2003 launch opportunity was the best one for a solar powered rover for I think 21 years. It was a unique launch opportunity in that respect. So a number of factors conspired to make that a good time to do this.

Carberry: I'll hazard to guess that you never dreamed that these rovers would last for 5 years. At the start of the mission, what did you think the longest possible lifespan for these rovers would have been?
Squyres: Realistically speaking - and not saying what I'd say was theoretically possible - but realistically, I was looking for six months. Nothing close to five years. If anyone says that they thought they would last for five years, they are lying.

Carberry: What would you say was the most exciting and significant discovery you made? Was it the water evidence?
Squyres: I think the most significant and exciting discoveries were clearly the ones related to water. In the case of Opportunity it was ground water and surface waters. In the case of Spirit, it was the hydrothermal systems, but in both cases it is related to water - it is the most scientifically exciting.

Carberry: The success of these rovers came at a very unique time in the space program as well. It was not long after the Columbia accident. With the success of the rovers (one prior to VSE announcement), do you think this influenced the decision making process on VSE and did the White House consult you at all?

Squyres: No. The White House did not consult with us at all concerning the Vision for Space Exploration at the time it was announced. We were very, very, very focused on operating our rovers. As you recall, the announcement of the Vision for Space Exploration came between the landing of Spirit and Opportunity. We had one rover - one brand new vehicle on the surface of Mars. We had another one bearing down on the planet and about to land. We were just up to our eyeballs in what we were doing. So, the White House didn't ask for our input at all in the planning of VSE.

Carberry: Starting a new clock right now, what would like to accomplish if you have another few years of operation from the rovers? Are there other major discoveries that you think these rovers are capable of making?
Squyres: Absolutely. However, since we are at year five, we have to understand that they could drop dead tomorrow. Every day is a gift at this point. I had no expectations of the vehicles lasting any longer than they have. We'll take whatever we can get. For Spirit, we have these two features called "von Braun" and "Goddard." For Opportunity, we hope to get to Endeavor Crater. Endeavor Crater is very far away - probably double the total mileage that we have on the vehicle so far. It is more than ten kilometers away. It is a wonderful target - a huge crater - 20 kilometers in diameter. The thing that makes it most interesting is the materials comprising the rim of the crater, which appears to be very different from anything either rover has seen before. But it's very difficult to predict how long it will take to get there.

Carberry: I have read quotes from you on the old question of people vs. robots. You have been quoted as

being a strong advocate for the need to send humans. What would you say are the strengths and weaknesses of robots and humans in Mars exploration?
Squyres: The strength of robots is that they are very inexpensive in comparison to humans and they don't want to come back home again.

Carberry: And you don't have to feed them …
Squyres: That makes them a lot easier to deal with than humans, but they are far less capable. They're less capable of exploring. They're less capable of improvising and responding to discoveries. They are less capable of inspiring future generations of explorers. That's an important part of what we do. Common sense dictates that a sound Mars program is going to involve both robots and humans. It will be more focused on robots early and more on humans later, but there will be plenty of opportunity for humans and robots to work together on Mars. Humans on Mars will certainly have robots to do things on their behalf.

Carberry: If you were to send people, where would you send them?
Squyres: That's a very difficult question. It depends on too may factors that I can't really guess. For example, to what extent is your mission architecture going to depend on in situ recourse utilization as opposed to just bringing everything with you. That will make a big difference. You want to go to a place where the scientific explorers are going to find the best science. Where that may be now may be very much different from where that might be after MSL flies. If I had to pick a site today, I'd pick a site, but we've got a lot to learn before we're going to be picking sites. We should pick a site on the basis of all the knowledge that we have at the time.

Carberry: What are your thoughts on the discoveries that the Phoenix Lander has made? The perchlorate and the water ice being so close to the surface?
Squyres: The perchlorate was a surprise to me. I think most Martian scientists had never heard of perchlorate at the time. That was a surprise to just about everybody. As far as the ice in large quantities close to the surface, to me and many other scientists that wasn't a surprise at all. There was some very compelling evidence from the gamma-ray spectrometer and the neutron detector on the Mars Odyssey spacecraft that there was ice not far from the surface in very, very high concentrations. The motivation for sending Phoenix to that landing site was the high probability of finding ice close to the surface. I even know planetary scientists who are experts on Martian ice who - even before Phoenix set down - predicted that the retro rockets would expose ice beneath the vehicle.

Carberry: Going back to Spirit and Opportunity, do you think it is a good model for future missions? With Mars Science Lander they are obviously using elements, but have essentially invented a whole new rover. Do you think that was a wise choice? Do you think it would have been cheaper to send a few more of the Spirit/Opportunity class rovers to Mars?
Squyres: Spirit and Opportunity are utterly incapable of doing the science that MSL will be doing. MSL is going to drill centimeters into rock, extract powder, bring it into the vehicle and search for organics with extraordinary sensitivity. These are things that Spirit and Opportunity aren't event remotely capable of doing, so if you want to test the hypothesis that there are [organic] molecules on Mars, Spirit and Opportunity are not the right vehicles for that. Mars is an incredibly diverse planet and we've only been to two sites with Spirit and Opportunity and I think there are many other sites to bring that vehicle to, but the Mars budget is very limited so we have to take what we can get.

Carberry: On that topic, we obviously have MSL scheduled for 2011 and the MAVEN mission in 2013, and not a lot solidly planned beyond that. What is the future of the Mars program and what are the main challenges that you see?
Squyres: There are a series of missions in the 2016 - 2018 time frame that are being formulated right now. One that comes to mind is ExoMars. ExoMars is a European rover mission that is in the works right now and is supposed to launch in 2016. There is a lot of interest in doing an orbiter that would follow up on the very interesting data concerning methane in the Martian atmosphere. And then of course there is the Holy Grail: a sample return mission - going down to the Martian surface and collecting samples and bringing them back to Earth. That is something that we have wanted to do for a very long time and still want to do.

Carberry: Do you think there is the political will to do that in the near future?
Squyres: It's hard to say. It depends on the level of funding for the Mars Exploration Program. The current funding doesn't support sample return in the near future or the more distant future, but with a modest funding increase, I think it is possible.

Carberry: Since the ExoMars is a collaboration with Europe and there is talk of additional collaborative missions, do you see this as the trend - rather than mounting our own independent missions we will opt for collaborations with ESA or others? And, do you think this is the correct course to follow?
Squyres: I think it makes sense to pool our resources to maximize the science return. Sample return is a great example of that. Sample return will be very expensive and difficult for any one space agency to pull off. If several space agencies or a couple could coordinate their activities and pool their resources, then common sense says, 'yeah, it's going to be easier to get the job done'. The hard part is pulling off the coordination. NASA works very differently than ESA. NASA is a single national space agency and ESA is a whole bunch of nations cooperating together. ESA has its own system for selecting missions and certifying them. Their schedule for developing missions is different from ours, and since the planning processes are so different in the two, getting the two agencies to

work effectively together can be challenging, but it can be done. The Cassini-Huygens mission is a spectacular example of that. Cassini-Huygens was a collaboration with the European Space Agency, and both Cassini and Huygens were spectacular successes. It is a model of how these types of collaboration can be done.

Carberry: Moving back to policy, do you have any sense of where the new administration is going with regards to NASA? I realize that this is a difficult question since a lot of the pieces have not fallen into place yet.
Squyres: I don't have a sense of where the Obama administration will move with regards to NASA. We don't yet know who the new NASA administrator is going to be. I think it will be an administrator who will begin the process of articulating clearly the administration's space policy, but for now we just wait.

Carberry: What do you think the space and Mars community can do to stimulate more interest not only with the administration and Congress, but also in the general public?
Squyres: The best way to stimulate interest in the general public is to be doing good stuff on Mars. Flying good missions - making exciting discoveries - and conveying those discoveries and what we do so that the public experiences the thrill of exploration and discovery - what it is like to succeed in exploring another world. I think that, as a scientist, is the best thing we can possibly do. It is not as much through advocacy, as leading by example.

Carberry: Perhaps it is the way we convey these discoveries. Perhaps we should get the message out more effectively so people understand that these discoveries are important.
Squyres: Getting the information out is an issue. The primary way you reach large numbers of people is through the media; whether it be through television, the Internet, newspapers, movies, you name it. There are many different ways. For all these media outlets there are gatekeepers who determine what stories get told and what stories don't get told. There are many, many dedicated, hard working space reporters. People whose job it is to report what is going on in space - what is going on Mars. But the gatekeepers of these stories are the editors and the people who make editorial decisions about what content gets before the American public and what content doesn't. And it is really those editors, those gatekeepers, which exert the most control over what we hear about and what stories get told. Their job is to get eyeballs on websites and get eyeballs on commercial time on TV, and in all those newspapers, etc. We need to work within the confines of that process.

Carberry: On a related note, what would you see as the best way for the Mars community to work more closely, more in unison, to help promote the goal? As you know, the various parts of the community, whether it's The Mars Society, the planetary science community, or even the human space program, haven't always worked effectively together to achieve shared goals - for various reasons.
Squyres: I think it is very important for the Mars advocacy community to work very effectively with the community of scientists and engineers who actually carry out these missions. There is obviously considerable overlap between the two groups, but not 100 percent. I think it would be very unfortunate if we have one group of people who fly the mission and analyze the data, etc., and another group of people who are the passionate advocates of The Mars Society and that they are independent of the activities of one another. It really, really helps in a situation where resources are tight when a community of people who have a common interest speaks with one voice. So, trying to coordinate the efforts of all of those groups who have an interest in going to Mars is a very important thing to do. I don't have any recipe for that, but I don't think anyone would be surprised if The Mars Society has an important role in that process.

URC Update

by Kevin F. Sloan

An international field of 10 college teams is hard at work programming microcontrollers, welding frames, and testing motor controllers in preparation for the 2009 University Rover Challenge (URC). All sights will be set on Oregon State University, who pulled out a close win in 2008 over the rest of the field, led by the University of Nevada, Reno, and York University. But it's not just the other rovers that teams will face threats from. The southern Utah desert is well known for its oppressive heat in the summer, and as teams discovered last year, can even muster up incredible winds that seemingly make the legendary dust storms on Mars look like a calm, still day.

The 2009 URC will take place May 28-30, 2009 at the Mars Desert Research Station, Utah. Be sure to watch The Mars Society website and newsletter during that period for stories, photos and videos from the field, detailing all of the action!

Convention Update

12th Annual International Mars Society Convention

University of Maryland, College Park

Your chance to hear the latest news and research from Mars, and to join us in advancing the cause of human space exploration!

CONFERENCE SPEAKERS

Hear the latest news and research from Mars, and join in advancing the cause of human space exploration! Confirmed and probable conference speakers include:

Dr. Jim Garvin (NASA)
Dr. John Mather (NASA; Nobel Prize winner)
Dr. Steve Squyres (Cornell; Mars Exploration Rovers)
Don Hassler (Primary Investigator for the RAD on the MSL)
George Butler (Director - Roving Mars; Pumping Iron)
Dr. Chris McKay (NASA)
Dr. John Grunsfeld (NASA Astronaut - Tentative)
Miles O'Brien (Formerly of CNN)
Dr. Mike Griffin (Former NASA Administrator - Tentative)
Dr. Scott "Doc" Horowitz (Former Astronaut and Associate Administrator of NASA - Tentative)
Dr. Penelope Boston (New Mexico Tech)
Michael Carroll (artist/author)
Andrew Chaikin (historian/author)
Dr. Carolyn Porco (Cassini - Tentative)

Special Programming

In addition to updates on the Phoenix Mars Lander, Spirit, Opportunity, Mars Express, and the Mars Reconnaissance Orbiter missions now exploring the Red Planet, as well as Mars Society programs, we will also be featuring some special programming. All are guaranteed to be informative and exciting!

Exploration: An Historical Perspective: We will examine the history of exploration on Earth and discuss how historical lessons might be able to be applied to space exploration.

The Art of Space: What role can art play in promoting and documenting space exploration.

Reporting Mars: A discussion of the role of media in space exploration.

Gaming Mars: How can video game producers help to promote Mars exploration

Private Trips to Mars? We will be conducting a panel to discuss the possibility of the private sector contributing to Mars exploration.

The Great 2009 Mars Blitz

Have you ever wanted to make a direct statement in front of Congress in support of humans to Mars? Here is your chance. At the Mars Society Convention, we will be sending at least 150 convention goers up to Capitol Hill to meet with their members of Congress and their staff on the afternoon of July 30, 2009. To make this activity a success, we need your help. If you are coming to the Convention, please sign up for the Blitz as well. Even if you are not coming to the Convention and can spare some time on Thursday afternoon, July 30, 2009, please join us on Capitol Hill.

"The Search For Intelligent Life"

Two astronauts looking for signs of intelligent life in the Capitol. Commissioned by Hal Fulton for use on the cover of his book "The Space Activist's Handbook".

Limited edition of prints available at www.tharsisartworks.com

Biosphere M

A Measure of Humanity

by Bruno D.V. Marino PhD

The problems of large scale habitation on Mars are many; however, sustainable ecosystems for production of food, water and biological diversity are critical for long term success. Notwithstanding the stark differences between the Martian and Earth natural environments, fundamental limitations of humanities capability to understand ecosystems and their functions, apparent now in the context of global warming, suggest that the popular paradigm of going to Mars to escape planetary ecosystem failure is in itself doomed to the same end. The Biosphere M project will explore Mars and planetary colonization from a biospheric and ecological perspective across scales of time, space, biodiversity, biogeochemistry, technology and human culture to consider pathways to Mars. Humanity clearly needs time to understand its own habitat as a means to repair Earth or to enable its success on other planets. Should humanity not be able to manage Earth's resources and the consequences of uncontrolled atmospheric CO2 are realized, "global civilization" may vanish just as early civilizations and cultures vanished in the late Holocene. Biosphere M concepts may offer insights into the Fermi Paradox, the Drake Equation and Gaian principles.

Introduction

A familiar call to colonize Mars in the wake of failing Earth ecosystems or other catastrophe is based on an assumption that humans can, de novo, develop and create large-scale, sustainable ecosystems on other planets such as Mars. While small-scale habitations and created environments may sustain early colonies, and to some extent have been proven, the issue of scale in general presents difficulties when considering productive, self-sustainable and diverse ecosystems capable of supporting large numbers of persons over long periods of time. The Earth, itself a mosaic of climate zones and biological diversity, represents a time evolved large scale "natural system" present long before human populations expanded around the Earth. Thrown into a world of biological and material richness humans have successfully evolved and exploited niches for nourishment and provision of all the material means required for reproductive success. However, within the last several hundred thousand years, modern humans have demonstrated a capacity to increasingly mine and harvest Earth's resources at an unsustainable and alarming rate with unintended consequences. Moreover, knowledge of the Earth's systems that support humanity appears to be insufficient to effectively sustain and manage Earth's key resources and ecosystems. If such knowledge was available it has been lost to humanity. The Biosphere M project seeks to assemble the knowledge required to create and repair ecosystems and thus lay the groundwork to establish sustainable ecosystems on other planets. In one sense, a measure of humanity lay in our capacity to understand nature on Earth and to recreate it on other planets.

Pioneer Effect

Over the last century, beginning with the Pioneer effect, the cumulative anthropogenic alteration of the Earth's atmosphere by greenhouse gases and destruction of ecosystems has resulted in a growing consensus that the human race may be approaching an irreversible threshold of change caused by global warming and its consequences. Without reversal of atmospheric CO2 concentrations and surface warming Earth systems may undergo vast reorganization, diminishing and or extinguishing many of the societies, economies and cultures as we have historically come to know them. To date, humanity has not been able to consider planet Earth with a view towards expedient reversal of the problems, nor undertake repair of damaged ecosystems on large scales. In the face of the consequences of global warming it appears that no single country or any group of countries possess the capacity to deliberately maintain diverse and invaluable ecosystem services that provide clean water, food, biodiversity and materials. The circumstances and the evidence suggest that humanity neither has an understanding of how to establish new ecosystems nor of how to sustain and maintain them. This "ecological uncertainty" frames a paradox in that humans have thrived by technologically exploiting Earth's resources, yet have unknowingly damaged natural ecosystems; humanity is not yet capable of repairing nor creating such systems de novo. From this perspective, colonization of Mars or of any other planet presents insuperable difficulties to saving humanity from itself.

Biosphere M: Reverse Pioneers

Current efforts to manage the planet's radiative skin by regulating emissions, such as the Kyoto Protocol, are nascent and from the start excluded the Earth's forests, oceans and biodiversity. These policy measures, while necessary in the face of the potential peril of climate change, may not be sufficient nor offer enough time to reverse conditions before irreversible thresholds are reached. Biosphere M, in one sense, is an effort to engender reverse pioneers of ecosystem damage and climate change. From another perspective, Biosphere M is a starting point, a reality check on our desire to populate space without understanding how to

bring nature along to sustain us. Failure to repair our own planet and/or to recruit sustainable biospheres on new planets might suggest that the Fermi paradox is not a paradox at all in that the absence of life in the universe is due to humanities inability to manage its planetary home(s). Likewise, according to the Drake equation the paucity of planets with suitable ecological conditions for evolution may not be difficult to imagine. Finally, humanities failure to prevail suggests that we have not been able to discern larger principles of Earth system organization that, for all intents and purposes, offer sustainable, self-regulatory and almost Gaia like qualities as proposed by James Lovelock.

In another sense, Biosphere M will focus on integration of key biological components that together could grow rapidly into a recognizable and sustainable ecosystem. A framework of ecosystem organogenesis for Biosphere M and for Earth may be based, in part, on lessons learned/opportunities lost on large-scale biospheric experiments (e.g., Biosphere 2) and consideration of closed/semi-closed system theory. The capacity to create self sustaining ecosystems suggests that planetary biospheres could be established long before human habitation begins or is needed, offering small space habitations an opportunity to "seed" a planet. Visionary organizations, such as The Mars Society, already have operating model space habitations where such possibilities could be explored in a realistic setting catalyzed by working groups and weekly focus themes.

Biosphere M will consider paradigms of planetary "plant domestication" based on germplasm engineered on Earth, potentially providing the carbohydrate basis for population growth much like the early domesticates of maize, rice, potato and millet provided for Earth's first complex civilizations . Biosphere M will require focus and participation from a wide audience.

Biosphere M Working Groups

Biosphere M working groups will be organized across broad disciplines and, when available, by facility. One example might be a working group focused on the requirements to set up the basic framework for large scale integrated ecosystems ahead of colonization. The Mars Society's Mars Desert Research Station (MDRS), located in Utah, could provide a stark "reality check" environment from which to consider possibilities, convene working groups, broadcast webinars and test ideas.

An understanding of the natural world we live in, the ability to care for it and development of the capacity to transfer humanity successfully to other planets represents new challenges in technology and in our thinking as a global society. However, a failure to address these issues now may lead us to a planetary end game that may threaten future generations and humanity itself.

Please contact Dr. Marino with a statement of interest and ideas to promote the objectives of the project. The Biosphere M project is a non-profit effort to enhance humanities understanding of the natural world.

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The Mars Society's Mars Desert Research Station (MDRS), located in Utah, could provide a stark, "reality check" environment from which to consider possibilities, convene working groups, broadcast webinars and test ideas.

IMAGE CREDIT: KEPLINGER DESIGNS

A Cold Dry Cradle

by Gregory Benford and Elisabeth Malartre

Introduction

In 1996, just after a NASA group claimed to see evidence of Mars biology in a Martian meteorite, Elisabeth Malartre and I discussed how life might survive and advance there. Her doctorate is in biology and with her knowledge, we created as plausible a scenario for a Mars expedition as we could. I had just about given up hope that NASA could ever send a manned expedition, so I concocted a way to get it done by private means.

These ideas were so stimulating, we wrote the novella. It was picked up and reprinted several times, leading to our writing the fully worked out version, The Martian Race. The novel sold well and is still in print. (The publisher wanted me listed as sole author, for sales, but Elisabeth fully wrote her half.) If you enjoy this novella, the novel will answer questions we hadn't room for in the cramped space.

Enjoy! *Gregory Benford*

It seemed...that if he or some other lord did not endeavor to gain that knowledge, no mariners or merchants would ever dare to attempt it, for it is clear that none of them ever trouble themselves to sail to a place where there is not a sure and certain hope of profit.
Prince Henry the Navigator,
assessing the motivations for
sea exploration, circa 1480

Part 1

He turned with a cry of surprise, falling helplessly with a silky slowness she would never forget.

Piotr had caught his boot and when he tried to free it he managed to trip as well. His second yelp rang in Ann's suit com when he hit the ground and his ankle snapped. His right arm smacked down vainly as he tried to break the fall. The impact sent plumes of red dust arcing up into the thin atmosphere. She trotted to him in the long, gliding steps that covered ground best in the deep gravel and low gravity. The dust began its lazy descent as she bent over Piotr and said, "How bad?"

"Da... Felt it go. Foot..."

She unfastened the bottom of his insulated legging and ran her hands lightly over the ankle cuff of the thin pressure suit underneath. "Suit looks OK, no breaches. How's your air?"

The damned dust had settled on his faceplate and she couldn't see him, but knew he would be checking the readouts on the inside of the helmet. "Normal." His voice was thin and strained.

"Good. How do you feel?"

He shifted slightly, groaned. "Like yesterday's blini. Light headed. My right foot hurts like Hell."

Keep him talking. Can't risk shock.

She kept her tone light. "That's what you get for doing cartwheels."

"Unh. I can't move it."

She frowned, wondering how difficult it was going to be to get him back into the rover. Help was more than 35 klicks away, and she was driving the only vehicle on the planet. So the two of them had to manage it on their own. From the rover she could contact the other two members of the team, for moral support if nothing else. If she could get him there.

"Let's get you up."

"Awright." His slightly slurred voice worried her. They were all worn down after months in this cold, raw land-scape and shock could be setting in.

She bent over and slipped her left arm clumsily around his waist, feeling like a kid in a snowsuit. Suit to suit contact had a curiously remote feel about it, with no feedback from the skin. Still, she liked hugging him, even this way. They slept together in a close embrace, ever since the launch from Earth orbit a year ago.

"I've got some great stuff in the rover that'll make you feel like a new man."

"Good. Aieee."

He heaved himself up onto his left leg, leaning heavily on her. Together they struggled for balance, threatened to go over, then steadied. She had long ago stopped counting how many times the 0.38 g's of Mars had helped them through crucial moments. It had proved the only helpful aspect of the planet.

"Whew. Made it, lover." Keep the patter going, don't alarm him. "Ready? I'll walk, you hop as best you can."

Like a drunken three-legged sack race team, they managed to stagger slowly up the crater slope. "You will work as a team," the instructor at mission training had said, but she hadn't anticipated this. Over com came deep, ragged gasps. Hopping through gravel, even in the low gravity, was exhausting Piotr. Luckily the rover was just on the rim, about a dozen meters away.

Not at all like the electric dune buggies used in the Apollo Lunar missions, the Mars rover resembled an oversized tank on wheels. It was really a mobile cabin that could keep a crew of two out in the field for two weeks. She got him into the lock and set the cycle sequence. No time to brush off the dust; the cab inside was hopelessly thick with the stuff anyway. She heard the cycler finish and felt the rover's carriage shift. Good; he had rolled out of the lock and was lying on the floor. She hit the pump switch and oxygen whistled into the cabin from half a dozen recessed ports.

The chime sounded; they were pressurized. She turned off her suit

oxygen, released the clamps on her helmet and as quickly as possible shucked her parka, leggings and finally, her suit. She shivered as she stepped out into the chilly cabin: she had actually been sweating on Mars -- a novel experience. A prickly itch washed over her face and neck and already she regretted their dusty entry. The usual routine was to brush the suits down outside with a soft brush. Some genius from mission prep with a lot of camping experience had thoughtfully stowed it aboard, and it quickly became one of their prized possessions. The Martian surface was thick with fine, rusty dust heavily laden with irritating peroxides. Her skin felt like it was being gently sandpapered all during the long months here, especially when she was tired, as now.

Fluffing her short black hair, she doffed a red Boeing cap and went over to help Piotr. She upped the pressure to get him more oxygen and together they gingerly peeled off his insulating layers and his suit. A look at his leg confirmed her guess: broken ankle, swelling fast.

From there it was straight safety manual stuff: bind, medicate, worry.

"I love you, even zonked on painkillers," she murmured to his sleeping face when she had checked everything five times. He had dropped off disturbingly fast. He kept up a front of invincibility, they all did somewhat or they wouldn't be here; it went with the psychology. But he had the bone-deep fatigue that came from a hard mission relentlessly pursued.

She was suddenly very tired. Emotional reaction, she diagnosed wryly. Still, better tend to it.

Time for a cup of tea. She looked around first for her tea cosy, carefully brought from Earth as part of her personal mass allowance. Nothing could've induced her to leave it behind-- home was where the cosy was. She retrieved it from a corner of the cooking area. Originally light blue and cream colored, it was now stained irretrievably with the red dust of Mars. When things got tough she sought the comfort of a proper cup of tea made in a teapot. There were precious few emergencies that couldn't wait until after a cuppa.

As the water heated she got on the AM channel and tried to reach the other two back at the hab, got no answer. They were probably deep in the guts of the Return Vehicle, starting the final checks for the approaching test fire. She left a heads-up on the ship's message system that they were coming back. No way could she get any more done out here on her own. Anyway, Piotr came first, and any solo work was forbidden by their safety protocols.

She stared out of the forward view port at the pale pink hills, trying to assess what this accident meant to the mission. Maybe just a mishap, no more? But Piotr still had plenty to do, preparing for their return launch. No, this would screw up the schedule for sure. Her own work would get shoved aside. Face it, she thought-- biology was not the imperative here any more. She had made her big discovery. To the world, their expedition was already a big success--they'd found life.

#

The robot searchers of years before had fruitlessly tried to find evidence of life or even fossils. But in the iron peroxide desolation all traces were erased. The tiny robots had an impossible task, akin to dropping a toy rover into Montana and expecting it to find evidence of the dinosaurs that had once tramped through its hills. Mars was bone-dry, but without bones. Not even the algal mats some had hoped might be preserved from the ancient lake beds.

The noxious peroxides had a good side, though. In chem labs Earthside hydrogen peroxide was a standard disinfectant, giving the Consortium a handy argument against those who said a human expedition would contaminate the whole planet, compromising the search for life. In closed-environment tests, the peroxides scavenged up the smallest microbes, making it quite clear why the Viking landers had found no signs of organic chemistry. For Earth life, Mars was like living in a chemical blowtorch.

But Mars life had found a way to circumvent and vanquish the peroxides. Life here was widespread, subsurface microbes using the ubiquitous iron peroxides as their energy source. Within a week after landing, some of Marc's first exploratory cores had come up with streaks of a dark, crumbly soil-like layer less than a meter below the surface.

Hoping to find something interesting, she set up a plastic inflatable greenhouse dome outside the habitat, spiked samples of the Martian soil with water and nutrients, sealed them in small pressure vessels and incubated them. She could then check for any gases produced by the metabolism of life forms in the soil. She was essentially repeating the robot Viking biology program, but this time life was looking for life directly. To avoid the embarrassing possibility of introducing her own microflora into the experiment, she worked with the samples only outside, under the cold red-stained sky. In her pressure suit and insulating outerwear she was somewhat clumsy, and each step went slowly. But finally she was satisfied with the setup. The elevated greenhouse temperatures kept the water from freezing and speeded up the results enormously.

Sure enough, as in the Viking experiments, there was an immediate response of dry surface peroxides to the water. A spike of oxygen. When that had run its course she bled off the gases and resealed the pressure vessels. And was rewarded in a few days with unmistakable signs of renewed gas production. Carbon dioxide this time. The microscope then confirmed living colonies of Martian microbes. The rest, as they say, was history. So why was she still restless, unsatisfied?

#

The crackle of the radio startled her. "Home team here. Got your heads-up, Ann. How is he?" Marc Bryant's crisp efficiency came over clearly, but she could hear the

clipped tenor anxiety, too.

"Stable." She quickly elaborated on Piotr's symptoms, glancing at his sleeping face. They had each taken a month of medical training but Marc had more. She felt relieved when he approved of her treatment. "Got to think what this means," he said laconically.

"We'll be there for supper. Extra rations, I'd say."

A small, very small joke. They had celebrated each major finding with a slightly excessive food allotment.

So far, they had not marked disasters this way. And they were having their share.

The first was the vent failure on the flight out. They found they had lost a big fraction of their water reserve, four months out from Earth, from a blown valve. There had been no time to console themselves with food, and good reason not to. They had landed bone-dry, and lived on the water manufactured by the Return Vehicle's chem plant ever since. That accident had set the tone for the others. Celebrate the triumphs, overcome the disasters.

"My night to cook, too," Marc said, transparently trying to put a jovial lilt to it. "Take care, gal. Watch the road."

#

Here came the heart-squeezing moment. She turned the startup switch and in the sliver of time before the methane-oxygen burn started in the rover engine, all the possible terrors arose. If it failed, could she fix it? Raoul and Marc could come out in an unpressured rover and rescue them, sure, but that would chew up time...and be embarrassing. She wasn't much of a mechanic, but still, who likes to look helpless?

Then the mixture caught and the rover chugged into action. Settling in, she peered out at the endless obstacles with the unresting concentration that had gotten her on this mission in the first place. To spend 550 days on Mars you wanted people who found sticking to the tracks a challenge, not boring. She followed the auto-tracker map meticulously, down a narrow valley and across a flood plain, then over a bolder-strewn pass and down a narrow valley and across a flood plain, then over a pass...

Here, a drive back to base that proved uneventful was even pleasant. Mars was always ready to thunk a wheel into an unseen hole or pitch the rover down a slope of shifting gravel, so she kept exactly to the tracks they had made on the way out, no matter how enticing a distant flow pattern in the rocky shelves might be. She had seen enough of this red-hued terrain to last a lifetime, anyway. Nothing more out there for a biologist to do.

In the distance she caught sight of the formation she and Piotr had dubbed the Shiprock on the way out. It looked like a huge old sailing ship, red layers sculpted by eons of wind. They'd talked about Ray Bradbury's sand ships, tried to imagine skimming over the undulating landscape. The motion of the rover always reminded her a little of being on the ocean. They were sailing over the Martian landscape on a voyage of discovery, a modern day Columbus journey. But Columbus made three voyages to the new world without landing on the continent. He 'discovered' America by finding islands in the Caribbean, nibbling on the edges of a continent. A sudden thought struck her: was that what they were doing-- finding only the fringes of the Mars biology? Many people had speculated that the subterranean vents were the most likely places for life on this planet. The frontier for her lay hundreds of meters below, out of reach. She sighed resignedly. But it had been great fun, at first.

#

She slurped more tea, recalling the excitement of the first months. Some of it was pure fame-rush, of course. Men on Mars! (Uh, and a woman, too.) They were household names now, the first Mars team, sure bets for all the history books. Hell, they might eventually eclipse Neil Armstrong.

She was first author on a truly historic paper, the first submitted to Nature from another world. Barth, Bryant, Molina & Trevinski's "Subsurface Microbial Life on Mars" described their preliminary findings: it would rank with Watson & Crick's 1952 paper nailing the structure of DNA. That paper had opened up cell biology and led to the Biological Century.

What would their discovery lead to? There was already a fierce bidding war for her samples. Every major lab wanted to be the first to crack the Martian DNA code, and determine the relationship between Martian and terran life. Her simple chemical tests --staining samples of thin-sectioned Mars colonies under the microscope --had shown that the basic constituents of life --proteins, lipids, carbohydrates, nucleic acids -- were the same here, or at least close enough to respond to the same chemical tests.

She used standard techniques and extracted what seemed to be DNA from the microbes. So how similar was it to Earth style DNA? She ran some hybridization tests with the dried DNA of terran microbes she'd brought along. Basically, you unzip the double-stranded DNA helix by heating, then mix the soup of single strands with strands of a different DNA. When the mixture is cooled down again, strands that are similar enough pair up. She got just enough pairing between Martian and terran microbial DNA to conclude that life on both planets at least used the same four-letter alphabet.

That was exciting, but not conclusive. In other words, all DNA might have to be composed of the same four bases just for molecular structural reasons.

But the DNA code was something else. DNA spells out the amino acids, which then construct the cellular proteins --both the structural brickwork and the busy enzymes that do the cell's business. If Martian DNA spelled in the same language as on Earth, it would mean unequivocally a common origin for life.

When she tried sequencing the Martian DNA, it came out gibberish. It looked like Earth-style DNA, but she

couldn't match it to known gene sequences. It was, once again, an ambiguous result. And that was as far as she could go with her equipment. The rest would have to wait.

Assuming that life emerged only once for the two planets, where did it start? If Mars cooled first, life would arise here while Earth was still a pool of hot lava. And come to Earth via the meteorite express. The Martian meteorites with their enigmatic fossils had tantalized scientists for years. When they were first discovered, the big question had been whether they actually contained fossils, because most people thought they knew that Mars was lifeless. Now we know about that part, at least, she thought.

Organized life forms from Mars seeding Earth's primitive soup of basic organic molecules would quickly dominate. Martians come to harvest Earthly resources. H.G.Wells with a twist. We may yet be Martians. Pretty heady stuff for the scientific community, and it would change our essential world view. Full employment time for philosophers, too, and even religious theorists.

But deep down she realized she'd wanted to find L*I*F*E, not microbes. The ghosts of Carl Sagan's giraffes had shaped her expectations. Marc was jazzed by the discovery of deeper layers of microbes, separated by layers of sterile peroxide-laden sediments in the old ocean beds. That implied periodic episodes of a wet and warm climate. But so far she had not found anything other than the soil microbes. Even the volcanic vent they had explored had no life, only peroxide soil blown into it from the surface, like a dusty old mine shaft. And now they were about to leave and the subterranean caverns were still unexplored. Damn!

#

After five hours Piotr was doing well, had regained his energy and good spirits. They even managed a clumsy but satisfying slap and tickle when she stopped the rover for lunch. They weren't going to get any more privacy, not with just two weeks to go until the return launch. She felt nervous and skittish but Piotr was a persistent sort and she finally realized that this just might do both of them more good than anything in the medicine chest back in the habitat.

The route began to take them--or rather, her, since Piotr crashed again right after sex; this time she forgave him--through familiar territory. She had scoured the landscape within a few days of the hab. Coming down in the Chryse basin, they got a full helping of Mars: chasms, flood runoff plains, wrinkled canyons, chaotic terrain once undermined by mud flows, dried beds of ancient rivers and lakes, even some mysterious big potholes that must be mini-volcanoes somehow hollowed out. Her pursuit of surface fossil evidence of life had been systematic, remorseless--and mostly a waste.

Not a big surprise, really, in retrospect. Any hiker in the American west was tramping over lands where once tyrannosaurus and bison had wandered, but seldom did anybody notice a bone sticking out of the ground. Ann was more systematic and probed deeper in the obvious places, where water had once silted up and could have trapped recently dead organisms. Algal mats, perhaps, as with the first big life forms on Earth. But she had no real luck, even in a year and a half of snooping into myriad canyons and promising beds of truly ancient lakes. That didn't mean life wasn't somewhere on the planet. A billion years was a long time, enough for life to evolve, even if Mars had not supported surface life for perhaps three billion or more.

She stamped her feet to help the circulation. Space heaters in the rover ran off the methane-oxy burn, but as always, the floor was cold. When the outside was tens of degrees Centigrade below zero, gradients in the rover were steep. Mars never let you forget where you were.

She tried to envision how it must have been here, billions of years ago. Did life give way with a grudging struggle, trying every possible avenue before retreating into the diminished role of mere microbes?

The planet did not die for want of heat or air, but of mass. With greater gravity it could have held onto the gases its volcanoes vented, prevented its water vapor from escaping into vacuum. Split from hydrogen by the sun's stinging ultraviolet, the energetic oxygen promptly mated with the waiting iron in the rocks. The shallow gravitational well failed. Light hydrogen blew away into the yawning vastness of empty space. Had Mars been nearer the sun, the sunlight and warmth would simply have driven water away faster.

So those early life forms must have fought a slow, agonizing retreat. There were eras when lakes and even shallow, muddy seas had hosted simple life --Marc's cores had uncovered plenty of ancient silted plains, now compressed into sedimentary rock. But no fossil forests, nothing with a backbone, nothing with shells or hard body parts. If higher forms had basked in the ancient warmth here, they had left no trace.

The squat hab came into view in the salmon sunset. Looking like a giant's drum, five meters high and eight meters across, it stood off the ground on sturdy metal struts. Long pink and white streamers of carbon dioxide and water vapor trailed from roof vents, signaling that Marc and Raoul were there. Inside, the two stacked decks had the floor space of a smallish condo, their home for the last two years. Not luxurious, but they would certainly be nostalgic for it in the cramped quarters of the Return Vehicle they would shortly be boarding.

By now the hab was familiar to billions of Earthbound TV viewers and net surfers. Everyone on Earth had the opportunity to follow their adventures, which were beamed daily from Ground Control and carried on the evening news. Their web page registered over a hundred million hits in the week following the landing. Mars had ceased to be Space and had become a place.

She told herself that she had done all anybody reasonably could. After finding the microbes, she had postulated that they used an enzyme

like catalase to harvest the peroxides' energy. Then she had tested it in her small greenhouse set-up, found it worked. She would write that up on the half-year voyage home, squirt it email to an eager audience of every biologist in the world. Heady stuff!

She had data on chemical and biological toxicity of Martian substances to terrestrial biota. Another paper there, too. Plus work on the suitability of local soils to support greenhouse agriculture. Marc had even tried to grow kitchen herbs, but none of the seeds sprouted. Her long searches for fossil microbial mats in the paleoseas had turned up plenty of oddities that might bear fruit under rigorous inspection back Earthside. But she still felt she was just nibbling at the edges, but of what?

Raoul and Marc climbed down out of the hab as she approached in the last slanting rays of a ruddy sunset, two chubby figures in dark parka suits. Only Raoul's slight limp distinguished them. The tracker system had alerted them, and they would have to carry Piotr in. Plus a little ceremony they had devised: salvaging water from the rover. The methane-oxygen burn made carbon dioxide, which the engine vented, and pure water. She backed the rover to the conical Return Vehicle, with its gaudy red-on-white MARS CONSORTIUM wrap-around letters, a meter high. Raoul and Marc hooked the water condensers to the input lines, so the chem factory inside could store it. They had full tanks of methane and oxygen for the liftoff, but water was always welcome, after the parching they had taken on the long flight here. The guys did this last task by way of saying, welcome home. In the bleak, rusty dusk, the cold of night biting already through her skinsuit, the symbolism was important. Mars was sharp, cold and unrelenting, and they all felt it to the bone.

End of Part 1. Part 2 will be included in the internet version of The Mars Quarterly, Volume 1, Issue 3, to be published July, 2009.

Photo of the Day

Don't forget to check the website daily for the "Photo of the Day", usually submitted by a crew at MDRS...