

P R E M I E R I S S U E

# THE MARS QUARTERLY



PUBLISHED QUARTERLY (EARTH TIME) BY THE MARS SOCIETY

VOLUME 1, ISSUE 1 - WINTER 2009

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**ARCHIMEDES  
UPDATE**

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## Welcome to The Mars Quarterly!

*By Susan Holden Martin*

If you are already a paid member of The Mars Society, we salute you with this premier issue of *The Mars Quarterly* (TMQ), which is the first step in the process of offering additional benefits to our members. If you are not a member, we offer this premier issue to you as a sample of the future issues that will be available to paid members only. If you would like to secure access to future editions, please join *The Mars Society* today.

This premiere edition of TMQ has impressive content: an exclusive interview with Mars Phoenix Lander Principal Investigator, Dr. Peter Smith; an article by NASA Goddard Space Flight Center Chief Scientist, Dr. James Garvin; an op/ed by former astronaut and NASA Associate Administrator, Dr. Scott "Doc" Horowitz; and a passionate message from Mars

Society President, Dr. Robert Zubrin. We thank these individuals for their time and contributions toward the launch of TMQ.

Our intention in creating this new publication is to offer a nexus of discussion for members of the Mars movement, and to mark and archive national and international events in a significant way. Each quarterly issue of TMQ will have articles and op/eds from many of the most renowned and highly regarded people in the Mars and international space community. TMQ will also be a venue to discuss the important policy issues of the day, and will provide updates and news regarding Mars Society technical missions and events.

If you would like to be a regular contributor, or work with us on TMQ on a volunteer basis, and have experience in any of the following

areas, please send your current CV and a brief description of your interests to us:

Advertising/Marketing  
Audience Development  
Copy Writing/Editing  
Design/Production  
Internet/Digital Media  
Photography/Illustration  
Science/Technical Writing  
Strategic Planning/Global Markets

We look forward to hearing from you.

We would also like to hear from you about this premier issue of TMQ. Please send us your comments and suggestions for future issues.

**On to Mars!** 

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# Transition

By Chris Carberry

In the United States, we are in the midst of a major political transformation, one that may change the course of the nation and will certainly determine the future of U.S. space travel for decades. Those of us at The Mars Society intend to do everything in our power to ensure that transformation includes a firm commitment to human exploration of Mars.

We sent 100 people to Capitol Hill in Washington, D.C. in 2006, to educate Congress on the need for an aggressive human space program. The stakes are much higher this year. There is a VERY good chance that current Mars plans could be delayed or even killed. In addition to increased national political outreach efforts, this summer we plan to send even more people to Capitol Hill. As part of the 12th Annual International Mars Society Convention, we will be staging "The Great 2009 Mars Blitz" on Capitol Hill. If you would like to join us, or for additional information, please visit: <http://www.marssociety.org/portal/c/Conventions/2009/convention-2009-event>

This year, with newly donated funds, The Mars Society will reach beyond our typical support base. In addition, through increased paid memberships and charitable donations, The Mars Society and its various chapters will continue to be global leaders in advancing the message of human space exploration. Whenever possible, we will team up with other groups and space advocacy organizations to encourage government officials around the world to embrace human space flight.


There is one certainty in these uncertain times. If we sit back and just hope for circumstances to move in our direction, we will not be leaving

low Earth orbit anytime soon. It is up to us to find opportunities in these difficult times — and by hard work and real effort, turn those opportunities into tangible results. To make this our most effective outreach campaign to date - one that will reach all

***There is a VERY good chance that current Mars plans could be delayed or even killed.***

generations, we encourage your input and suggestions. In addition, we have a number of new initiatives and in order for them to succeed, your participation is urgently needed.

Winston Churchill said it best - "Attitude is a little thing that makes a big difference." As space exploration advocates, we must push forward with a confident attitude. If we do, we will make an enormous difference. Here are a few of the ways in which you can make a difference:

1. Help us engage President-elect Obama and the new Congress.
2. Volunteer to help The Mars Society with our many projects and outreach efforts.
3. Be a speaker in your community.
4. Form a Mars Society chapter.
5. Write letters to the editor of your local newspaper.
6. Become a paid member of The Mars Society, or make a charitable donation.
7. Create videos for YouTube and other websites in support of humans to Mars.
8. Promote the cause on blogs, Facebook, MySpace, Twitter, and other networking websites.
9. Brainstorm innovative new ways to promote the cause.
10. Ask a friend to join The Mars Society.
11. NEVER GIVE UP! 

*Chris Carberry is the The Mars Society Executive Director.*

# Home is where the Hab is

By Artemis Westenberg

For veterans like myself "home is where the Hab is" is most certainly true. And for all the new kids on the block, we at Mission Support want to make it come true. As Mission Director, I oversee a rather unique adventure, where scientists of many creeds can test their research on Mars as close as we can create that for them. After seven seasons, they still flock eagerly to our Mars Desert Research Station near Hanksville, Utah, as even the European Space Agency expects a better understanding of what research and equipment needs on the planet Mars will be by using our quirky Hab. For quirky it is, however hard the indomitable engineering team and the myriads of volunteers have worked over the years to make it practical and homey for its visitors, it is still hard living in a harsh environment of cold dry and rough desert.

In the coming season we have instituted a number of changes, all with an eye to make the Hab simpler in operating and upkeep. In space

terms: we are working on taking many points of failure out of every system, and where possible, replacing machines with manual systems, that need no electricity. Also we are tying the Hab more closely into the community of Hanksville by hiring and buying locally. The supplies will be delivered to the Hab before each new crew by the local supermarket, repairs will be tended to by local support and local repairmen. Next to making the Hab simpler, we aim at making the Hab nicer to live in. Refurbishments for every floor are planned, as it is your home while living on analogue Mars, and we would like you to have the best of both worlds: In Sim research and comfort.

I would like to introduce proudly to you the people that make the analogue research stations possible: The Engineering Team, at present under the leadership of James Harris, who recently took over from Paul Graham who dedicated so much of his time and creativity to the Hab over the years, as Gary Fisher does for our

water recycling systems in the GreenHab; Peter Detterline in overseeing the telescope in the Musk Observatory; the Science Team with Jonathan Clarke as its head, and scientists literally from all over Earth giving their time and advice to the crews and the research projects; the Mission Support CapComs that are the kind voice of Earth to the crews struggling with harsh Mars.

Of course without your many donations, small and large, we would never have the resources to outfit the Hab, stock its laboratories and run our crew-seasons. Thank you, donors, for your trust and belief in us. Thank you for our wonderful home away from home.

Visit us at <http://desert.marssociety.org/MDRS/> to keep abreast on what is happening at the MDRS. 🍊

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IMAGE CREDIT: KEPLINGER DESIGNS



# The New Mars Frontier and the Crossroads Ahead

By Dr. Jim Garvin

Today a dynamic scientific revolution is at hand as human understanding and insight about the planet Mars increases at an unbelievable pace. This time of rapidly changing paradigms about

Mars is truly unprecedented and it whets our appetite for a future era of human exploration of the Red Planet. In about a decade, the Mars of the Viking era has been replaced with a "new Mars" in which the prospects for a fruitful examination

of the biological potential of another planet are at an all-time high. This era of revolution has been catalyzed by the NASA Mars Exploration Program (MEP), which was totally restructured and revamped in 2000, as a consequence of the loss of the Mars Climate Orbiter and Mars Polar Lander in 1999.

The new MEP has established a unique "robotic beach-head" on Mars, and provided human-scale reconnaissance suitable for planning an increasingly ambitious and exciting strategy of Mars exploration that could culminate in human on-site exploration. The NASA MEP is clearly second-to-none in its achievements over the past decade, not only scientifically but also in terms of technological capabilities. Since the 2000 restructuring, the MEP has delivered on-going and exciting missions that include the Mars Odyssey orbiter, the twin Mars Exploration Rovers (Spirit and Opportunity), the unprecedented Mars

Reconnaissance Orbiter (MRO), and most recently, the Mars Phoenix Scout polar lander. Soon to come is the first Mars flagship mission since the Vikings of the 1970s — the Mars Science Laboratory (MSL) is now

***This time of rapidly changing paradigms about Mars is truly unprecedented and it whets our appetite for a future era of human exploration of the Red Planet.***

slated to launch to Mars in the 2011 opportunity. MSL will explore the surface at a site more scientifically compelling than any visited to date for at least one martian year. MSL is the culmination of a scientific strategy crafted for Mars by an

inclusive, community-based set of activities in 2000-2001, and its capabilities are designed to be a bridge to a next-generation of Mars exploration, and a catalyst for human exploration in the future.

With the remarkable scientific and technical achievements of NASA's MEP missions since the Mars Pathfinder and Mars Global Surveyor missions of the late 1990s, there is danger that the pace of discoveries, accelerated most recently by discoveries from the MRO and Phoenix lander, will

be forced to slow to a pace more akin to the period between Viking and the Mars Global Surveyor (1980-1998). It is important to recognize that after a dazzling decade of Mars robotic successes, the MEP is at a major cross-roads.

When the MEP was replanned in 2000-2001, there was a specific set of guiding principles and programmatic ground-rules established, in part thanks to the powerful recommendations of Tom Young's

Mars Program Independent Assessment Team (MPIAT), which was convened after the losses of MCO and MPL. Over the past several years, the guidelines established with the MEP rebirth have been continuously eroded, and the ability of the NASA Mars program to weather the storm of challenges associated with increasingly complex missions and shrinking budgets has been compromised.

The MSL mission, the first "flagship" class mission to Mars since 1976, has come under attack from many fronts on the basis of misperceptions about its cost growth and capabilities. These attacks, coming in the face of tightening budgets faced by NASA at a time of "change," have eroded the ability of the MEP to develop a sustainable Mars presence, as required in the stepping-stones to an era of human exploration.

With MSL slated to explore the martian surface starting in 2012, and the MAVEN climatology-aeronomy orbiter scheduled to observe Mars from 2014 through 2016, that leaves the key Mars launch opportunities of 2016, 2018, and 2020 essentially open in terms of a NASA strategy. From now (2009) thru mid-2012, the Mars presence we have come to expect will be in the hands of missions now in their extended phases of operation, including Odyssey, MER, and MRO. MSL will rely on the relay-telecommunications capabilities of 5-10 year old Mars orbiting assets, including Odyssey and MRO, during its primary mission as well.

These predicaments raise a vital issue — can NASA sustain a forward-looking Mars Exploration Program in the face of other pressures, and take advantage of extremely favorable launch windows, such as that of 2018, to build a bridge to an era of robotic sample returns and eventual human exploration? This is an important question for the United States and its space program as new leadership

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*Mars Science Laboratory Spacecraft Assembled for Testing*

IMAGE CREDIT: NASA/JPL-CALTECH

# ARCHIMEDES Update

By Hannes Griebel

ARCHIMEDES is an effort to probe the atmosphere of Mars by means of a hypersonic drag balloon, a device known as a "ballute", with a diameter of 10 meters. The project is currently under study by the Mars Society Germany and several institutes of the University of the Federal Armed Forces of Germany in Munich. It is further supported by the AMSAT-DL .e.V. organization, the DLR, and several other research institutions and industrial companies. The probe is planned to be integrated into the AMSAT's P5-A Mars satellite, and to be released from the spacecraft when in orbit around the planet. Launch of the P5-A is currently planned as a piggyback payload on an Ariane V rocket, as it is standard practice for spacecraft of the German AMSAT section.

The scientific scope of the ARCHIMEDES project involves in situ measurements in the Martian

atmosphere, magnetic environment and surface throughout almost the entire altitude range reaching from outer space to ground.

Another important goal of the project is to demonstrate and qualify the ballute technology for entry into planetary atmospheres at high velocities on a representative mission. The term "ballute", combining the words "balloon" and "parachute", was coined by the Goodyear Aerospace Corporation when the company pioneered the technology for NASA back in the 1960s. Although an actual flight test was never done, data gained during

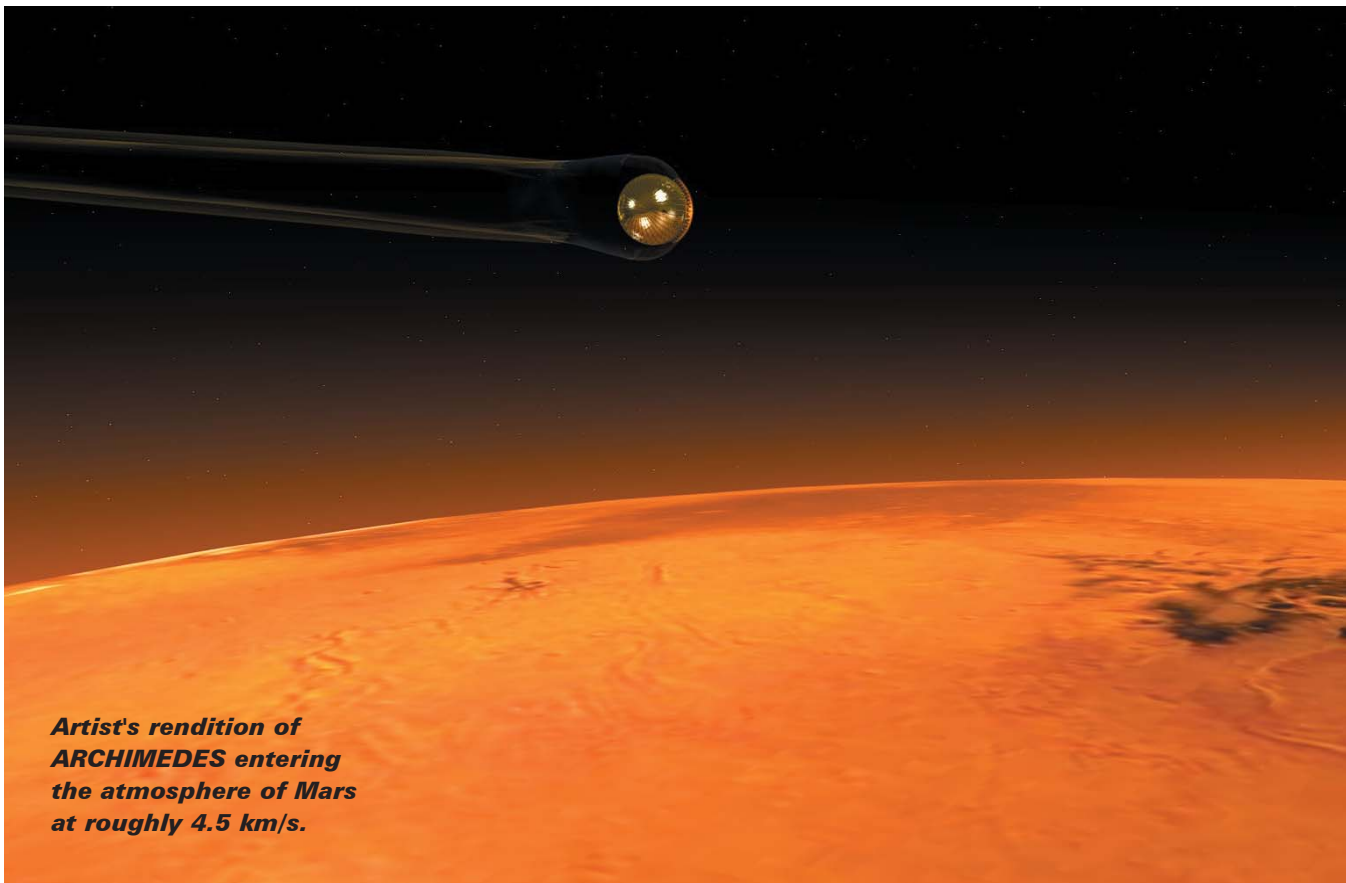
their extensive research program can still be used today in the design phase of ARCHIMEDES.

The suggested payload suite is reflected in the mission name, which forms an acronym for "Aerial Robot Carrying High-resolution Imaging, a Magnetometer Experiment and Direct Environmental Sensors". Hence, the primary payload constitutes a high resolution camera suggested by the DLR center for planetary exploration Berlin, a magnetometer experiment provided jointly by the IGEP institute of the technical university of Braunschweig and the private company MAGSON of

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***The suggested payload suite is reflected in the mission name, which forms an acronym for "Aerial Robot Carrying High-resolution Imaging, a Magnetometer Experiment and Direct Environmental Sensors"***

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***Artist's rendition of ARCHIMEDES entering the atmosphere of Mars at roughly 4.5 km/s.***

Berlin, and the so called ATMOS-B weather sensor suite suggested by the Finnish Meteorological Institute (FMI) of Helsinki. Additionally, a pyrolytic compression wave temperature experiment by the IRS institute of the Technical University of Stuttgart and a high sensitivity accelerometer built jointly by the technical universities of Iasi and Pitesti in Romania are foreseen to ride in the nose cover assembly, which will be jettisoned after the transition to subsonic speeds.

To augment the science return of the mission, a low weight low power radar altimeter is currently under development for ARCHIMEDES which will give altitude accuracy between 1 and 10 meters for a range of up to 100km. The validation of this altimeter will be part of the flight test program.

The flight and operations testing activities are carried out within the program CLEOPATRA. Testing in the past involved many major and minor tests, most notably a large scale deployment test done at the Olympia Hall in Munich in 2004, a parabolic flight test, the in-space deployment test REGINA and the in-space deployment and inflation test MIRIAM.

During the 40th ESA parabolic flight campaign in June 2005, a 1:2 scaled model of the ARCHIMEDES deployment system was verified.

The deployment system was designed, manufactured and qualified using facilities of the University of the Bundeswehr in Munich, Germany. By using a servo-actuated interlock mechanism it was possible to reset starting conditions with a folded, packed and locked balloon package in less than 50s after deployment. This allowed repeated testing during the campaign. All test objectives were met, the reliability of the deployment system was found to be 95%.

A modified deployment system was tested in space as part of the REXUS-3 sounding rocket campaign (project REGINA). Parallel to the improvement of already tested structural components the deployment system was enhanced to further improve reliability. A second mechanism was developed and implemented to separate REGINA from the REXUS

rocket. For evaluation of the separation and deployment process a camera module was put on top of the REXUS rocket. After finishing the manufacturing process REGINA underwent extensive structural, dynamic and vacuum tests in order to guarantee complete conformance with sounding rocket flight specifications.

REGINA was flown on April 5th, 2006 from the ESRANGE facility near Kiruna, Sweden, on top of a Rocket launched by the Mobile Rocket Base group (MORABA) of the German Aerospace Research Center (DLR) at Oberpfaffenhofen. The balloon was deployed successfully.

Program CLEOPATRA so far culminated in the in-space inflation test MIRIAM on the 22nd of October, 2008. MIRIAM was to test the complete mission scenario for the first time, however did not meet all of its mission goals when the spacecraft failed to properly separate from the rocket. MIRIAM's ballute had a diameter of 4m and was made of a polyimide by the trade name of UPILEX. Launch this time was provided by the newly formed EuroLaunch consortium, of which MORABA is a major part, from the ESRANGE complex.

The next step in the development of ARCHIMEDES would be the repetition of the spaceflight test MIRIAM. Based on the architecture of MIRIAM, its successor would feature not only a different separation mechanism, but also an improved ballute, an improved spacecraft bus and an improved observation system. However, funding for this mission remains to be raised. We therefore welcome all contributions towards the continuation of this program. 🍷

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*To obtain more information please feel free to direct inquiries to the German Mars Society - an independent organization affiliated with the International Mars Society - at either hg@marsociety.de or hannes.griebel@unibw.de. More information is also available at the German Mars Society's web site.*

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inherits a decade of discovery at Mars (and elsewhere).

Mars will continue to dazzle scientifically, as the observations from a decade of sustained robotic exploration are synthesized and better understood. Recent discoveries suggest a much richer history of persistent surface waters and a modern era of "buried water as ice" that may be a critical element in any strategy that searches for evidence of life off of planet Earth.

There is no question the MEP has delivered spectacular results and capabilities that will feed-forward to essential future missions, including robotic sample return and eventually for human surface exploration of Mars. It is important to recognize that a sustained "Mars Observing System" will enable the US to continue its leadership role at the frontier of deep space. The NASA Mars team across such key centers as JPL, ARC, GSFC, KSC and at affiliates such as Johns Hopkins APL and industrial partners (Lockheed Martin, Ball Aerospace, SWRI, Northrop Grumman, etc.) are ready to deliver amazing new missions to the Red Planet within the next decade. The opportunity for such missions is essential, if the expertise across NASA and its primary partners from industry is to be maintained and strengthened.

While balance is essential in NASA's science portfolio, Mars does hold a special place by virtue of its proximity and the possibility that it may have harbored biological activity independent from our home planet. It is a bonafide frontier worthy of human wonder and exploration, and thanks to the past decade of discovery, it is ripe for a new era of understanding as we pursue our own place in the vast Universe. 🍷

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*Dr. Jim Garvin, Formerly NASA Chief Scientist, and NASA Chief Scientist for Mars Exploration, is currently Chief Scientist, NASA's Goddard Space Flight Center*



# Phoenix - An Interview with Dr. Peter Smith

by Chris Carberry

[Editor's note: this interview was conducted in early November, 2008.]

Q: What is the current status of Phoenix?

A: Winter is coming and the Sun is setting. It's getting colder and dust storms are more common. After a day of high energy usage, a dust storm reduced our solar power and put us into crisis mode. We have not been able to recover, although we're still trying. We'll continue to try, but at the moment the possibility of contacting Phoenix is extremely low.

Q: Did the lifespan of Phoenix exceed what you expected?

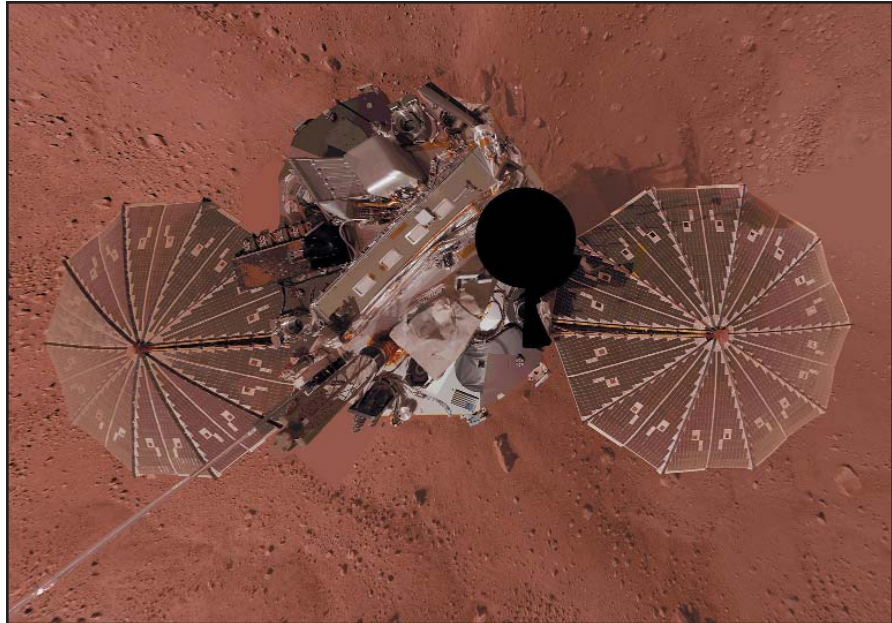
A: When we wrote our proposal six years ago, we promised 90 primary science days, when we'd do our sampling — then 60 extended mission days to take us up to Sol 150. What actually happened is that on Sol 151 we lost communication with the spacecraft. So its lifetime is exactly what we estimated.

Q: What are the origins of Phoenix, and did The Mars Society have any influence in the origin of Phoenix?

A: In a way it did. Two members of The Mars Society Steering Committee, Carol Stoker and Chris McKay, called me and that conversation was the genesis of this mission. So, it was your Steering Committee members that got Phoenix started. I always thought that the one thing missing in The Mars Society plan for colonizing Mars was a destination — where do you go? Connecting with the HiRISE experiment would be a good start for that search. After all, you've got to find a place where you can drill a well for a water supply. The Mars Society should be actively involved with space missions, rather than just reading about them in the newspaper.

Q: Do you see a role for The Mars Society taking on a role in this type of mission in the future?

A: It depends on what kind of mission it is and who's going to be able to participate in it. Many of The Mars Society members, aren't free to participate 100 percent of the time. However, I think they could contribute



ideas and offer support in various ways, and certainly be part of a public outreach program. For instance, The Planetary Society likes to participate in all missions. The Mars Society could do it for the Mars missions.

Q: What are the implications for a human mission to Mars based on what you have learned from Phoenix?

A: Well, we're putting that story together now. As of today, I realize that this mission is probably over, so now is the time to pull together all of the data and figure out what we've learned. We haven't quite completed that, but the discovery of perchlorate on Mars raises questions about astronaut health. It is a serious problem if you find it in drinking water on the Earth — even at the parts per billion level. We're seeing it at a much higher level on Mars, nearly 1%. So, you have to wonder — are there other components in the Martian environment that are actually toxic to humans? I don't think that perchlorate is one of the worst by any means, but it was a surprise. It causes thyroid problems in humans and future astronauts need to take care.

Q: Would you call the discovery of perchlorate a disappointment?

A: You know how they filter it out of drinking water on Earth? They use bioremediation. Microbes like to eat

perchlorate. It's a source of oxygen for them and of course an energy source. So the perchlorate story has many levels of meaning. We're still trying to piece that story together. The fact that we have found something on Mars that is considered toxic, although not extremely toxic, has implications for future missions. I think robotic missions are of critical importance before you dare send humans to Mars. Can you imagine breathing perchlorate dust for a year and a half? All of a sudden you're getting these mysterious growths all over your body and a thyroid as big as a football.

I wouldn't call finding the perchlorate a disappointment, because it is a source of energy for microbes. What it means to me is that there are still profound surprises to be found in the composition of the Martian soil. Despite all the previous missions, to find something like perchlorate, which is also the oxidizer in rocket fuel, just raises all sorts of interesting possibilities. Once you know it's there, you can come up with ways to deal with it — to be prepared. Humans should have little problem protecting themselves from perchlorate. It's the substance that you don't know about, that you're not prepared to deal with, that's much



scarier.

Q: Were you surprised how close to the surface the water ice was? Finding water would seem to be a positive development if we intend to send humans to Mars.

A: Yeah, that's absolutely true. It's only a few inches deep. Mars scientists who had studied the polar region from space and had done theoretical modeling thought it would be just a few inches deep. I was actually hoping that it would be a little deeper. I would have preferred if it was 20 centimeters deep. Then you have a nice trench and you can look at the history of the soil through the trench, but if it is only 2 inches deep, your trench is one scoop deep and it is very hard to subsample that.

Q: Despite not being able to dig a trench, I'm sure the first images must have been pretty exciting for you?

A: You know the alternative was that there was no ice at all and you would have gone there with the expectation of studying the history of ice and you wouldn't find any. So, we were overjoyed to find it. Especially exposed by the thrusters which told us right away how deep it was.

Q: What do you think was the greatest achievement of the Phoenix mission?

A: I'm not ready to label the greatest achievement yet because we're just getting the in-depth analysis going on in our data sets. As you know, we have a fairly small team compared to some of the other missions and we've been just totally occupied with gathering data. The three major discoveries that we have now are all pretty interesting: The calcium carbonate and the alkaline soil, the perchlorate story and the interaction of the atmosphere with the surface. In fact, we actually see it snowing on the surface. Those three things I think are major discoveries, but I really don't want to say that we won't have another one. We'd really like to be able to say something about organics — either positive or negative — whatever the truth might be. We took the type of data that should help us unravel that story.

Q: Shifting gears, do you see this partnership with NASA to be a model

for the future particularly given the fact that NASA will likely have tight budgets for the foreseeable future?

A: I like the model — obviously — it works well! When you have one person in charge of the science, it keeps the mission focused on well-defined science goals. Some missions have 10 PIs and do science by committee. Cross-instrument studies are much harder to do when you have many PIs that have strong personalities and don't necessarily get along well. When the tough choices need to be made, the PI can, hopefully, make wise decisions about how to proceed. The next Scout mission is called MAVEN (Mars Atmosphere and Volatile Evolution) and will launch in 2013. After that, nobody knows what the Mars program will become.

Q: Will MAVEN have the same sort of management structure as Phoenix?

A: It's a scout mission. A PI will be leading it, Bruce Jakosky from the University of Colorado, where The Mars Society was founded. That's where it's being run and it will be an orbiter looking at the atmosphere. Hopefully it will be able to detect bio-signatures. What I like about this model is that you can actually operate a spacecraft from a university. You can have the full resources of a university and work closely with students rather than a NASA center that is set up to do engineering development.

Q: How much outreach were you able to do within the University [of Arizona] and the community?

A: The University is very excited about the program. We were the poster child for the last year. We've been involved in all sorts of activities from the dance department, the art department...

Q: What did the dance and art departments do?

A: The dance department actually did an interpretive dance on space travel. Young school kids wrote poems — then UA students danced to the poems. It was really great. They did a couple of other interpretive pieces about Mars. The entire program had a Mars theme; really a magnificent night. The art department

painted a 60' x 20' mural on the front of our building. Twelve students got class credit for mural painting. Also, the band did a half-time show about Mars and they had a rocket flying to Mars sketched out with all the band members and then I think there were about twelve of them all dressed as aliens holding their cymbals and they had flames coming out of the top of the cymbals. The whole thing was incredible. They also did a cadence "I don't know but I've been told, planet Mars is really cold..." with about six verses. They were chanting it as they marched around the field at half-time. So, there were all sorts of interactions going on with the university.

Also, we got all sorts of publicity at the university and they loved it because it shows them off as a premiere research university, running their own Mars mission. They donated our operations building, which cost them \$8 million.

Q: I think just this element makes this worthwhile. You were able to build up excitement at your university that would not be possible at JPL or elsewhere....

A: And, we hired approximately 25 or 30 students who worked with the scientists and supported the mission. Several of them have changed their careers to become scientists. They think it's really cool now after seeing how it really works. We had an open door policy for students who wanted to participate. I'll tell you, many of us getting kind of old in the space business. We need the young blood.

Q: What do you think is the most important next step for robotic missions? Do you think we are on the right track?

A: Well, the next rover, Mars Science Laboratory, is quite complex. I sure hope it works. It's the most complicated project that JPL has ever done. The landing system is all new. The complications of getting this rover to work are beyond what they ever expected. I hope they haven't bitten off more than they can chew and that we really do have a successful program. It's still not clear that they're going to launch next year. If everything goes right, they can do it. If two or three things go wrong, they

may miss their launch date. That worries me. I think the MAVEN mission should be a good one — it's an orbiter of course. Still there is an awful lot to be learned from landers. I'm a proponent of landers, as is The Mars Society. I think we've generated a lot of excitement by landing with thrusters...

Q: True. It is unlikely that astronauts would land with airbags...

A: True. The Mars Science Lab has thrusters as well, with a Sky Crane.

Q: What do you think are the greatest challenges for the next 10 years?

A: Can we get any more money beyond 2013? The Mars programs started evaporating during the last few years. We're in a position where we're not sure what our future is after 2013. People talk about sample return, and then they're scared it's going to cost umpteen billions of dollars — nobody can afford it and it might not work. So, what is the Mars program?

Q: I suppose it depends on the next few months to see what the next administration's true view towards space exploration and who they pick for various positions.

A: As you say, it really depends on who they pick and what their instructions are when they take over. I don't know if the vision of sending astronauts to the Moon and later Mars will survive. It could be cancelled. After all this development, it would be a shame.

Q: How do you see the relationship between humans and robots in this type of exploration? Where do you see each of them being most important?

A: I've been watching this program developing for a long time and I don't see us any closer to Mars than we were 10 or 15 years ago. Every year we move forward in time, the Mars mission moves ahead two years. So I'm really a big proponent of a major robotic, super exploration of Mars. There are so many interesting places and frankly we really don't really know where to send a human on Mars. We don't know enough about the various places on Mars to choose which one

would be best for human activity. I think we have a way to go. The place that you would send humans to is a place where you could dig a shallow well, maybe down a couple of hundred feet and have some hope of bringing water up to the surface. That would be ideal. Can we find that? I think we should try. But, I don't think the polar regions are a good place for humans to land.

Q: Other than extremes in temperature, what are the other reasons for this?

A: Well, when you build a launch facility, you try to avoid the poles because you like to use the centripetal force caused by the rotation of the planet at the equator. If you're up at the polar regions, it's small. There are a lot of reasons why you wouldn't want to be at the poles. It takes an awful lot of energy to melt ice if you want to use it for a water supply. The ice is at minus 90 centigrade, so you're going to have to heat it up to zero and then you are going to have to put in the heat of fusion to melt the ice before warming it to room temperature. It would be much better to pump liquid water if you can find it at an equatorial site.

Q: What do you think the odds are of finding liquid water? There has obviously been evidence of its existence, but do you think it is likely?

A: I don't know the answer to your question. But, Mars is full of surprises and water is in there somewhere. What about these gullies? You know, we've learned a lot about Mars. After returning in 1997 and during the last 10 years we've learned a tremendous amount about Mars through orbiters and landers. I think if we continue that kind of high energy exploration it is certain that we will find things that are of great interest — like water below the surface.

Q: Do you have any other comments that members of The Mars Society might be interested in about this mission or the general goal of humans to Mars?

A: Well, we went to Mars looking for a habitable zone and in preparation for that, we also took a trip to Antarctica a year ago and did similar

science in the a remote dry valley — a place that has not seen a drop of liquid rain for 10,000 years. We dug down to an ice/soil boundary. The ice was about 30 centimeters deep and analyzed some of it in our laboratory, and by God if there aren't a colony of microbes living in it. That gives me a lot of hope for Mars. But we really don't yet have the right tools for seeing microbes in the ice/soil boundary. We're trying to piece together the scientific evidence to determine whether this is a place that is habitable. That means that there isn't necessarily anyone living there — we're not claiming that there is Martian life, but does the soil have all of the right ingredients for life and maybe not even today but maybe in the last 5 million years when the climate changed with the tilt of the polar axis. As the climate warms up there may be liquid water and as the soil gets wetter, there could be a place where life really can exist. That's the goal of our mission. We just finished our operations phase and we have just started our data reduction and analysis phase, so we don't have the final answers to that, but I hope in the next six months we will be able to make definite statements about habitability — either yes or no.

Q: It would be pretty exciting news, particularly at the beginning of a new administration. Such an announcement could have a tremendous impact on future programs.

A: Wouldn't that be something. I think it really does propel future exploration. Finding something of great importance to the people of Earth — not just a mineral that they've never heard of — but something to do with living creatures — I think they would be much more excited to send missions to Mars — and to send humans to Mars. We're hoping we can find something of that nature.

Q: Quite obviously, so do I. Good luck in the hunt, and thank you for doing this interview. 🍎

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*Dr. Peter Smith is the Principal Investigator, Phoenix Mars Mission*



# Membership in TMS

*By Patricia Czarnik,  
Membership Chairperson*

Hi All! I am quite excited about this new venue for reaching out to members. The ultimate goal is to have a place where chapters can showcase what they are doing, share their successful (and not so successful) projects, events, membership drives, etc.

The coming year holds a lot of uncertainties and more than ever we need a strong grassroots effort to continue our goal of humans to Mars. We need each member to continue spreading the word and we need more members. With the new administration we will need to continue our efforts to inform Congress to not only continue manned spaceflight in the United States but to make Mars the goal.

Over the next few months I would like to initiate a membership drive challenge for chapters. I would like your input as to how you think would be the best venue to do this. There are also plans to reinstate the Political Outreach contest for chapters.

Look for more to come in future newsletters. 🍀

Contact Patt Czarnik via email at: [pattczarnik@hotmail.com](mailto:pattczarnik@hotmail.com)

# THE MARS SOCIETY

OFFICIAL MEMBERSHIP AND DONATION FORM

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Fax this form to 307-459-0922, or Donate online at  
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**The Mars Quarterly**

# Ares V - Bigger is Better

by Scott "Doc" Horowitz

When I was in the 4th grade, I lived in Indian Harbor Beach, Florida about 30 miles south of launch Pad 39 at the Kennedy Space Center. I remember the headline in the local paper that stated: "The Saturn V won't go up, Florida will go down!" On November 9th, 1967, I watched the first Saturn V liftoff; it was like watching a skyscraper take flight! I thought that when I was older that I might fly a giant rocket ship like that to Mars.

America had a capability matched by none, we could send 118MT (260,000 lb) to LEO, and 47MT (100,000 lb) to the moon. The last Saturn V flew on December 6th 1972 and then America gave up the ability to explore space beyond Low Earth Orbit (LEO). I have been fortunate to have been afforded the opportunity to help explore space in LEO, but it has been a quarter of a century since we gave up heavy lift and the associated capabilities to explore our universe. It is time to restore this capability so that the next generation of Americans can become the world leaders in space exploration and enjoy all the associated benefits.

In 2004 the White House issued The Vision for Space Exploration which directs NASA to:

- Complete the International Space Station
- Safely fly the Space Shuttle until 2010
- Develop and fly the Crew Exploration Vehicle no later than 2014 (goal of 2012)
- Return to the Moon no later than 2020
- Extend human presence across the solar system and beyond
- Implement a sustained and affordable human and robotic program
- Develop supporting innovative technologies, knowledge, and infrastructures
- Promote international and commercial participation in exploration

In 2005 NASA conducted the Exploration Systems Architecture Study and determined that the best launch vehicle architecture to accomplish these goals was the "1.5 launch architecture" consisting of the Ares I and Ares V launch vehicles. The Ares I is optimized for crew safety and provides the necessary performance to deliver the crew to LEO while delegating the job of lifting the fuel, cargo, and other equipment required for journeys beyond LEO to the Ares V. Every serious study of space exploration architectures has come to the same conclusion: you need heavy lift if you want to send people anywhere beyond LEO. The airline industry has come to a similar conclusion: You can't send a Learjet to do a jumbo jet's job.

The Ares V is a BIG launch vehicle. The current Point of Departure (POD) design for the Ares V can deliver 150MT (330,000 lb) to LEO. The combined Ares I/Ares V system can send over 70MT (154,000 lb) to the moon, or 154% of what a Saturn V could deliver! This capability will allow us to do substantially more on the moon, and enable exploration missions to Mars and beyond. The Ares V and Ares I launch vehicles build on the best propulsion systems from the Saturn V, the Space Shuttle, and current Evolved Expendable Launch Vehicles (EELVs). The Ares I first stage utilizes a 5-segment Solid Rocket Booster (SRB) derived from the Space Shuttle's 4-segment SRB, and uses an updated version of the Saturn V's J-2 (the J-2X) liquid Hydrogen/liquid Oxygen rocket motor for the second stage. The Ares V uses the same SRBs, and adds six updated RS-68s (the RS-68A) used on the Delta

IV EELV. The Ares V core stage is derived from the Space Shuttle External Tank but is larger in diameter (33 feet, the same as the Saturn V). The Ares V also uses the J-2X for its Earth Departure Stage (EDS). The Ares I, using Probabilistic Risk Assessment, is predicted to have a

failure rate of 1 in 450, while the goal for the Ares V is to be better than 1 in 100. This architecture delivers high mission reliability with a low probability of loss of crew

during ascent (better than 1 in 2,500). The Ares I program has completed its Preliminary Design Review (PDR), has all the elements on contract, has completed initial testing for the J-2X, has hardware in production for the first stage which will have its first full-scale static firing next summer, and will launch Ares I-X, a full-scale flight test vehicle, several months after launch pad 39B is released from supporting the next Hubble servicing mission. In only three years since ESAS, real progress has been made in developing the Ares I and Ares V and transitioning the Space Shuttle infrastructure and workforce to support exploration missions. Since the Ares V uses much of the same hardware as the Ares I (SRB's, J-2X, upper stage structures, etc.) all of the Ares I development work is directly applicable to the Ares V. Not only is the hardware development on Ares I supporting the Ares V development, but more importantly the "retooling" of NASA and the contractor workforce to restore the ability to design, test, and operate this class of launch vehicle is well underway. So by separating crew and cargo to the maximum extent possible, optimizing the Ares I to safely deliver the crew to LEO, and developing the Ares V to do the



Concept of Ares V in Earth orbit.

image credit: NASA MSFC



heavy-lifting, the safest, highest mission success, most cost-effective launch architecture is achieved.

There have been numerous studies about architectures to accomplish human missions to Mars. In general the conclusion is that you need to be able to deliver to LEO the equivalent mass of one or two International Space Stations; which weighs approximately 250MT (550,000 lb), to send a mission to Mars. Some have suggested that EELVs or other launch vehicles could support space exploration. The table below shows why this is a bad idea (or as my Calculus professor used to say: "it is intuitively obvious to the most casual observer..."). In order to accomplish a lunar mission a single Ares I/Ares V pair will be launched with a single rendezvous and docking. The probability of losing the crew during ascent will be approximately 1 in 2,500 and the probability of losing the mission during launch will be approximately 1 in 85. In contrast using the EELV (heavy variants) will require 8 launches with 7 rendezvous and dockings (6 of which will be automated). For this approach the probability of losing a crew during ascent will be approximately 1 in 133 (assuming a 75% effective launch abort system) and the probability of losing the mission will be approximately 1 in 4.6 (not including the probability of an unsuccessful docking). For a Mars mission the situation is even more acute. The Ares I/V system will require a single Ares I and at least two Ares V launches

while an EELV approach would require at least 15 launches. For the Ares I/Ares V architecture the probability of losing the mission during launch will be approximately 1 in 46. For the EELV architecture the probability of losing the mission during launch will be approximately 1 in 2.7. As far as cost is concerned, it is hard to imagine how launching 15 EELVs and performing 14 rendezvous and dockings and on-orbit operations could ever be competitive with launching a single Ares I and two Ares Vs. In other words; don't send a Learjet to do a jumbo jet's job. (See Figure 1)

In summary, the only way to get humans to Mars is to develop the Ares V heavy lift rocket, and the quickest way to get the Ares V flying is to develop the Ares I. If the new Administration provides NASA with sufficient resources to complete the International Space Station and properly fund NASA's Exploration program (Constellation), in the not-too-distant future a 4th grader will stand on the beach in Florida, look up in awe as the Ares V lifts off, and think about being one of the first people to walk on Mars! 🍀

*Scott "Doc" Horowitz is a retired USAF Colonel, F-15 fighter pilot, test pilot, four-time Shuttle pilot/ commander, and previous NASA Exploration Associate Administrator. He is a founding member of the Mars Society, current member of the Board of Directors and has a PhD in Aerospace Engineering. He currently is the President of Doc's Aerospace.*

Figure 1	Ares I	Ares V	Ares I/V	Heavy EELV
LEO Performance (MT)	25	150	175	25
Reliability (per flight)	0.998	0.99		0.97
# flights per Lunar Mission	1	1		8
# flights per Mars Mission	1	2		15
Probability of Loss of Mission (Lunar)	1/450	1/100	1/85	1/4.6
Probability of Loss of Crew (Lunar)	1/2,500		1/2,500	1/133
Probability of Loss of Mission (Mars)	1/450	1/50	1/46	1/2.7
Probability of Loss of Crew (Mars)	1/2,500	1/2,500	1/2,500	1/133

*Author's Note: The attached link takes you to a petition I have started asking President-elect Obama to keep Michael Griffin as the NASA Administrator. If you too would like to keep Michael Griffin as the NASA Administrator please sign the petition and forward to as many people as you can.*  
<http://www.ipetitions.com/petition/KeepMike/>

# The 12th International Mars Society Convention

July 30-August 2, 2009  
 University of Maryland  
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## Speakers Include:

- NASA Scientist Dr. James Garvin
- Nobel Prize Winner and NASA Scientist Dr. John Mather
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## The Great 2009 Mars Blitz

The Mars Society will be sending over 100 people to Capitol Hill to tell Congress why they should support human missions to Mars.

*Don't Miss It!*



# No Challenge too Big for University Teams

by Kevin F. Sloan

The hot sun above seemed to mask the torrential downpours that marked the previous day, and didn't give any indication of the unfathomable winds coming the next. For the five dozen students standing in a gravel parking lot in Hanksville, Utah, the only point of focus was the last minute testing of their rovers on this barren, rocky terrain in preparation for the next two days of competition.

The first week in June is typically the time of year when most college students are occupied with final exams, or are just beginning summer internships. Few would think of packing up a year's worth of hard work and driving into the desert of southern Utah for a friendly intercollegiate, and perhaps interplanetary, competition.

The students competing in the second annual University Rover Challenge (URC; held June 5-7, 2008) were not here on a "typical" assignment. There were no textbooks, no homework assignments, no lectures, and no extra credit — only a year of preparation, and four difficult tasks. Each task required the expertise of students from many fields of study, all working together. And therein lies the biggest challenge of all - the one that doesn't appear in the rules, or in any of the instructions given to teams - just making it to the Mars Desert Research Station (MDRS) with a working system. Robotics has always been known as a multidisciplinary field, and it only becomes more complex when the tasks the robot is performing become more complex and cover more fields.

The humans vs. robots debate concerning Mars exploration has long since evolved into the challenge of building robots that can aid humans on the surface of Mars. Robots that can join the team to supplement an astronaut's dexterity, participate in meaningful science exploration, and even conduct rescue missions. Work this complex should require large industry and government teams



working with unlimited funds. But these college students are proving that not to be the case. They are showing that students aren't limited in their ability to work on complex, multi-disciplinary systems, that they do have critical project management skills, and that when presented with the opportunity, they can accomplish seemingly any task set before them.

In 2009, the URC challenges will only get harder. More challenging versions of the 2008 competition's Construction Task, and Emergency Navigation Task will be coupled with an Extremophile Search Task and a Site Survey Task.

While the challenges will be more difficult, the one constant will be the enthusiasm and tenacity of the college students competing. Every year they continue to impress the judges and exceed all expectations - all while continually proving that there is no substitute for being passionate about your work. If these students are the future, then there is a lot to be optimistic about in these uncertain times. 🍊

*Know any students who are up for the challenge? Visit [www.marsociety.org/portal/c/urc](http://www.marsociety.org/portal/c/urc) to learn more about the 2009 University Rover Challenge.*





# TEMPO<sup>3</sup> to Demonstrate Critical Humans-to-Mars Technology

by Tom Hill

When humans travel to Mars in zero gravity, the 180-day trip has the potential to leave them weak and fragile when they arrive. Using some basic physics and the discarded upper stage that sent the craft on its way to Mars, the crew can travel in an artificial gravity field, keeping themselves fit for action when they land on the Red Planet. The Mars Society will answer fundamental questions about this technique with its Tethered Experiment for Mars inter-Planetary Operations Cubed (TEMPO<sup>3</sup>) project.

TEMPO<sup>3</sup> is a CubeSat-based mission designed to test basic assumptions about tether-generated artificial gravity. CubeSats are small (typically 10 cm on a side, though variations are possible) satellites that have become a

sort of standard for universities and small groups who are interested in launching a space mission. The spacecraft (pictured, in its deployed state) will spin to generate artificial gravity, and then transmit data describing the amount of acceleration being generated to receiving stations on Earth. The team is also investigating other transmissions, for public outreach and potential scientific study.

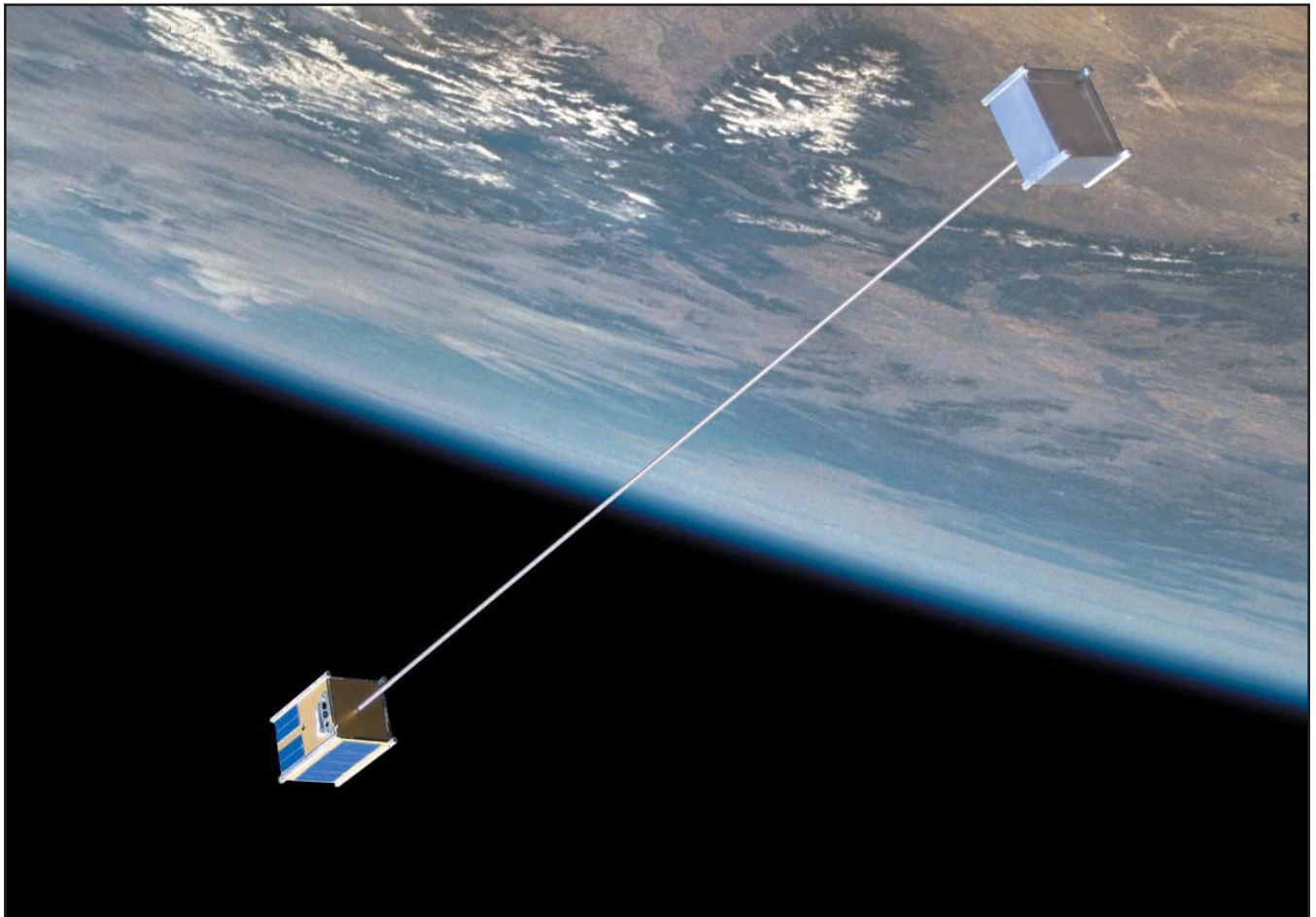
Efforts so far have been devoted to forming the teams and starting design and public outreach work. Current plans have us completing a preliminary design by early February 2009, then having an independent panel review it before team members attend the CubeSat conference in April. At the conference, we hope to

firm up potential launch dates, then move into final design and integration.

TEMPO<sup>3</sup> is an all-volunteer Mars Society effort. From team leaders through model builders and graphic artists, people who've expressed an interest in a specific portion of the project have helped greatly. We need more people, however, especially in the area of fundraising. TEMPO<sup>3</sup>'s budget is \$500k, though early challenges in fundraising have forced us to turn a critical eye towards this small (by space mission standards) amount. 🍎

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*If you can help, or are interested in contributing, please contact Tom Hill at [tomhill@marsociety.org](mailto:tomhill@marsociety.org).*



*The TEMPO<sup>3</sup> satellite deployed in orbit.*

ARTIST RENDITION BY CL VANCIL

# The Change We Need

by Robert Zubrin

As the year 2008 moves toward its close, those of us concerned with the human future in space are faced with both a crisis and an opportunity.

On the one hand, the situation appears to be dismal. The U.S. budget deficit is running at a record level of \$500 billion this year, with all signs pointing toward an incredible trillion dollar red-ink blowout next year. Our new President, while not an outspoken opponent of the space program, has no track record of support for it either. So, if budgets need to be slashed, NASA - particularly the Bush administration's Vision for Space Exploration - could easily end up on the block. This is all the more the case since NASA unwisely chose to devolve the VSE from its original formulation as Moon-Mars-and beyond vision to a Moon-only program, thereby depriving it of all popular support or scientific justification.

On the other hand, the displacement of the Bush crowd from policy making positions provides an opportunity to reformulate the space program into something much better than the Lunar dead-end that the VSE had become. Spending the next generation working on an "Apollo on geriatrics" return to the Moon would have been an enormous waste. Now we have a

chance to escape that fate.

During the election campaign, Barack Obama criticized the American space program, saying it was no longer inspiring people the way it had done in the 1960s.

His point is well taken.

But is the answer for an uninspiring space program cancellation, or transformation? Do we simply abandon the timid goal of a return to the Moon, or bravely embrace the challenge of humans to Mars?

Calling for the initiation of a bold space program in the face of current economic crisis may seem totally unrealistic, but the fact of the matter is that it is in the toughest of times that the greatest of deeds have been done. It was the Lincoln administration, faced with a rebellion that threatened to destroy the nation, that initiated the visionary project of building the transcontinental railroad. It was the Roosevelt administration, faced with a fascist onslaught to enslave humanity, which initiated the greatest scientific mobilization the world had ever seen. It was the Kennedy administration, faced with imminent threat of nuclear war, that launched us on our path to the Moon.

With respect to the space program, the situation remains as it has for the past three decades. NASA needs a goal, and that goal should be humans

to Mars. This is so, because Mars is where the science is, it is where the challenge is, and it is where the future is. But with respect to the nation, the issue has reached its critical moment. We are faced with, as Obama has said, quoting Dr. Martin Luther King, Jr., "the fierce urgency of now." Because now is the time when we decide whether we are going to rise to the occasion or not. Is the dream of an unbounded future going to live, or will it die, snuffed out by a defeatist acceptance of the age of limits?

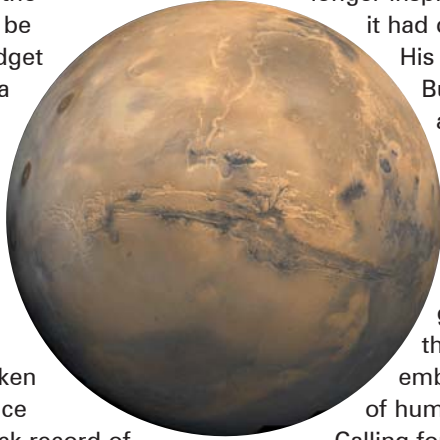
"Do not go softly into that good night."

It is in times of darkness that the torch needs to be lit. It is in times of fear that the flag needs to be raised.

A humans to Mars program would help mobilize our economy, at a time when it needs to be mobilized, and inspire millions of youth to develop their minds. But it would do more than that. It would raise the flag, the flag of courage, and hope, and the pioneer spirit. It would say to the world, and to ourselves, that we will not accept defeat. That we remain a nation whose great deeds will continue to be celebrated in newspapers, and not just in museums. That we as a nation are not old, but young; that we are living not at the end of our history, but at its beginning. It would say, in no uncertain terms: "Yes we can."

That's the change we need. 🇺🇸

*Robert Zubrin is the President of The Mars Society.*



**THE MARS SOCIETY** is a 501(c)3 tax-exempt non-profit organization with headquarters in Colorado, USA, committed to furthering the goal of the exploration and settlement of the Red Planet, via broad public outreach to instill the vision of pioneering Mars, support of ever more aggressive government funded Mars exploration programs around the world, and conducting Mars exploration on a private basis.

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