THE MARS QUARTERLY

PUBLISHED QUARTERLY (EARTH TIME) BY THE MARS SOCIETY

VOLUME 5, ISSUE 2 – FALL 2013

Together to Mars

Robert Zubrin

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Ludovic Celle

IN THIS ISSUE

On the Cover – "Mission to Phobos"

(Credit: Ludovic Celle - http://ludoviccelle.com).
Please also visit Mr. Celle's Da Vinci-Mars Design blog, at: http://davinci-marsdesign.blogspot.fr.
The blog is inspired by the Mars trilogy of K.S. Robinson.

FROM THE FLIGHT DECK

One of the main goals of the Mars Society is to create a greater public understanding of the importance of Mars exploration and the need for a long-term human presence on the Red Planet. As a membership-driven organization, the Mars Society has established chapters across the United States and around the world to help in this effort.

Much of the public outreach carried out by the Mars Society is done through local chapters. Chapter representatives reach out to the general public by organizing Mars-related lectures and discussions and setting up informational tables and displays at public events. A number of chapters also cultivate strong ties with local media to help promote humans-to-Mars.

In addition, chapter members cooperate with educational institutions, ranging from grade schools to universities, to create programming and discussions that answer space-related questions, clear up misconceptions about a human mission to the Red Planet and provide Mars advocates with an opportunity to make personal contact with young people.

The Mars Society has seen steady growth in the number of chapters in the U.S. and internationally over the last 3-4 years. Currently, there are 18 chapters in the U.S. and 19 international chapters. Three new chapters have sprung up over the last 12 months – China Lake & Upper Mojave Desert (California), Maryland/Washington, D.C. and Philadelphia.

If you're interested in joining a Mars Society chapter, please visit our web site (www.MarsSociety.org) for more details. If you would like to help build a chapter in your area, with the help of Mars Society membership and management, please contact us (info@MarsSociety.org) to learn how.

Michael Stoltz, Editor

THE MARS QUARTERLY

Fall 2013 – Volume 5, Issue 2

Publisher: The Mars Society
Headquarters
11111 W. 8th Ave., Unit A
Lakewood, CO 80215 USA

www.MarsSociety.org

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Together to Mars

Robert Zubrin

Mars Society President Dr. Robert Zubrin traveled to Moscow in October 2013 to "spread the word" about the importance of Mars exploration, his 'Mars Direct' plan for human settlement of the Red Planet and the need for international cooperation in exploring space.

During his visit, Dr. Zubrin spoke at the Skolkovo Institute of Science & Technology, a private graduate research university established in collaboration with MIT, and at the Moscow Aviation Institute, one of the world's leading engineering schools dedicated to aerospace technologies, and was interviewed by numerous Russian language media outlets.

[A version of this article appeared in the November 19th issue of USA Today.]

SK (Zubrin talking in Moscow)

Russian-American relations are deteriorating. It is not just a matter of side issues like Snowden and Syria. A faction in the ruling camp, exemplified by prominent Putin advisor Alexander Dugin, is urging the regime to embrace a new "fourth political theory" synthesized from communism, fascism, Malthusianism and reactionary traditionalism to prop up its domestic power and make Russia the leader of the global forces opposing the West. "Liberalism," says Dugin, meaning the whole western consensus, "is an absolute evil….Only a global crusade against the U.S., the West, globalization and their political-ideological expression, liberalism, is capable of becoming an adequate response…The American empire should be destroyed." This is very dangerous stuff. It not only threatens the prospects for freedom in Russia, but could lead to a global catastrophe.

We need to turn this trend around. But how? Here's my answer: Let's invite Russia to join with us in a grand project of sending humans to Mars.

The idea has heritage. Dr. Carl Sagan proposed a similar concept to help counteract U.S.-Soviet tensions in the 1980s. It was a good idea then, but critically necessary one now.

Unlike the Soviet Union of the 1980s, which could bask in its superpower status, today's Russia is a nation with something to prove. That could mean real trouble. But a joint Russian-American human Mars exploration program would allow Russia to stand forth before the world as a great nation once again, without needing to muscle anyone.

I was just in Russia, giving a number of talks to technical audiences and the press on Mars exploration. It was very clear to me that space still greatly excites the enthusiasm of the Russian public, and that there are many, many people there of talent and good will who would like nothing better than to be friends with America and work and strive together with us on such a great project. If we extended the invitation,

Let's invite Russia to join with us in a grand project of sending humans to Mars.

they would rush to accept and pull their nation with them.

A humans-to-Mars program is also what America needs for itself. Our human spaceflight program is currently adrift, operating aimlessly without a meaningful goal. If we are to make any progress, we need a concrete goal, and one that's really worth pursuing. That goal should be sending humans to Mars.

As a result of a string of successful probes sent to the Red Planet over the past 17 years, we now know that Mars was once a warm and wet planet, possessing not only ponds and streams, but oceans of water on its surface. It continued to have an active hydrosphere on the order of a billion years -- a span five times as long as the time it took for life to appear on Earth after there was liquid water here. Thus, if the theory is correct that life is a natural phenomenon emerging from chemistry wherever there is liquid water, various minerals and a sufficient period of time, then life must have appeared on Mars.

If we go to Mars and find fossils of

past life on its surface, we will have good reason to believe that we are not alone in the universe. If we send human explorers, who can erect drilling rigs that can reach underground water where Martian life may yet persist, we will be able to examine it. By doing so, we can determine whether life on Earth is the pattern for all life everywhere, or alternatively, whether we are simply one esoteric example of a far vaster and more interesting tapestry. These are things that thinking men and women have wondered about for thousands of years. They are truly worth finding out.

There would be other benefits. The challenge of a humans-to-Mars program would be an invitation to adventure to every young person in the nation, sending out the powerful clarion call: "Learn your science and you can become a pioneer of new worlds." The net result would be millions of young scientists, engineers, inventors and medical researchers, making technological innovations that create new industries, find new cures and increase national income to an extent that utterly dwarfs the expenditures of the Mars program. The same return would hold true for all other nations participating, which could eventually include not only America and Russia, but Europe, Japan, India, China, Brazil and everyone else willing and able to share the costs, risks, tragedies, joys and triumphs of the effort.

Beyond that, there is the ultimate reason to go to Mars: the doorway it opens to the future. Uniquely among the extraterrestrial bodies of the inner solar system, Mars is endowed with all the resources needed to support not only life but the development of a technological civilization. For our generation and those that will follow, Mars is the New World. It is the great challenge of our time, one which can bring nations together in the spirit of the grand endeavor that it truly is.

Russia, America, Europe and Japan are already collaborating on the International Space Station program. But that is a glacial bureaucratic effort, drifting slowly onward in time without objectives. In contrast, if it is to capture the imagination and enthusiasm of the world, the humans to Mars program should be conducted in a radically different spirit, one with the dash and daring of the 1960's space race. Our goal should be bold: Humans to the Red Planet within a decade.

It can be done. As I explain in detail in my book, The Case for Mars, we are much better prepared today to send humans to Mars than we were to send men to the Moon in 1961, when President John F. Kennedy started the Apollo program – and we got there eight years later. If embraced today, a well-conceived hard driving effort could get us to Mars on a similar schedule, at a shared cost of several tens of billions of dollars. This would be a pittance compared to the trillions of dollars and innumerable lives that could be wasted were we once again forced to engage again in global armed confrontation with Russia.

Working together with the Russians could make the humans to Mars program much more robust, adding launch capacity, alternative crew transport, propulsion and life support systems and many other technologies. Of particular interest would be Russian expertise in space nuclear power generation, which is needed to support extended operations on the Martian surface, where dust storms can make solar power unreliable.

The American people want and deserve a space program that really is going somewhere. The forces of light in Russia want a chance to join the free world. We can accomplish both, by joining hands to take on the challenge of Mars, together.

Dr. Robert Zubrin is President of Pioneer Astronautics and the Mars Society and the author of The Case for Mars: The Plan to Settle the Red Planet and Why We Must.

News Brief

2013 EuroMars Conference a Great Success

Mars exploration was front and center in Europe in late October 2013 during a very successful convening of the 13th Mars Society European Conference (EMC13), organized by various European Mars Society chapters. The international forum was held October 25-27 at the Institut Polytechnique des Sciences Avancées (IPSA), a prominent French postgraduate aerospace engineering school in the Paris area.

More than 70 people attended the three-day convention, with participants from France, Germany, the United Kingdom, Austria, Belgium, Italy, Poland, Switzerland and the United States. High-level presentations were given by scientists involved in ongoing Mars exploratory missions and representatives of several leading space agencies, including ESA, CNES and NASA.

Several Mars Society European chapters also presented lectures on Mars related topics, as did Mars Society (U.S.) President Dr. Robert Zubrin. In addition, chapters set up a variety of Mars and space-related educational displays at the conference.

To read the full report about the EMC13, please visit: http://www.marssociety-europa.eu/emc13-report.

MAVEN & What's Next for Mars

Q&A with NASA's Jim Green
Kerri Beauchesne

NASA

On November 18, 2013, the Mars Atmosphere and Volatile EvolutioN (MAVEN) spacecraft launched successfully from Cape Canaveral Air Force Station in Florida. Dr. James Green, NASA's Director of Planetary Science, spoke with me from his vehicle en route to the launch site.

A.Mann (ISRU on Mars)

TMQ: How's the weather looking?
Dr. Green: It's a spectacular day for launch! The window opens at 1:28 and rain isn't forecast until later in the afternoon, so we should miss the rain if we go early enough in the window. There are thousands of people down at the Cape, streaming into the Visitor Center.

TMQ: What specifically do you expect MAVEN to accomplish over the life of its mission?
Dr. Green: MAVEN will interrogate the upper atmosphere and ionosphere to understand how Mars changed from perhaps a blue planet in the distant past to the arid planet we see today. It's all about studying its climate history and the processes that occur, evaporating and stripping out the atmosphere.

TMQ: What do you think might have caused Mars to lose its atmosphere?
Dr. Green: Several possibilities have been considered. Mars had a pretty extensive magnetic field early on. We know this because an earlier orbiter, Mars Global Surveyor (MGS), was able to observe the magnetism still trapped in the rock. If this early magnetic field was anything like Earth's, which we believe it was, it would have protected the atmosphere from the solar wind. When it was in the process of losing its magnetosphere, there would have been periods of high variability in Mars's ability to hang onto its atmosphere. So, in a nutshell, the prevailing thought is that when Mars lost its magnetic field, it lost its atmosphere.

TMQ: How can MAVEN answer this question definitively? What kinds of evidence would point to a cause?
Dr. Green: Mars actually has water tracks under the soil and trapped under the CO2 polar cap, and there are traces of water in vapor form that circulate through the atmosphere and are disassociated. CO2 can also be disassociated by UV light from the Sun. What we'll look at is what is leaving Mars and what is getting stripped (like CO2 and oxygen). It's all about looking for the right stuff. We have ion and neutral gas mass spectrometers, a UV spectrometer and other instruments to do that. MAVEN can take all sorts of great measurements, including what happens to the solar wind, the direction of the magnetic field and particles in the solar wind, how it varies, etc.

TMQ: Can you lay out, as you see it, NASA's future plans for robotic Mars exploration?
Dr. Green: We've worked very hard over the last year on both our own missions and international collaborations. We have opportunities for launch every twenty-six months, but the question is do we have a mission? In 2016, a European Space Agency (ESA) orbiter will launch with one of our instruments on board, and we'll launch our own lander, InSight, which will help us to measure how seismically active Mars really is. It will

really allow us to expand our understanding of what the structure of the planet is all about: the mantle, crust size, core, etc. The only planet for which we currently have that information is Earth, so understanding the structure of Mars is the next step for understanding the terrestrial development process. In 2018, the ESA will launch the ExoMars rover. We're providing part of an instrument on that one, an organic analyzer. We're also planning a new rover mission in 2020 that's modeled after Curiosity.

TMQ: What about human exploration of Mars? How likely is it that we'll see boots on the ground by mid-century? What are the key events that must take place to make that possible?
Dr. Green: We need the support of President Obama, certainly. National space policy has in it the challenge of orbiting by the 2030s, and we're working hard to build the capability to do so. Right now, it's important to understand where we are. There are a number of things we don't know that we need to know. It's not like Star Trek, where we go where no one has gone before.

From the scientific point of view, in this decade we need to continue with the rovers, learn where the water resources are, and so forth. In the 2020s, we'll send an in-situ resource utilization (ISRU) package to bring in materials from the surface and the atmosphere and generate new things we'll need for humans in the future. That's the first major human exploration testing system. These are our next steps, and they're all progressing well. In addition, I truly believe that, for human exploration to be feasible, we need to bring samples back. That's important.

TMQ: Regarding the Solar System Exploration Research Virtual Institute (SSERVI), can you describe this collaboration between the nine research groups in more detail? What do you envision the end result being?
Dr. Green: SSERVI will build on the work done by the NASA Lunar Science Institute (NLSI) by expanding the realm of human exploration and science. Our next big step is to study a lot more of the small bodies, like asteroids and small moons (specifically Phobos and Deimos). In future opportunities, we hope to include Mars in that realm, but right now we're concentrating on the very first next steps for science and exploration. The institute is about bringing teams of engineers and explorers together and connecting them with the scientists.

TMQ: You and Dr. Daniel Baker received an AAS award last year for your article on the impact of coronal mass ejections (CMEs) on the U.S. power grid. Others, like the congressional EMP Commission, have sounded similar alarms. Have we made any steps toward rectifying the problem?
Dr. Green: We were reporting on a National Research Council study on the importance of our power grid and how it's vulnerable to CMEs, relative to how active the Sun can be. It can be tremendously active, and in our lifetimes (i.e., since our power grid was built), we haven't seen it put out what it's done in the past. Consequently, it's really coming out that the power companies need to consider some of these solar extremes, and we'll see what happens from their perspective. They have to look at it from a cost-benefit perspective, along with any regulations the government can do. It's all part of ongoing research. We're in the assessment stage now, determining what to do about it next.

TMQ: Thank you for your time! Good luck with the launch today!
Dr. Green: You're very welcome.

Dr. James Green has been working at NASA since 1980 and became Director of the Planetary Science Division in 2006. He has a Ph.D. in Space Physics from the University of Iowa.

News Brief

French Mars Society Conducts Successful Anti-Gravity Demo


APM

Association Planète Mars (APM), the Mars Society's French chapter, announced in October 2013 that it had successfully conducted an artificial gravity test during a parabolic flight. According to Richard Heidmann, APM chapter vice president, "We were able to demonstrate an artificial gravity system during a flight of a zero-gravity (zero-g) airplane from Novespace in the skies over Bordeaux (France) on October 9th."

The experiment had been proposed two years ago by APM to engineering students from École Centrale de Lille. The project was sponsored by APM and CNES, the French space agency, which selected it as part of the framework of its annual student zero-g flight program. CNES provided funding for the flight demonstration and technical and operational support to participating students. Also involved were French school teachers and Novespace representatives.

"This zero-g demonstration is a great success for humans-to-Mars planning, our French chapter and the Mars Society as a whole. It's definitely an important step in developing a plausible means of transporting humans to the Red Planet in the near future," said Mars Society President Dr. Robert Zubrin.

NASA's MAVEN Launches to the Red Planet

Mike Killian

After a decade of work from a team spread across the country, NASA's MAVEN spacecraft is on its way to Mars to begin an ambitious science mission that will—for the first time—be devoted entirely to understanding the upper atmosphere of Mars and the role loss of atmosphere has played in the evolution of the planet. Mars was once wet and had an atmosphere capable of (possibly) giving life the recipe it needed to thrive, and the $670 million Mars Atmosphere and Volatile Evolution (MAVEN) mission will shed more light on exactly why the Red Planet is now a dead, dry, desolate landscape.

MAVEN's ride to space, the 188-foot-tall workhorse United Launch Alliance Atlas-V 401 rocket, thundered out of Cape Canaveral's Launch Complex 41 under overcast skies, right on time at 1:28 p.m. EST on November 18, 2013. Weighing in at 5,400 pounds (with a full fuel load), the bus-size spacecraft (with solar arrays deployed) roared into space on 860,000 pounds of thrust, pushing through the clouds and sending sonic booms out for miles around from the Atlas-V's RD-180 engine.

MAVEN, which is now under the control of the Lockheed Martin Operations Center in Denver, Colorado, is scheduled to arrive at Mars on Sept. 22, 2014. The University of Colorado at Boulder, NASA's Goddard Spaceflight Center, The University of California at Berkeley, Lockheed Martin, and NASA's Jet Propulsion Laboratory all have a role in carrying out MAVEN's mission successfully.

The spacecraft will not land on the Red Planet's surface but will instead position itself into an elliptical orbit around Mars. Over the next 10 months, MAVEN will cruise through the empty vacuum between our worlds, tapping into its 431 gallons of highly toxic hydrazine fuel to fire its thrusters for control and trajectory adjustments during the cruise and approach phases of the flight. The spacecraft will perform four course correction maneuvers en route to Mars, but most of the fuel will be conserved for MAVEN's arrival in September 2014, when it will need most of that 431 gallons to place itself into position for orbit insertion and to perform orbital correction maneuvers once at Mars. The fuel will also help MAVEN maintain a correct elliptical orbit throughout the mission and will boost the satellite into a higher elliptical orbit at the end of its mission to relay data from other spacecraft (including the Curiosity and Opportunity rovers) currently exploring the surface of the Red Planet.

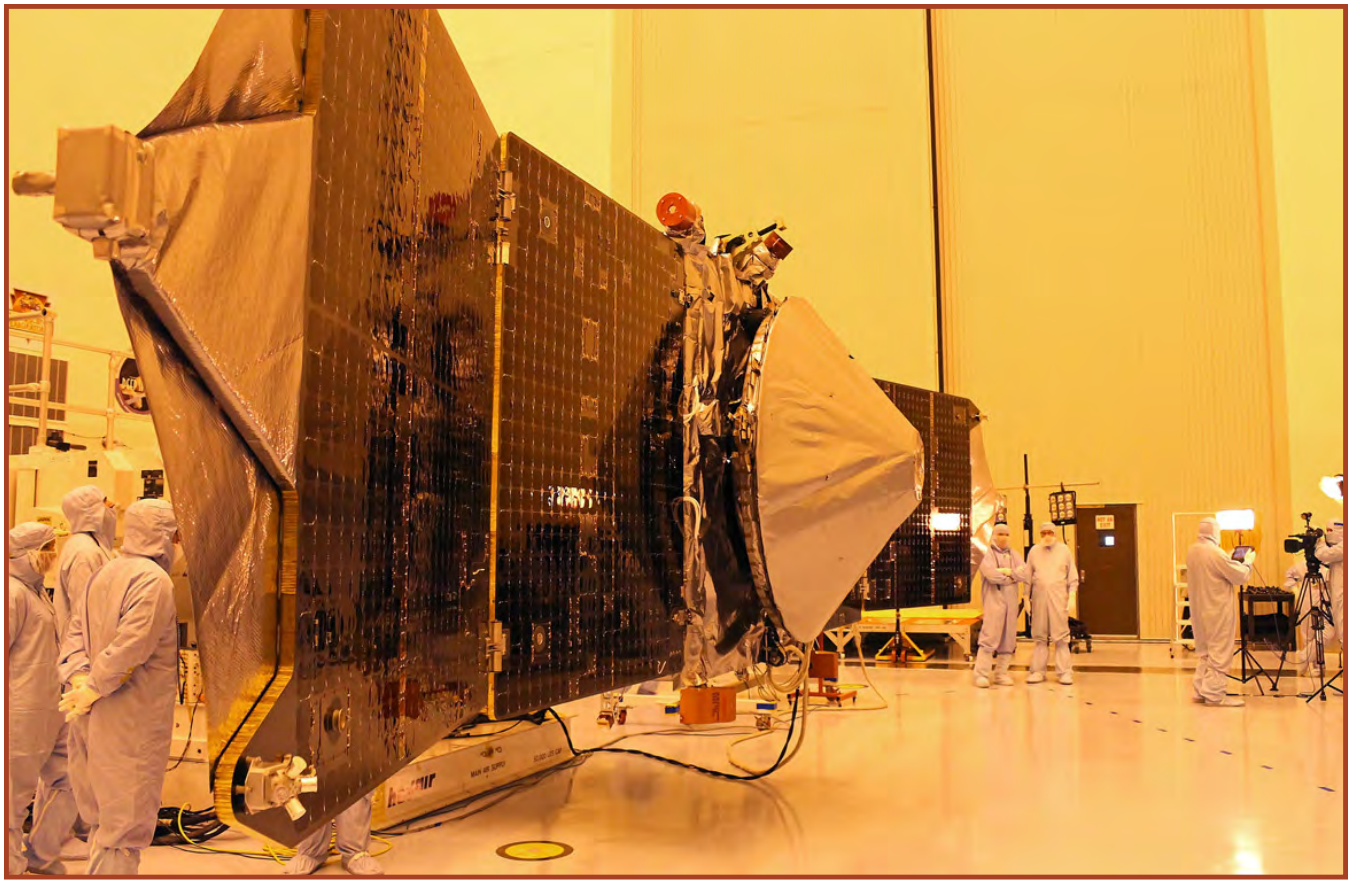
M.Killian (MikeKillianPhotography.com)

MAVEN will thoroughly study the Martian upper atmosphere by measuring the current rate of escape of atmospheric gas to space.

Once at Mars MAVEN will take five weeks to get into its final science-mapping orbit, test the instruments, and test science mapping sequences before beginning its one-Earth-year primary mission. MAVEN will thoroughly study the Martian upper atmosphere by measuring the current rate of escape of atmospheric gas to space. Those measurements will provide information about the relevant processes to allow extrapolation backward in time to determine how much of the Martian atmosphere has been lost over the eons.

At its closest point the spacecraft will be 93 miles above the surface, allowing MAVEN to sample the gas and ion composition of the Martian upper atmosphere directly on each orbit. Five "deep dives" are planned to place MAVEN even closer to the surface (77 miles), which will provide information down to the top of the well-mixed lower atmosphere, giving scientists a full profile of the top of the atmosphere. At its highest point, MAVEN will be more than 3,728 miles above the surface, allowing for ultraviolet imaging of the entire planet.

A total of eight science instruments will help MAVEN study Mars's upper



M.Killian (MikeKillianPhotography.com)

atmosphere and ionosphere to determine how the loss of nitrogen, hydrogen, and carbon dioxide from the atmosphere has impacted the planet over the eons.

"They can take that information and make computer models," said Guy Beutelschies, program manager for the mission at Lockheed Martin. "They can then use those models to basically go back in time and see when in the history of Mars conditions would have been right to have oceans, lakes, and rivers on the surface. If we can show in these computer models that Mars once had liquid water and that it was warm enough, then you've got all the conditions for life potentially to have evolved."

Understanding the role that loss of atmospheric gas played in changing the Martian climate should shed more light on whether or not Mars was a habitable world at some point. If Mars was habitable in its ancient history, when was it and for how long before the Martian Armageddon?

"A better understanding of the upper atmosphere and the role that escape to space has played is required to plug a major hole in our understanding of Mars," said Bruce Jakosky, principal investigator for MAVEN at the Laboratory for Atmospheric and Space Physics at the University of Colorado Boulder. "We're really excited about having the opportunity to address these fundamental science questions. MAVEN is not going to detect life, but it will help us understand the climate history of Mars, which is the history of its habitability."

"MAVEN is going after something the others haven't," said David Mitchell, MAVEN's project manager for NASA's Goddard Spaceflight Center in Maryland. "It's going to look at the current composition of the upper atmosphere and how solar storms and other factors changed the atmosphere. We'll then be able to project back in time to see how it was in an earlier epoch. Scientists believe the planet has evolved significantly over the past 4.5 billion years. It had a thicker atmosphere and water flowing on the surface. It wasn't like Earth, but it was not like it is today. Ultimately, the mysteries that MAVEN will help decipher should be a treasure trove for the science community."

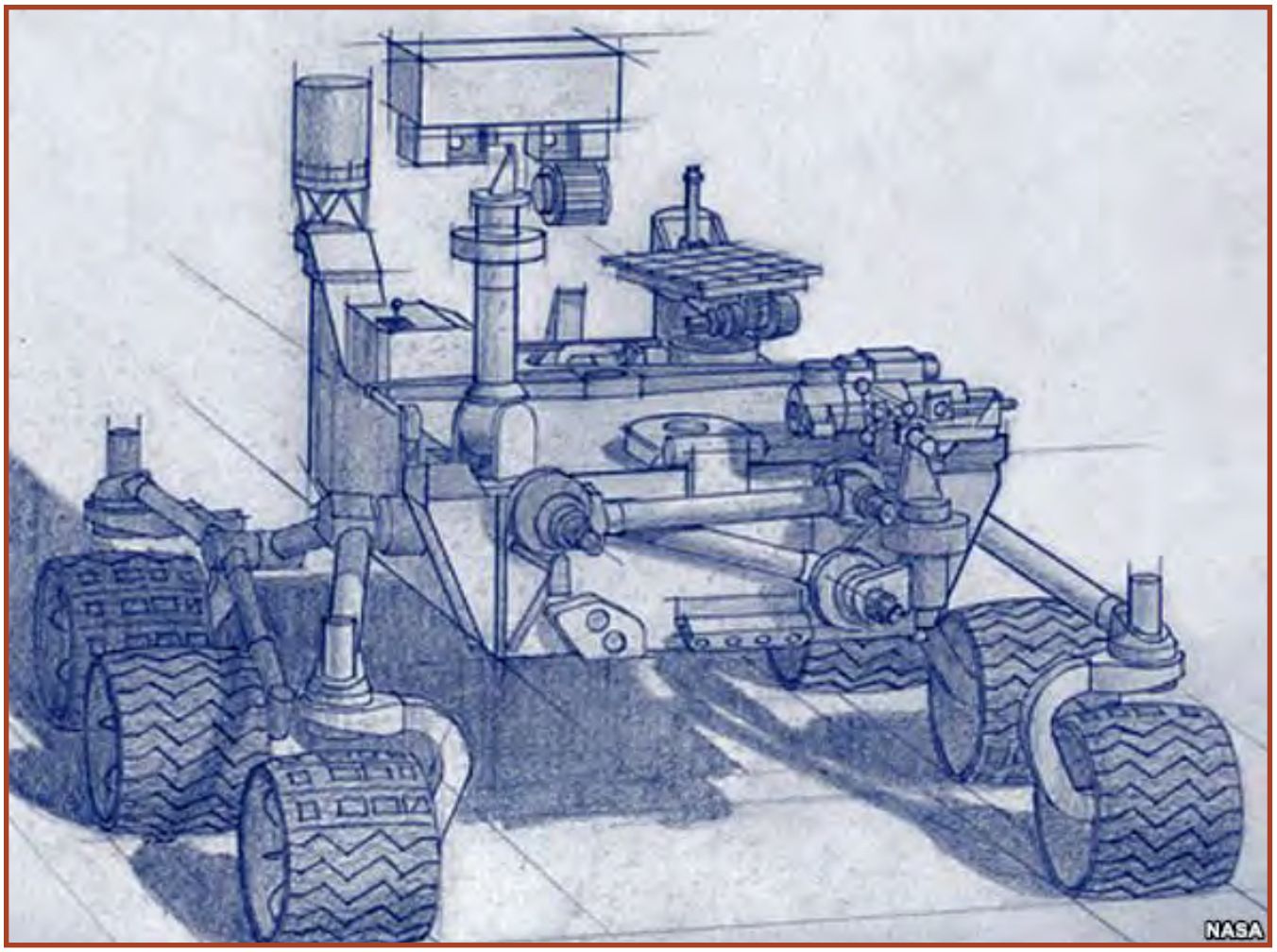
MAVEN will join three other NASA spacecraft currently orbiting the Red Planet on their own missions (Mars Odyssey, Mars Express, and the Mars Reconnaissance Orbiter). Two other vehicles are currently exploring the surface, the rovers Opportunity and Curiosity. All six spacecraft will work to do their own part in piecing together the puzzle of Mars's history, helping to answer questions about water, habitability, and whether life ever had a chance to thrive before the atmosphere withered away and sterilized the planet.

"There's something about going to another planet that's very exciting," adds Mitchell. "When you're talking about going to Mars, it isn't hard to get great people to come work the job. And, ultimately, the mysteries that MAVEN will help decipher should be a treasure trove for the science community."

Mike Killian is a Photographer and Writer for AmericaSpace (americaspace.com) and is a regular contributor to The Mars Quarterly.

NASA's Vision for Next Mars Rover is "2020"

Jason Rhian



NASA

By all measures, NASA's Mars Science Laboratory (MSL) rover, Curiosity, has been a phenomenal success. It should come as no surprise then that when NASA started looking at the next wheeled robot that it wanted to send to the Red Planet, that it would base it off of the MSL design. The rover, which for now is simply called the 2020 Mars Rover, has only been briefly described by the space agency. However, what clues have been given about its abilities and characteristics offer a tantalizing glimpse into future.

NASA's Mars Program Planning Group has been cited as one of the guiding influences behind the decision to build yet another rover similar to Curiosity. The way that Curiosity was developed and built lent itself to being utilized as a template for future rovers. The reason for this bit of forethought is readily understandable given the current economic environment.

As with most everything these days, NASA is concerned about the cost of its missions. One of the largest factors in planetary missions is the expense of development. In an effort to limit development costs, NASA decided to follow the old adage: "If it ain't broke, don't fix it." As such, they opted to use the proven design of MSL. NASA even had some spare components left over from Curiosity's construction.

There will be some differences between the two rovers, however, primarily in the instruments that the robot will carry with it. As the Mars 2020 rover will be following in the Curiosity's footsteps, it will have new questions to seek answers to, fresh investigations that it has to conduct. The landing system, however, will be very familiar to MSL fans. Both the acclaimed sky crane rocket as well as the heat shield will be virtually the same as those employed on MSL.

As for the experiments which will be part of the rover's backpack, NASA is still working on what to include. The U.S. space agency announced an open competition for scientists in the planetary community to submit proposals for what instruments the Mars 2020 rover will bring with it.

In January 2013, a Science Definition Team was selected by the space agency. Composed of 19

NASA/JPL

scientists and engineers from a wide range of organizations and research facilities, the SDT was charged with defining the objectives of the Mars 2020 rover mission They were, in essence, the ones who would develop the rover's core mission, keeping in mind that it must achieve several high-priority scientific goals, one of which was to move us closer to sending crew to the Red Planet in the 2030s, as directed by President Obama.

NASA has stated that the Mars 2020 rover's primary mission will be to determine whether or not the Red Planet is a possible habitat for life: it will seek out evidence that life existed there sometime in the past and collect specimens for a potential sample-return flight to Earth. Most intriguing, perhaps, is that NASA has stated the rover will also demonstrate technologies which could enable future human exploration missions to Mars. How this will be accomplished is unclear.

"The Mars 2020 mission will provide a unique capability to address the major questions of habitability and life in the solar system," said Jim Green, director of NASA's Planetary Science Division. "The science conducted by the rover's instruments also would expand our knowledge of Mars and provide the context needed to make wise decisions about whether to return any collected samples to Earth."

Whatever mission requirements that the 2020 Mars Rover is assigned, one thing is clear: the Mars 2020 did not reach its destination without a wealth of experience in conducting Mars rover operations. When the 2020 Mars Rover sets down on the dusty Martian surface, it will follow a growing line of those that came before her, starting with the 1993 Mars Pathfinder mission, the first rover to be sent to the Red Planet. Then came the "twin" Mars Exploration Rovers, Spirit and Opportunity, which landed back in 2004 and far exceeded their design parameters (in fact, Opportunity is continuing to explore Mars to this very day). Finally, in August of 2012, Curiosity began her journey of discovery at Gusev Crater.

"For many folks last summer was an incredible ride – seven minutes of terror to get Curiosity, the Mars Science Laboratory, on the surface of Mars," said NASA astronaut and Associate Administrator for the agency's Science Mission Directorate, John Grunsfeld. "The year after has been an incredible drive. Even though we are still on our way to Mount Sharp, we still have a fundamental question to answer, one that has piqued the curiosity of astronomers and planetary scientists for quite a while: did Mars ever have an environment that was habitable for life, and is there or has there ever been life on Mars? Does Mars support life now?"

The question of whether or not Mars ever been able to support life is, at least in a microbial sense, the key mission for the Mars Science laboratory. It is a question that Grunsfeld said harkens back to the very first landers to successfully touch down on Mars.

"Back when I was in high school in the 1970s, we sent the Viking landers to answer that question, and it was very exciting, very challenging – these were grand voyages," Grunsfeld added. "From these missions, Mars appeared to be lifeless, but the question remained: did Mars ever have an environment that could support life?"

That question has come into increasingly sharper focus since the Viking landers touched down in 1976. For a long time afterward, Mars faded from the scientific consciousness as the data gleaned from the spacecraft that had traveled to the Red Planet suggested that it was a lifeless world and one which was unlikely to have supported life in its past. However, with the uptick in missions and interest in Mars that began in the 1990s, it has become increasingly clear that Mars was not always as we see it today. The 2020 Mars Rover will serve to deepen our knowledge of the planet's history.

What Curiosity has done is, essentially, to develop another layer of understanding about the forces that have shaped the Red Planet. One of these elements in particular, the Martian atmosphere, will come into sharper focus next year when NASA's Mars Atmosphere and Volatile EvolutioN (MAVEN) arrives at Mars. It will look into how Mars' atmosphere has been shaped throughout the planet's life. The 2020 Mars Rover will doubtlessly continue the narrative that began with Viking and could redefine how we view the Red Planet and its history.

Jason Rhian is Senior Editor of SpaceFlight Insider (spaceflightinsider.com) and is a regular contributor to The Mars Quarterly.

Chapter Close-Up: Los Angeles

Bryan Guzman

The Los Angeles Chapter of the Mars Society was established in December 2012. We have had a very productive first year growing our chapter and planning for the future.

The strategy of the Mars Society LA chapter is three-fold – Mars Outreach, Mars Forum and LA Space Activities. Mars Outreach is our primary goal – to educate the public on the importance of continued and sustainable Mars exploration and inspire the next generation of engineers, scientists and explorers. Mars Forum is an open and informal environment where we discuss current Mars related news, research and more. LA Space Activities are regular field trips and tours of Mars and human spaceflight-related landmarks in the greater Los Angeles area.

One major outreach event held this year was Mars Society LA's sponsorship of an informational booth at the annual Aerospace Summer Games in July. Local aerospace companies, including Boeing, Northrop Grumman, Raytheon and SpaceX, compete in friendly competition in volleyball, horseshoes and other events at Dockweiler State Beach in Los Angeles. Mars Society LA was able to share Mars-related news with the broader community and recruit a few new members in the process.

Our second major outreach event in 2013 was a presentation to a local area Rotary Club. The Mars Society LA team developed a public briefing presentation on the history of Mars and the limitless possibilities of future Mars exploration. The Rotary Club was very appreciative of our presentation, even deeming it the most informative presentation they had seen all year!

Our chapter started the year with a presentation by Dan Coatta, Mass Properties Engineer for NASA's Mars Science Laboratory (MSL) mission, sponsored by the Society of Allied Weight Engineers. Dan's presentation focused on a number of interesting mass property challenges encountered during development of NASA's MSL rover. This was Mars Society LA's first membership recruiting event using our newly designed promotional materials. We also began significant coordination with AIAA in January, thanks to our AIAA liaison Seth Potter and AIAA LA-Las Vegas events chair Christianna Taylor.

Members of the Mars Society LA team also attended the 2013 Mars Habitability Conference at UCLA and a presentation by Dr. Susan Rice, a member of the project science team for MSL Curiosity and Mars Exploration Rover Opportunity at

B.Guzman

B.Guzman

NASA's Jet Propulsion Laboratory in Pasadena in February. In addition, three members of our chapter traveled to Boulder, Colorado in August to attend the Mars Society's annual international convention. One of our members, Gary Stephenson, presented a track talk on systems engineering concepts as related to future human Mars missions.

The Mars Society LA core group meets regularly to plan our events and share other Mars related happenings. In addition to Seth's regular coordination with AIAA and the Planetary Society, Nick Orenstein is our UCLA and GreenHab liaison, providing regular updates from the Aerospace Department at UCLA and from the Mars Desert Research Station in Utah.

In March we had our first "LA Space Activity" event, a trip to the "Rocket Junkyard," a shop in the San Fernando Valley specializing in "the nuts, bolts and heat exchangers that helped American astronauts shrug off the steely embrace of gravity." Most of the "space junk" is now used primarily by the LA movie industry for props in films. We also toured the SpaceX facility in Hawthorne, California in May. A special thanks to Krystal Puga, our Vice President and Events and Outreach Coordinator, for setting up our LA Space Activities and Outreach events this year!

We have a busy year planned for 2014. Major events planned are the Mars Fest held every March in the Mojave Desert and the First Annual West Coast National Mars Day, sponsored by Mars Society LA. The latter is planned to be a west coast analog to the National Mars Day celebrated each July in Washington, D.C. on or near the anniversary of the Viking landing on Mars in 1976.

Mars Society LA is always looking for new members, either as part of our core planning team or as those who simply wish to join our mailing list in order to be informed about our events. To join our chapter in either capacity, please contact: mars-la@marssociety.org.

Mars Society Appoints New Volunteer Coordinator

The Mars Society announced in September 2013 that Florence Maisch has been appointed as the organization's new Volunteer Coordinator. In this role, Mrs. Maisch will help coordinate and streamline the group's volunteer opportunities and outreach efforts to attract new volunteers.

Mrs. Maisch is a long-time proponent of Mars and space exploration with a strong professional background in Information Technology and Project Management. In addition, Mrs. Maisch is fluent in Spanish and has a working proficiency in Portuguese.

"The Mars Society is a volunteer-driven organization, so Florence's role will be very important in helping our group develop and expand its activities and advocacy work on behalf of Mars exploration and planning for a humans-to-Mars mission," said Michael Stoltz, the Mars Society's Director of Media and Public Relations.

If you would like to know more about volunteer options with the Mars Society, please email Mrs. Maisch at: fmaisch@marssociety.org.

News Brief

Join Space Advocates at 2014 SEA Legislative Blitz

Space Exploration Alliance

In 2004, a group of 13 major space advocacy groups, including the Mars Society, formed the Space Exploration Alliance (SEA) to have their voices heard in Washington, D.C. The first SEA "Legislative Blitz" brought together 76 space advocates from around the country, converging on Capitol Hill and visiting over 200 congressional offices to express support for NASA and space exploration.

The 2014 SEA Legislative Blitz, scheduled for February 23-25, comes at a time when the American space program is at a serious crossroads, both in terms of funding and direction. A recent Congressional Budget Office report actually suggested shutting down the U.S. human space flight program all together. The voices of the space advocacy community must be heard now as perhaps never before.

Let members of Congress know there is strong constituent support for an ambitious and sustainable U.S. space program by joining the SEA campaign in Washington, D.C. this February!

For more details, please visit: www.spaceexplorationalliance.org/blitz.

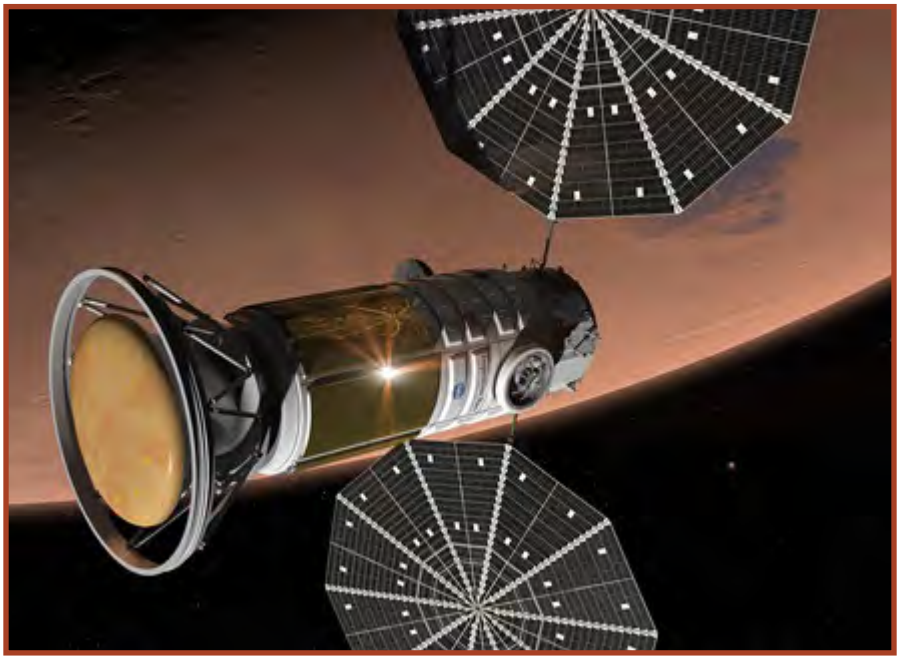
Inspiration Mars International Student Design Competition: Rules

Students to propose design concepts for Inspiration Mars mission

During the 16th Annual International Mars Society Convention, the Mars Society announced the launch of an international engineering competition for student teams to propose design concepts for the architecture of the Inspiration Mars mission. The contest is open to university engineering student teams from anywhere in the world.

Inspiration Mars Executive Director Dennis Tito and Program Manager Taber MacCallum were present for the announcement. "Inspiration Mars is looking for the most creative ideas from engineers all over the world," said Tito. "Furthermore, we want to engage the explorers of tomorrow with a real and exciting mission and demonstrate what a powerful force space exploration can be in inspiring young people to develop their talent. This contest will accomplish both of those objectives."

Commenting on the contest, Mars Society President Dr. Robert Zubrin said, "The Mars Society is delighted to lead this effort. This contest will provide an opportunity for legions of young engineers to directly contribute their talent to this breakthrough project to open the space frontier."



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Rules

The requirement is to design a two-person Mars flyby mission for 2018 as cheaply, safely and simply as possible. All other design variables are open.

Alumni, professors and other university staff may participate as well, but the teams must be predominantly composed of and led by university students. All competition presentations must be completed exclusively by students. Teams will be required to submit their design reports in writing by March 15, 2014. From there, a down-select will occur with the top 10 finalist teams invited to present and defend their designs before a panel of six judges chosen (two each) by the Mars Society, Inspiration Mars and NASA. The presentations will take place during a public event at NASA Ames Research Center in April 2014.

Designs will be evaluated using a scoring system, allocating a maximum of 30 points for cost, 30 points for technical quality of the design, 20 points for operational simplicity and 20 points for schedule with a maximum total of 100 points.

The contest is open to university-based teams from any country in the world.

The page limit for the design reports is 50 pages, using 12-point type and 1" margins. Smaller type may be used in figures, so long as it is legible. The report may include references to supporting backup material, which may include published books or papers, as well as additional material generated by the team and posted on the team's website along with the report by March 15, 2014. However, there is no guarantee that the judges will read such material, so the 50-page design reports should be as complete and self-contained as possible. Design reports should be in English. Verbal presentations by finalists will also be in English; however, teams from countries with other native languages may make use of a translator, provided they make such arrangements themselves.

The first-place team will receive a prize of $10,000, an all-expenses paid trip to the 2014 international Mars Society convention and a trophy to be presented by Dennis Tito at that event. Prizes of $5,000, $3,000, $2,000 and $1,000 will also be awarded for second through fifth place.

All designs submitted will be published by the Mars Society, and Inspiration Mars will be given non-exclusive rights to make use of any ideas contained therein.

To view Frequently Asked Questions (FAQs) for the Inspiration Mars International Student Design Competition, please visit: http://www.marssociety.org/home/inspiration-mars/rules.

We Are One

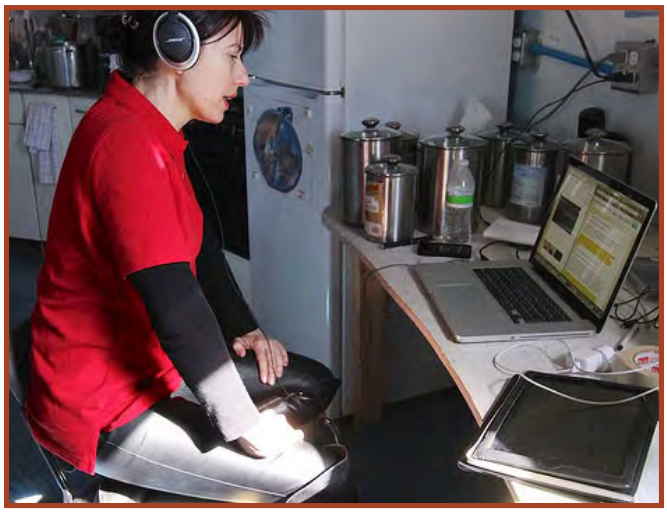
World Space Week's 2013 Mission to Mars
Haritina Mogosanu

I am writing this from Middle Earth, a nickname for New Zealand, where I am still pondering about the recent "World Space Week's (WSW) Mission to Mars." This October, space enthusiasts spread across the globe, from Utah to North Dakota, from France to Austria, to undertake an unprecedented outreach exercise. They "explored Mars to discover Earth." I thus had the chance to see globalization at its finest!

This year's WSW theme was "Exploring Mars, Discovering Earth." It may sound a bit like reverse engineering in getting to know our own planet. But the World Space Week Association (WSWA) saw it as a splendid opportunity to show humankind that by learning about Mars, we could also learn about ourselves. That by doing it, we have the chance to define from scratch what world we want to live in. To show that limited resources on another planet can be used to build an entire civilization and that we can support life without destroying our environment!

Every year, the WSWA is backing the international celebration of "the contributions of space science and technology to the betterment of the human condition" during the United Nation's endorsed World Space Week: 4-10 October. WSWA supports this goal by providing a platform where these events are publicized. Also, teachers, students and space enthusiasts can find here outreach materials and ideas provided by different organizations that are involved in the space education and outreach business.

World Space Week Mission to Mars 2013 brought about a paradigm shift in the way these contributions were showcased. For the first time, a global-scale space-related outreach operation was engineered, with the help and at the initiative of volunteers around the



Crew member working inside Hab

Crew getting ready for media interview

Five crew members prior to MDRS sim

Two crew members climbing hill

world. With no government involvement, no political interests and no power games, volunteers and space enthusiasts together opened a historic new chapter in international collaboration for the peaceful exploration of space.

The World Space Week Association, Space Generation Advisory Council, the Mars Society, the Austrian Space Forum, New Zealand's KiwiSpace Foundation and all their other partners worked as one in 2013. From 4-10 October they curated and produced a series of public Mars analogue research demonstrations, including an analog expedition at the Mars Society's Mars Desert Research Station (MDRS) in Utah.

The top objectives of the mission were to deliver a platform for bringing the World Space Week 2013 theme to life, inspire event organizers and participants about the future of space exploration, excite children about learning and their future, show the benefits of Mars exploration to society and foster international exploration in space outreach and education.

Education and outreach programs were provided via the Mission Control Center, which supported WSW events around the world. Teams around the globe demonstrated their hardware, conducted telecoms with schools, students and space enthusiasts and in some cases allowed the public to remote control their respective hardware via web interfaces. My favorite part was when three analog spacesuit teams performed simultaneous experiments for the World Space Walk 2013, which was broadcast live. Coordinated from a single mission control center, the experiments were carried out in Innsbruck, North Dakota and Utah.

I've always felt like World Space Week is the space nerds' equivalent of Christmas (for the lack of a more famous, beloved and well known celebration around the world). This year's event broke all the records of participation: doubled the events (1,400 events registered around the world) and saw 80 nations engaged, with millions of media impressions. All of these on volunteering time!

So maybe there is something to be said after all for humanity's desire to be united. I am convinced after seeing this year's World Space Week that we are on the verge of inventing a new global culture for the betterment of the human condition, driven not by governments or obsolete instructions but by each of us who is choosing to celebrate life. And if dreaming of space and Mars can bring us all together, if only for once a year, leaving disputes behind to join the World Space Week and shake hands across hemispheres and cultures, then that's one more reason for humanity to become a spacefaring civilization.

Haritina Mogosanu is Manager of Educational Relations for the World Space Week Association and is also involved in MDRS public outreach.

Crew member taking soil sample

Two crew members roaming "on Mars"

SPOTLIGHT ON ...

Leonard David, Space Journalist

Kerri Beauchesne (Part 2)

In Part 1, TMQ talked with Leonard David about his early interest in space and how his career in space journalism got off the ground. Also don't miss Mission to Mars: My Vision for Space Exploration*, which David co-authored with Dr. Buzz Aldrin, the second astronaut to set foot on the Moon.*

L.David

Frustration with stalled progress is what led to Leonard David's involvement with the Mars Underground, a movement that led to the establishment of the Mars Society. In 1979 he wrote an article for Future Life magazine entitled "Mars in '88." Lamenting the sharp fall-off in funding and support for the space program, he wrote, "Today, officially at least, human flight to Mars is but a forgotten dream of futures past," words that unfortunately still ring true today. Later in the article he speculated on what he thought of as a Mars underground, a scattered group of Mars enthusiasts with technical skills who weren't talking to each other much but were trying to formulate a plan for Mars at a time when NASA was getting lost.

The idea took hold, and in 1981 a group of graduate students from the University of Colorado Boulder, including Chris McKay, Carol Stoker and Penelope Boston, organized the first Case for Mars conference. Funds for conference space at the university were generously provided by several advocacy groups and . . . buttons. "I made Mars Underground buttons," said David, "and they sold like hotcakes. Being a member of the Mars Underground and having a button was really important to people." In fact, a Mars Underground button lies in the grave of Thomas Paine, NASA administrator during the Apollo missions and active member of the Underground. "If I remember correctly, Carol Stoker jumped into the pit to put it on his coffin," David said.

That first conference, which drew approximately a hundred attendees, was primarily about testing the waters. "We wanted to see what was out there and who would show," said David. The response was overwhelming. "It got so out of control with so many people showing up to that thing that we ended up splitting later conferences into workshops and sidebars because there were too many people. We couldn't handle it all, the amount of passion showing up at the doorstep." They wanted to return a sense of legitimacy to the idea of going to Mars, to show that it was doable. "Some JPL engineers were very helpful early on," David said, along with an array of other engineers and scientists who presented papers and participated in brainstorming

L.David w/ Buzz Aldrin

sessions. The unexpected boon, however, came in the form of artists in the audience. "In the early conferences, Carter Emmart and a guy from Walt Disney Studios would sit in the audience and draw what they heard people describing," he said. "They produced some really compelling black and white artwork about red planet operations, to show people what it would look like." After completing a successful but exhausting conference, David and the other organizers would vow, "never again," but three years later they'd say, "Let's do another one!" In all, the Case for Mars conferences ran from 1981 to 1996.

What's puzzling is that a case for Mars needs to be made at all. "Mars was not originally flagged as a giant leap of faith," David said. "It was one of many things that were sort of 'there to do,' versus this huge output we seem to be going through now. When I was a kid, flying to another star like Alpha Centauri was going to be the big jump." On the other hand, David cautions against making the case for Mars sound like an end point. "Some seem to view Mars as somehow the end-all of the space program," he said. "We have a longer, bigger, more significant picture coming, and Mars is just one spot we've got to tame as we move forward. Mars is a litmus test to see if we have the political and scientific willpower to get there, much as we did on the moon." He subscribes to more of a stepping stone philosophy. "When I worked with Buzz on Mission to Mars," he said, "it was all about earning your stripes. You've got to develop all these different capabilities – test astronauts, hardware, mission control, etc. – and somehow maintain the political will of the country to stay the course."

In the absence of another nationalistic space race to revitalize that political will, the key might be the evolving relationship between public and private space industry. "I'm a little paranoid about these private sector ideas they're floating around, whether we're talking Mars One or the Tito plan," David said. "Mars will never be easy, and they make the public think it's a done deal. We're at a point that it's still dangerous out there. You can't just lob people out there willy-nilly and hope they'll come back okay." But he is impressed with some of the work being done. "Elon Musk and SpaceX have done a lot of heavy lifting," he said. However, "Love 'em or hate 'em, NASA still has the best of the best and a proven record. Yes, the government is heavy-handed with bloated budgets, but you still have to have the technical know-how to get there and know what not to do." The question right now is whether public and private industry can develop the right relationship and level of mutual trust to make things happen.

International cooperation is also playing an increasing role. "When you look at the International Space Station, sixteen countries worked together to make that thing happen," he said. "It shows where political windows are open to work with other countries. Will it be a window of opportunity for other countries to be involved as well? For example, China and India are talking as though, if they're invited, they might show up." International relations have changed a lot since the early days of the Space Age. Now, "Even Mexico has a space agency," he said. "There are all kinds of interesting opportunities to open relationships, and the US doesn't even have to be involved." During the space race, the feeling was that the USSR was our opponent and that they stood in the way of what we wanted to do in space. "Somehow Russia was going to delay things or mess it up. Today, they're doing a pretty good job, and we've relied on them quite a bit over the years in developing the ISS," said David. "Meanwhile, China has the makings of an early leadership capability in human spaceflight, with ongoing projects aimed at going back to the moon, building their own space station, and a lot of other things." With so many other countries doing productive work in space, David said, "I think we increasingly need to rely on partnerships with other countries, especially during economic downturns." Will the U.S. be a leader or a follower in this new era? In *Mission to Mars*, David and Aldrin put the onus on President Obama and his successor; now is the critical time when the world leadership role in space is up for grabs.

Leonard David is Space.com's Space Insider Columnist as well as a contributing writer for several publications, including Space News and Aerospace America. He has also served as editor-in-chief of several magazines, technical consultant on several documentaries and consultant to NASA on various projects. He has received numerous prestigious awards for his work in the field.

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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Mars Society Video on Giving Library
Watch the Mars Society video (http://www.givinglibrary.org/organizations/mars-society) that appears on Giving Library, an online video archive providing philanthropists with an efficient way to learn about work being done by non-profits in the U.S.

THE MARS SOCIETY

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