THE MARS QUARTERLY

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In This Issue:

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IN THIS ISSUE

On the Cover – An astronaut aiding a fellow crew member on Mars (Image: P.Smith - www.philsmith.us)

FROM THE FLIGHT DECK

Advancing the cause of Mars exploration and humans to Mars has never been more important than it is today due to the continuing effects of sequestration on NASA's budget and the apparent lack of political will in the halls of government. The Mars Society continues to be your voice for Mars advocacy.

As a grassroots advocacy group, we can't effectively address the issues of importance to you without your participation. Your active involvement helps us to define our agenda and develop and fund a strategy for action. Working together, we are in a much stronger position to advance the cause of humans to Mars and support America's space program.

Through our advocacy efforts, as well as the programs at our research stations in the desert of Utah and the high Canadian Arctic, we can help promote the development of a sustainable and prosperous Mars exploration program. Please visit our web site (www.marssociety.org) and join the Mars Society or renew your membership today!

Michael Stoltz
Editor

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Publisher
The Mars Society
Headquarters
11111 W. 8th Ave., Unit A
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www.MarsSociety.org

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Mars Society Launches Effort to Conduct One-Year Mission in the Canadian Arctic

The Mars Society announced on May 20, 2013 that it is initiating an effort to conduct a one-year simulated human Mars exploration mission at its Flashline Mars Arctic Research Station (FMARS) in the Canadian Arctic. Situated at 75 degrees north, roughly 900 miles from the North Pole, FMARS is located in the midst of a polar desert on Devon Island that is known to represent one of the most Mars-like environments on Earth. By conducting a Mars surface mission simulation at FMARS of the same duration as is needed for an actual expedition to the Red Planet, the Mars Society will take a major step forward towards learning how humans can most effectively explore this new frontier.

The Mars Society plan, called Mars Arctic 365 (MA365), is divided into two phases. Scheduled to commence this July, the first phase will accomplish the refit of FMARS and enhance the facility's equipment, enabling it to support a one-year mission, which will require wintering at the station through six months of deep sub-zero temperatures. Phase 2 will be the one-year simulated Mars mission itself. Costs of the MA365 program are estimated at $130,000 for Phase 1 and $1,000,000 for Phase 2.

As Mars Society President Dr. Robert Zubrin explained, "The Mars Society has already received a $30,000 cash pledge, as well as the free loan of the services of two Arctic-capable aircraft and their expert pilots, worth (at least) $50,000 to support the mission. Thus we now have in hand $80,000 of the $130,000 necessary to fully accomplish MA365 Phase 1, and therefore we are starting the program. We still need, however, another $50,000 if we are to complete Phase 1 this summer, which has to happen in order to initiate Phase 2 in 2014. As such, I am calling on everyone who wishes to see human explorers on Mars in our time to contribute whatever you can now to make this bold plan a reality."

Nothing like this has ever been done before. It needs to be done, and we intend to do it.

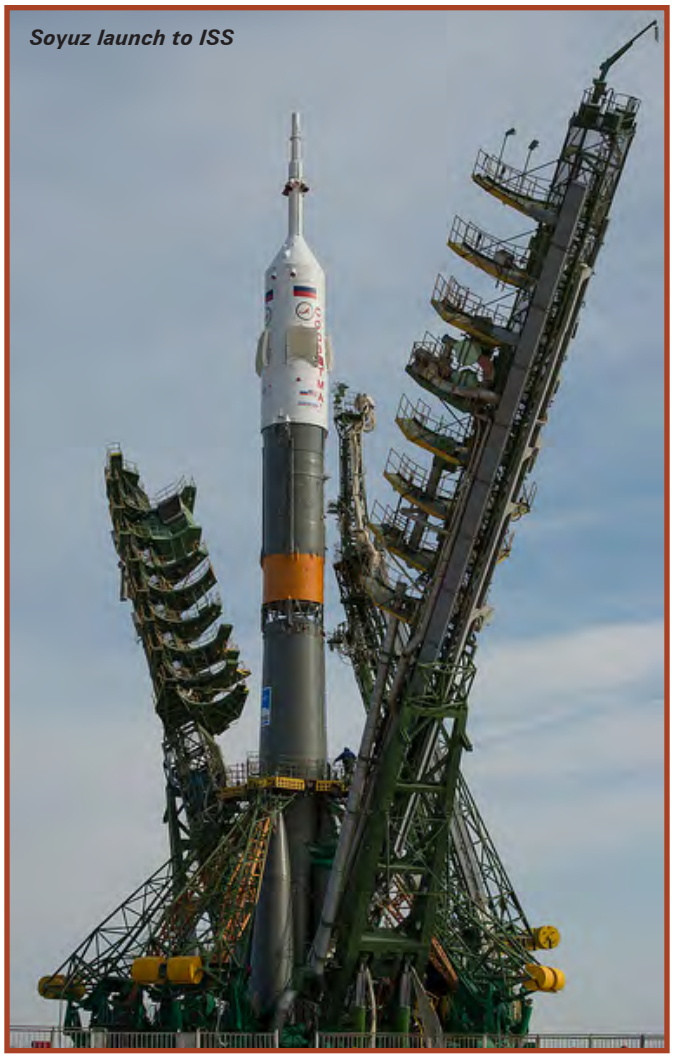
Dr. Zubrin continued, "The Mars500 mission recently completed in Moscow achieved a lot of good scientific data and attracted worldwide attention, however MA365 will go much further. We will also deal with isolation issues, but instead of sitting safe and sound in a nice warm room in the middle of a city, our FMARS crew will conduct a sustained program of geological, microbiological and climatological field exploration in a cold and dangerously remote environment while operating under many of the same constraints that a human crew would face on Mars."

"It is only under these conditions," Dr. Zubrin added, "where the crew is getting real scientific work done, while dealing with bulky equipment, cold, danger, discomfort, as well as isolation, that the real stresses of a human Mars mission can be encountered, and the methods for dealing with them mastered. It is only under these conditions that all sorts of problems that Mars explorers will face can be driven into the open and dealt with. Only by doing these missions can we make ourselves ready to go to Mars. Nothing like this has ever been done before. It needs to be done, and we intend to do it."

Please express your support for Mars exploration by giving generously to the new FMARS mission. All donations to the Mars Society, a registered 501(c)(3) non-profit organization, are tax deductible. For more details about the FMARS program and how to contribute, please visit our web site (www.marssociety.org).

High Hopes & Broken Martian Promises

Ian O'Neill



Soyuz launch to ISS

Image credit: Roscosmos

For years, the world has been frustrated by a lack of progress in space. After the Apollo era, when the world's government-run space programs were motivated by a power struggle between the superpowers, the future of space exploration looked like a universe filled with bountiful possibilities. Granted, the motivation was fear and military prowess, but it was motivation nevertheless.

But after Neil Armstrong's first step onto the lunar surface, public interest, particularly in the U.S., waned. The program was ultimately canceled prematurely in 1972, a demise no doubt accelerated by public disinterest and evolving Cold War politics.

Then came Skylab, then the Soviet Mir space station and, eventually, the Shuttle Program, giving NASA a powerful foothold in space. Although Russia had the most reliable means to take astronauts to orbit -- the Soyuz -- the Shuttle and its huge cargo hold could do so much more. The Shuttle fleet, despite its huge costs and two horrific accidents, helped build a space station, delivered huge robotic spacecraft into orbit, serviced the Hubble Space Telescope multiple times and gave us a glimpse of what the future of pseudo-reusable spacecraft may look like.

But, several canceled programs later and after the retirement of an aging Shuttle fleet, NASA was left depending on their old Cold War foes for paid access to an orbital outpost America invested billions to construct.

Tightening budgets, political shortsightedness and economic meltdown has left the U.S. in a state of confusion. The world's premier space agency no longer has a means to get astronauts into space. But that doesn't mean there aren't efforts to change that.

The burgeoning private space industry has done more than turn heads in the last decade. With forthright intentions to "make mankind interplanetary," Internet mogul Elon Musk plowed his billions into Space Exploration Technologies (SpaceX). Only a few short years ago, Musk had small rockets blowing up on his South Pacific launch pad; now he has a spaceship delivering supplies to the space station under lucrative NASA resupply contracts.

Orbital Sciences Corporation has just proven the viability of its Antares rocket and hopes to carry out its first test flight to the space station in late June, joining SpaceX on space station delivery runs. Other companies, including aerospace giant Boeing and Jeff Bezos' Blue Origin are all becoming part of the nation's commercial spaceflight conversation.

And that's not even mentioning suborbital (and, eventually, orbital) space tourism ventures. Virgin Galactic and XCOR no doubt lead the pack on tapping into wealthy coffers to further develop their lofty plans of sending fee-paying tourists beyond low-Earth orbit (LEO).

Many of these companies may not go the distance — they may be developing into a sector where money isn't as forthcoming as they had hoped — but all have one thing in common: they are taking a step-by-step approach, fulfilling gaps in the space market, pursuing profit to ultimately develop a multi-faceted infrastructure that may one day make space travel not only commonplace, but also profitable.

However, frustration remains. The biggest manned missions into space only remain possible for the biggest bank accounts, and those bank accounts are currently controlled by governments and choked by government policy.

As became obvious in President Obama's cancellation of the Moon-centric Constellation Program at the behest of the Augustine Committee in 2010 and then the downgraded,

Proposed Mars One settlement

Image credit: Mars One

robotics dominated "asteroid capture" mission that's scheduled to launch in 2017, manned exploration headed by NASA will be in constant threat of cutbacks and cancellations.

There is some hope in the ongoing partnerships between NASA and private spaceflight companies, at least as long as the space station remains in orbit. But once the re-supply contracts end, what of the future of commercial spaceflight?

Some very enthusiastic and smart entrepreneurs, scientists, engineers, even ex-NASA astronauts are putting their bets on the commercial sector as a means to build not only an infrastructure in LEO, but well beyond.

In light of the Feb. 15 meteor impact over the Russian Urals region, for example, there have been renewed calls for the development of asteroid mitigation strategies. A potential spin-off from the technologies developed to deflect asteroids could be used for asteroid mining. Many of these concepts are highly theoretical, but there seems to be a light at the end of the tunnel -- suddenly, given enough money, anything seems technically feasible.

But what about Mars? The Red Planet always seems to be that distant and unreachable goal for NASA; can the commercial sector accelerate our Martian dreams?

According to Mars One, a non-profit organization founded by Dutch entrepreneur and engineer Bas Lansdorp, getting to Mars isn't the problem because we already have the technology; it's money we need -- $6 billion to be exact.

For that bargain price, by Mars One's reckoning, we will have a four-person crew on the Martian surface, living permanently in a habitat delivered there by a commercial spaceflight company, most likely SpaceX and a modified Dragon spacecraft. When will this happen? On April 22, 2023 -- in only ten years time.

The intriguing thing about Mars One is that the bulk of the funding will be raised through television rights -- the whole thing will be driven by selling the Mars trip as a reality TV experience. But, as I've already written in DiscoveryNews.com, I am skeptical that a sustained media interest will continue for the lifetime of training, through launch, to (hopefully) successful landing on the Martian regolith. Also, there's the question of control; how will Mars One guarantee that the Mars colonists will "play ball" with the distant media companies when they want their cameras to continuously watch the crew Big Brother-style?

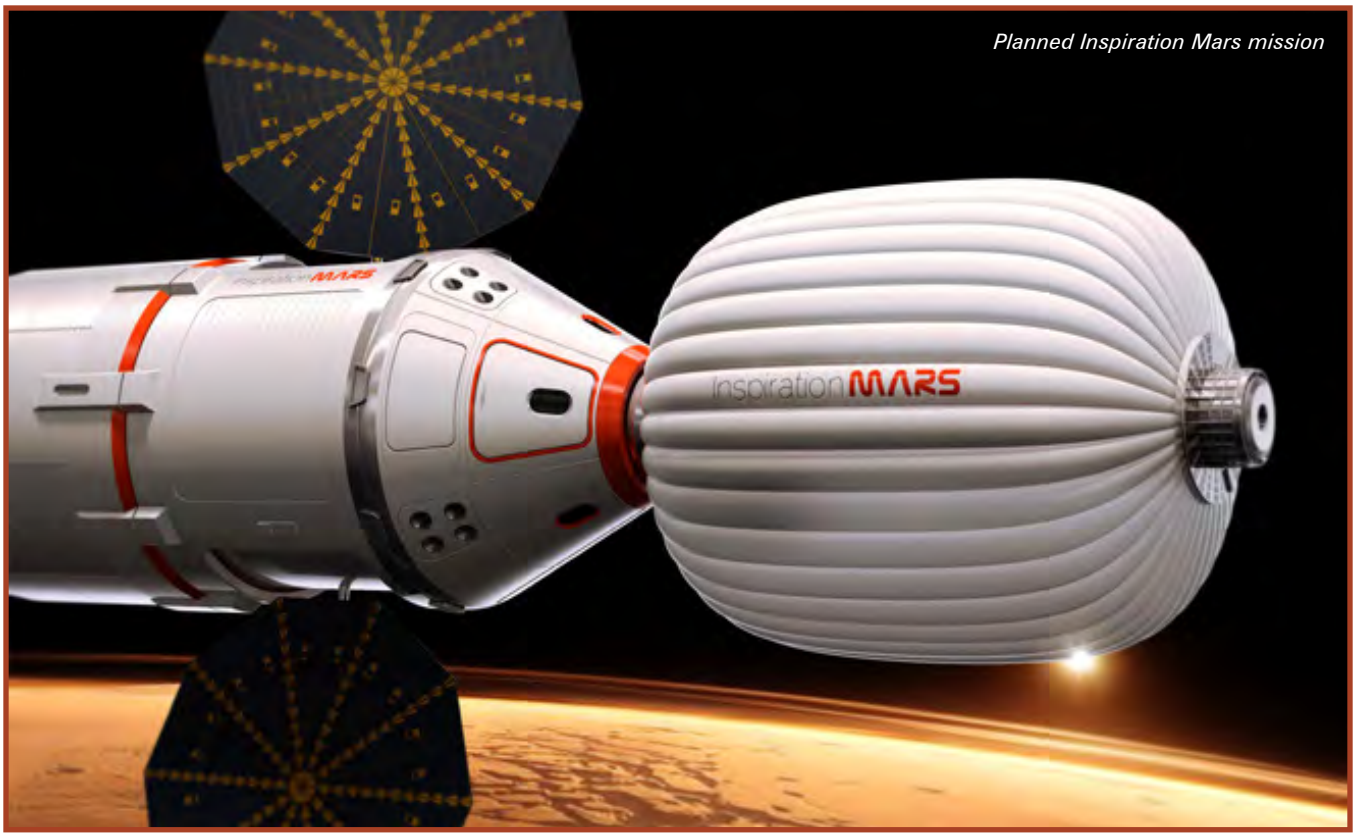
Lansdorp is very conscious of this, stating that the colonists will need their privacy. This presents an obviously confusing predicament for potential investors. They have ownership of the TV rights, but there's no assurance that the colonists won't simply switch off the cameras when survival skills kick in and the very notion of "reality TV" is as alien as Earth itself.

But then again, Mars One is perceived by the public and mainstream media as making a bold move. Thousands of hopeful astronauts from around the globe want to sign up immediately -- who can blame them? The pioneering spirit of adventure, while injecting some urgency into the proceedings, has invigorated a frustrated space generation, regardless of the project's flaws.

Another project, the Inspiration Mars Foundation, headed by multimillionaire and first space station tourist Dennis Tito, seems to be the embodiment of frustration with the current slow pace of space development.

Launching in 2018, the Inspiration Mars spacecraft -- again, a modified SpaceX capsule has been tapped as the possible vehicle of choice -- will blast two astronauts on an interplanetary joyride, culminating in a flyby of Mars.

Why? The clue is in the name: Inspiration. It is hoped that by carrying out a 501 day flyby mission



Planned Inspiration Mars mission

Image credit: Inspiration Mars

to Mars, the population of America will want to see a huge manned push to the Red Planet.

"This 'Mission for America' will generate new knowledge, experience and momentum for the next great era of space exploration," the Inspiration Mars Foundation wrote in a press announcement in February. "It is intended to encourage all Americans to believe again, in doing the hard things that make our nation great, while inspiring youth through Science, Technology, Engineering and Mathematics (STEM) education and motivation."

Once again, in principal, this sounds like a noble plan. It would be an incredible feat, a shot of adrenalin to our collective psyche. Although it suffers from the same timeframe issue as Mars One, the key difference is that the technologies for long-duration spaceflight do exist -- the necessary life support developments at least seem feasible and the non-requirement for a risky Mars landing really boosts the project's appeal.

Arguments over whether bold projects like Mars One's one-way mission to set up a colony or Inspiration Mars' no-frills 'Mars shot' are technically feasible will likely rage for the duration of the initiatives, however.

At face value, Mars One seems to be overreaching, whereas Mars Inspiration at least seems feasible. Mars One's business plan will likely be its undoing -- too many assumptions are being made of a fickle reality TV industry and the hypothetical Mars colonists themselves. As the lackluster attendance of reporters at its recent "Mars One Launch" press conference in New York on April 22 suggests, interest will wane and promises of sponsorship will ebb away. Far less challenging space projects have fallen by the wayside.

The interest Mars One has whipped up, feeding off the seething frustration that mankind hasn't set foot on another world since 1972, is commendable. But when it fails, the project will be chalked up as another disappointment for all those wannabe astronauts who would fly to Mars tomorrow given the chance.

Supporters will call this critical viewpoint unfair: overreaching Mars initiatives are for the betterment of mankind; how dare you question their viability! Even if they fail, at least they're giving it a shot, unlike all those government-led projects that came before them. They are giving a generation hope, while stimulating dreams of Mars colonies!

Sadly, I suspect the opposite may be true. What if the space analysts' skepticism is correct and projects like Mars One disappear without a trace? How will that affect existing, legitimate groups that are working for the long-term goal of getting boots on Mars? They aren't promising tight schedules and unrealistic means of funding, but they aren't sitting around doing nothing either. By turning Mars into a pie-eyed dream, the court of public opinion will be less willing to accept Mars as a real target in the future.

When hyped talk of Mars colonies slip out of the mainstream media and are forgotten as a bad idea, will future unified efforts to get a manned mission to Mars be ignored? For the sake of seeing humans on Mars in my lifetime, I hope not.

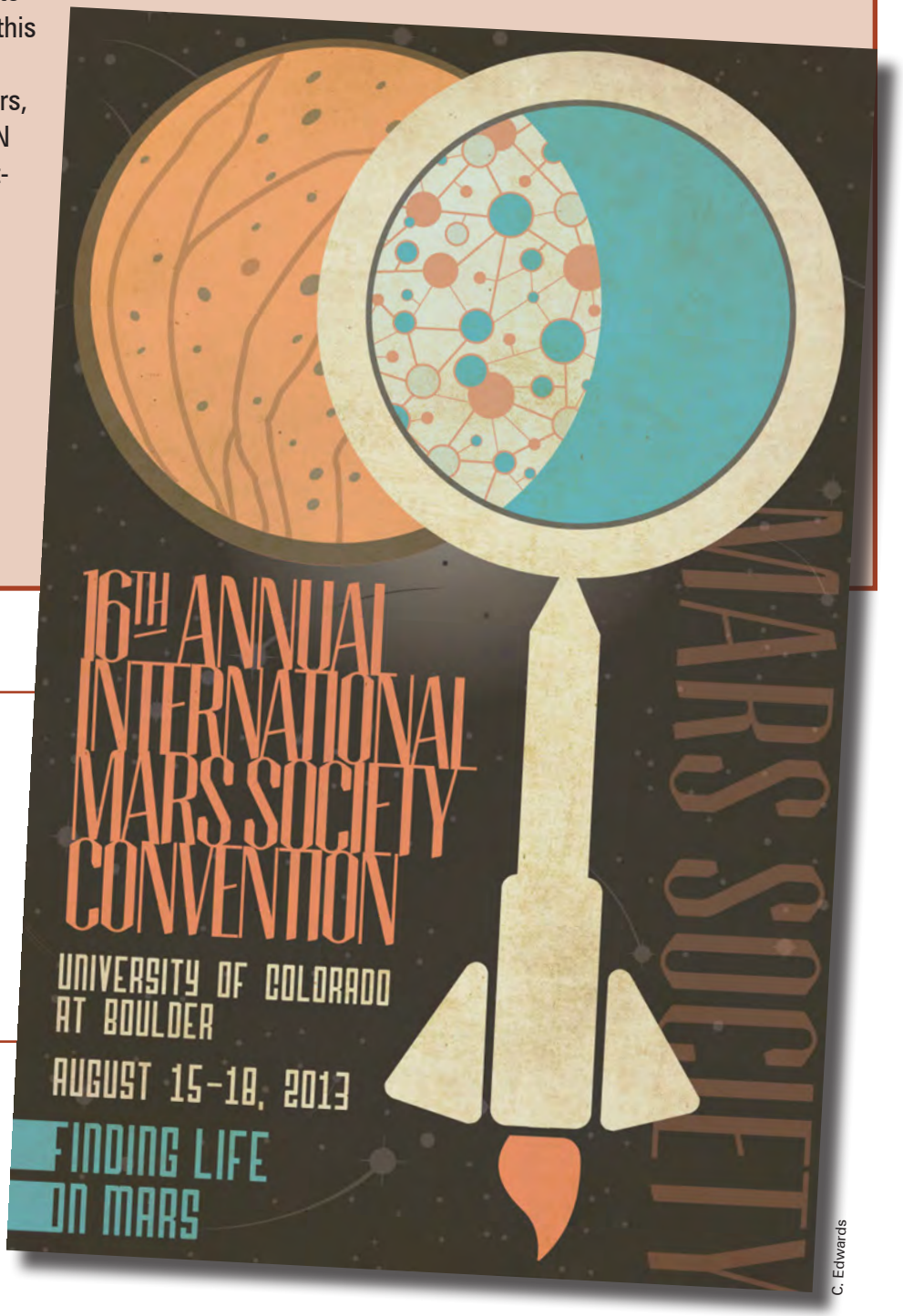
Dr. Ian O'Neill is Space Producer of Discovery News, a member of the Mars Society's Steering Committee and can be followed on Twitter at: @astroengine.

News Brief

Key Speakers Attending 2013 Mars Society Convention in Boulder

The Mars Society will convene the 16th Annual International Mars Society Convention on the campus of the University of Colorado in Boulder from August 15-18, 2013. The annual four-day event brings together key experts, scientists, journalists and policymakers to discuss the latest news on Mars exploration and planning for a humans-to-Mars mission in the coming years.

Some of the confirmed speakers for the convention's plenary talks include: Dr. Steven Squyres of Cornell University (our keynote speaker and the recipient of this year's Mars Pioneer Award), Dennis Tito of Inspiration Mars, Dr. David Brain of the MAVEN science team, Michael Lopez-Alegria of the Commercial Spaceflight Federation, Dr. James Reuther of NASA's Space Technology Mission Directorate, Chris Voorhees of Planetary Resources, Dr. Carol Stoker of NASA, Leonard David of Space.com and Dr. Robert Zubrin of the Mars Society.



C. Edwards

16th Annual International Mars Society Convention, University of Colorado, Boulder, August 15-18, 2013 - Don't Miss It!

For more details about the Boulder convention, please visit: www.MarsSociety.org.

Dennis Tito to Speak at 2013 Mars Society Convention

The Mars Society is pleased to announce that Inspiration Mars Executive Director Dennis Tito will give a plenary talk at the 16th Annual International Mars Society Convention, which will be held at the University of Colorado, Boulder, August 15-18, 2013.

Inspiration Mars is planning to launch a two-person flyby mission of the Red Planet in 2018. Tito's talk on August 16th will kick off a special morning plenary session devoted to discussing the mission, during which he will be joined by other leading members of the Inspiration Mars team. In the afternoon, workshops will be held to set up working groups to assist the Inspiration Mars project with engineering support, fundraising, public outreach and other key areas.

Tito is a U.S. engineer and multimillionaire, most widely known as the first space tourist to fund his own trip into space. In mid-2001, he spent nearly eight days in orbit as a crew member of ISS EP-1, a visiting mission to the International Space Station. This mission was launched by the spacecraft Soyuz TM-32 and was landed by Soyuz TM-31.

Tito holds a Bachelor of Science degree in Astronautics and Aeronautics from New York University, a Master of Science degree in Engineering Science from Rensselaer Polytechnic Institute and also received an honorary Doctorate of Engineering from Rensselaer Polytechnic Institute. In addition, Tito is a former scientist of NASA's Jet Propulsion Laboratory, where he was involved in designing the trajectories that guided several of the Mariner probes to Mars and Venus.

Image credit: Soyuz

Soyuz Crew TM-32 (L-R: Tito, Talgat Musabayev, Yuri Baturin)

In 1972, Tito founded Wilshire Associates, a leading provider of investment management, consulting and technology services in Santa Monica, California. He serves an international clientele representing assets of $12.5 trillion.

Through an arrangement with space tourism company Space Adventures, Ltd., Tito joined the Soyuz TM-32 mission on April 28, 2001, spending 7 days, 22 hours, 4 minutes in space and orbiting Earth 128 times. He paid a reported $20 million for his trip.

In February 2013, Tito launched Inspiration Mars and announced his intention to send a privately financed spaceflight to Mars by 2018. For more details about this effort, please visit: www.inspirationmars.org.

News Brief

Mars Society Sets Up Speakers Bureau to Further Education & Advocacy

The Mars Society, the world's largest space advocacy group dedicated to the human exploration and settlement of the planet Mars, aims to educate the public, the media and government about the importance of exploring Mars and the need to create a second home for humanity on the Red Planet.

To help advance this cause, the Mars Society recently established a Speakers Bureau with a list of representatives in the U.S. available to talk about the organization's mission, its work in Mars-related research, such as the Mars Desert Research Station and the University Rover Challenge, the latest news about Mars exploration and the growing field of STEM-driven education and curriculum with a special focus on space exploration, including the Red Planet.

If your school, organization, club or company is looking for a speaker on any of these subjects, please feel free to contact one of our representatives to inquire about availability. Please visit the Speakers Bureau at: http://www.marssociety.org/conventions/speakers-bureau.

From ISS to Mars: A SpaceX Odyssey

Jason Rhian

Mars, the world that has transfixed so many for so long, has also apparently captured the eye of the frontrunner in the commercial space revolution – Space Exploration Technologies (SpaceX). A number of statements, rumors and plans have come out of the Hawthorne, California-based company over the last couple years which point to ambitious plans that could open up travel to the Red Planet. If these statements were made by anyone else, they would not be taken as seriously. However, given the company's penchant for doing exactly what it says it will do, SpaceX's Martian ambitions have gained serious attention.

SpaceX

SpaceX's founder and Chief Executive Officer Elon Musk told Space.com reporter Rob Coppinger that his company has its sights set on the colonization of Mars. He envisions a relatively small group of people establishing a beachhead on the Red Planet – but he expects that number to swell to an estimated 80,000.

Under Musk's plans for Mars, these pioneers would be sent with provisions and supplies needed to construct a transparent dome which would be pressurized to support crew (Mars' atmosphere is less than one percent of Earth's and composed primarily of carbon dioxide).

"Elon Musk has always been clear that the long-term goal of SpaceX is to play a role in extending life beyond Earth to Mars and to make humans a multi-planetary species," said SpaceX spokesperson Hannah Post when asked about the company's ambitions vis-à-vis Mars. "SpaceX is working towards that goal by designing, manufacturing and launching the world's most advanced rockets and spacecraft, which will ultimately make a dramatic difference in the cost and reliability of space travel."

SpaceX has also been associated in the news with other Mars-based efforts. Dennis Tito's "Inspiration Mars" project, which aims to have two people conduct a flyby of Mars, initially had some observers tying the millionaire's proposal to SpaceX's Dragon spacecraft. However, the company's president, Gwynne Shotwell, denied these reports.

SpaceX

"As far as the Dennis Tito flight, I think his plan is very ambitious. We have been rumored to be in partnership with him, which we are not. But we are a launch service provider, and if he can come up with the funding to execute this mission, we'd be happy to have him as a customer," Shotwell said during the Commercial Resupply Services 2 mission briefing held at NASA's Kennedy Space Center in Florida.

SpaceX is steadily building a reputation as a major player in the private space industry. The company has completed the $1.6 billion Commercial Orbital Transportation Services (COTS) contract and has since moved on to delivering cargo to the International Space Station under the space agency's Commercial Resupply Services initiative. To date, SpaceX's Dragon spacecraft has launched three times to the space station, delivering an estimated 4,700 lbs of supplies.

SpaceX has also begun testing its "Grasshopper" Vertical Takeoff, Vertical Landing (VTVL) rocket, with each successive test sending the prototype higher and higher. Grasshopper is an experimental technology-demonstrator, which could prove invaluable in SpaceX's other space exploration efforts.

The company has stated that starting as early as next year, attempts will be made to accomplish a safe landing of the Falcon 9's first stage off the coast of Florida and then return it for refurbishment. After the company has demonstrated that it can conduct this procedure, they will take the project to the next level.

Through the use of thrusters placed on the Falcon 9's first stage, this vital element of the launch vehicle will be directed to return to the launch site at Cape Canaveral Air Force Station's Space Launch Complex 40. It is an ambitious plan, one in a long line of projects that the company has announced, developed, attempted, accomplished and moved on to the next challenge. It is this history that has provided SpaceX with the credibility needed to state that it will send humans to Mars – and be believed.

Jason Rhian is the Editor of AmericaSpace.com.

Health Challenges Facing Humans in Space

Kris Lehnhardt

Image credit: PSmith (www.philsmith.us)

"Humans are going to Mars." For decades, news stories have made this claim, discussing not if but when; after Neil Armstrong, it has been assumed that we will walk on other worlds, as well. And yet, despite the confident talk, we have still not achieved our goal. The big question, of course, is why?

There are many different answers to that question. One answer is that, in order to be successful, humans will need to arrive at Mars both alive and healthy. Many people in the space community believe that this is easy to do right now, but based upon the aerospace medicine knowledge that has been accumulated over the years, the reality is that this challenge will be very difficult indeed. However, difficult does not mean insurmountable. Most aerospace medicine experts believe that every risk to human health and safety in long-distance spaceflight can be mitigated, given appropriate levels of attention, research, and funding.

The primary risk for humans living and working in space far from Earth is space-based radiation. This radiation is made up of galactic cosmic radiation (likely from supernovae) and solar particle events. Space-based radiation is generally unlike Earth-based radiation, as it is composed of higher energy particles that have more mass and are capable of generating significantly more damage to biological tissue. We are protected from this radiation here on Earth by the atmosphere, the Earth's magnetic field, and the Sun's magnetosphere. Even the International Space Station (ISS) is somewhat protected from space-based radiation due to its close proximity to Earth. However, once humans venture out further past low Earth orbit (LEO) again, the risks of space-based radiation become more of a reality.

What exactly are the risks of space-based radiation for long-distance human spaceflight? The true answer to that question is unknown. Very few studies have ever been done on the effects of that type of radiation on biological tissue. Based upon the current body of knowledge, there are already a substantial number of health risks that may be associated with space-based radiation: cancer, cataracts, heart disease, dementia, impaired wound healing, infertility, birth defects, and increased chance of infection. One certainly doesn't need to be a doctor to see that list and know that many of the issues listed above are serious health threats to humans.

The approaches to solving these space-based radiation problems can be broken down into two categories: the vehicle and the human. Vehicle solutions include faster propulsion and effective shielding. Getting to Mars as quickly as possible in a vehicle that has substantial radiation protection could significantly mitigate the risks associated with space-based radiation. The human solutions will likely focus on crew selection, diet, medications, and nutritional supplements. Crew

Image credit: ESA

Exercising in space

members could be selected based upon their genetic predisposition to radiation resistance and they would then be provided with food and medicine that allows their bodies to best repair the tissue damage that occurs with radiation exposure. These types of vehicle and human solutions to the problems associated with space-based radiation will only be achievable with additional research and funding.

Another substantial risk to humans on long-distance spaceflight missions is related to the absence or near absence of gravity in space called microgravity. Spending many months in a microgravity environment causes the human body to change dramatically: bones and muscles lose mass, becoming weaker; pressure increases in the brain, causing partial visual loss; the heart and blood vessels become deconditioned and blood volume is reduced, resulting in dizziness and fainting; and balance/coordination are greatly altered, leading to trouble walking and problems with fine motor skills. These microgravity-related problems are certainly enough to cause illness or injury for the crew, if not complete mission failure, if they are not dealt with accordingly.

The research that has been done to date on this problem has primarily occurred onboard the ISS; as a result, the aerospace medicine community has become very well equipped to deal with microgravity. There are two types of solutions to this problem: simulated gravity and countermeasures. Finding ways to simulate gravity on a long-distance space mission, such as short-arm centrifuges or a rotating vehicle structure, could go a long way to solving this problem entirely. However, in the meantime, countermeasures are the key, and these include many hours of exercise per day in addition to proper nutrition, medications, and dietary supplements. Increasing the duration of ISS missions will certainly enable more research into the area of microgravity countermeasures but supporting new research on simulating gravity would be a huge boon for a human mission to Mars.

Although there are many more risks associated with humans living and working far from Earth, the last one that will be discussed here is related to psychology. Past experience has shown that humans generally do not fare very well in isolation environments, as our species is quite social in nature. Long-duration isolation missions (Antarctica, Mars500, Mir/ISS, Biosphere, etc.) have provided useful insights into how humans react to remoteness, loneliness, and seclusion: motivation decreases substantially, interpersonal conflicts arise much more easily, feelings of depression become more likely, and even psychotic behavior may occur. The success of any human space mission is dependent upon the crew working together in a highly effective manner, which may not be possible if their psychological responses to isolation are not taken into account.

Studies have shown that the best way to address the issues related to human psychology in spaceflight is through making the people on board the spacecraft as happy as possible. This starts with selecting the right crew composition, and then continues with effective training and preparation. Providing the crew with entertainment (books, games, music, movies, etc.) and allowing frequent communication with family and friends on Earth will help them to relax and reduce stress, which is essential for staving off depression. Offering rewards for a job well done and building flexibility into work schedules can increase crew motivation dramatically. These solutions will be very useful for long-distance human spaceflight. One specific research area can definitely use more work, however: designing a vehicle that is nice to live in.

Is it inevitable that humans will one day go to Mars? The answer to that question will be no unless there is a reasonably high chance of arriving both alive and healthy. The risks associated with long-distance human space flight pose significant challenges to mission success. None of these challenges are insurmountable, though, if they are each given the appropriate level of focus and attention. Only then can it be said with certainty that humans are going to Mars.

Dr. Kris Lehnhardt is an Attending Physician and Assistant Professor at George Washington University (GWU), where he specializes in Emergency Medicine and Aerospace Medicine. He is currently a Flight Surgeon for the Mars Desert Research Station. He can be followed on Twitter at: @AerospaceDr.

Moving Forward with Mars & STEM Education

Nicole Willett & Chuck McMurray

Seeing educational outreach as a growing part of its space advocacy mission, the Mars Society (TMS) established an Education Task Force in early 2013, led by Nicole Willett, Director of Education, and Chuck McMurray, Deputy Director of Education, in order to reach out to teachers, students and Mars enthusiasts with the goal of bringing a comprehensive Mars curriculum to the general public.

When humans travel to Mars, it will be important for everyone to understand our new home. There must be one location for anyone to go to receive streamlined information about Mars and the human exploration and settlement of the Red Planet. TMS has an educational website (http://education.marssociety.org) with a plethora of information and resources about our future home. The site has details available for the public to share with others, including links to books, videos, a biweekly educational blog and an official TMS curriculum for grades K-12. We feel that knowledge is power, and the more informed the public is about Mars exploration, the more accepting they will be when humans go on that long awaited journey.

...knowledge is power, and the more informed the public is about Mars exploration, the more accepting they will be when humans go on that long awaited journey.

Part of our objective is to connect with local schools, astronomy clubs and organizations and invite teachers and students to participate in presentations by members of our local chapters, as well as our Education Task Force. Space, Technology, Engineering and Mathematics (STEM) education is a vital part of inspiring future scientists. This outreach will move us closer to our goal of the human exploration and settlement of Mars. Recently, our Georgia chapter participated in Astronomy Day in Savannah. The Oglethorpe Astronomical Association graciously invited the local chapter to participate in an all-day outdoor event attended by many, including children. They really enjoyed handling the Mars globe, looking at the posters and reading books by Dr. Zubrin and others that were on display.

In the Chicago area, Chuck McMurray has visited many schools to further the Mars educational vision and carry the Mars Society message forward out to hungry audiences of young students. Since March 5th, Chuck has hosted multiple 60-90 minute talks in various grade levels of the Naperville school system. The Naperville STEM and other astronomy-related programs happily invited him back after his presentation to the Springbrook 5th grade, entitled "From Mars to the Stars." The late semester timing was well aligned, since most teachers cover the solar system and Mars toward the end of their standard science curriculum. Many of them were looking for content related to how the Mars missions will happen. Students were excited to ask questions as the presentations took place about where people will live on

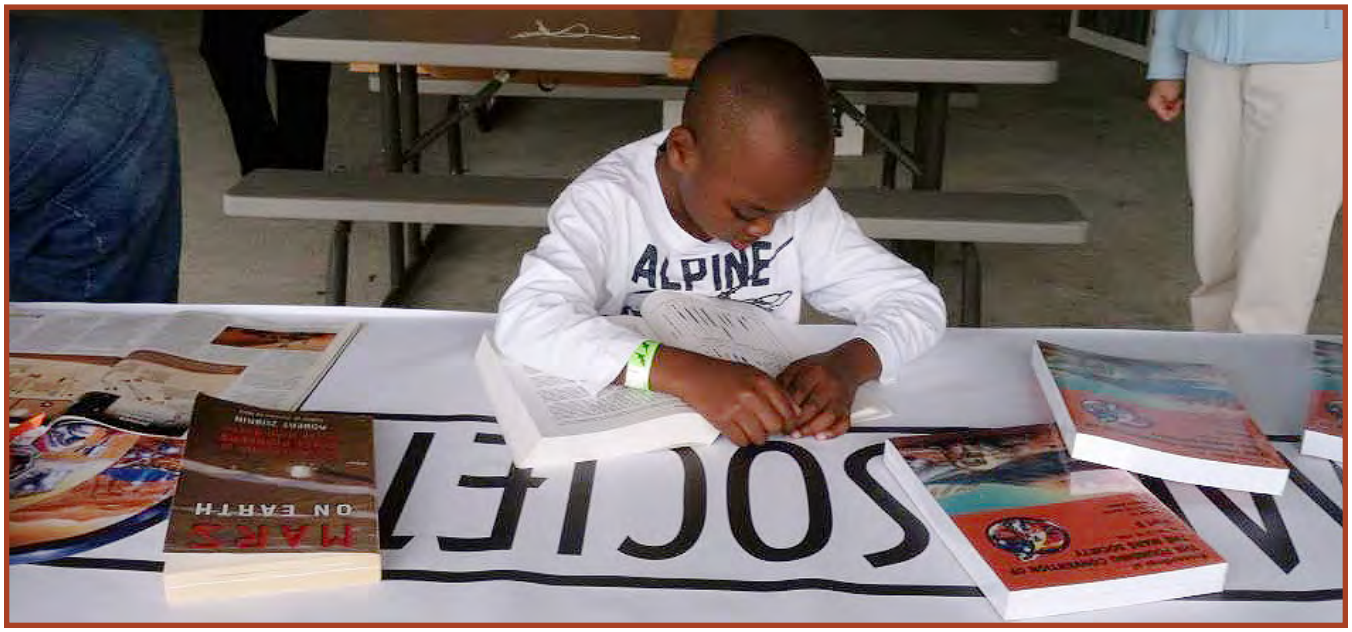


Image credit: N.Willett

Child reading Mars book at Society event

Image credit: N.Willett

Child learning about Mars and geology at Society event

Mars, what they will eat, how we will get there, why we would go and how we would plan for it. It was great to see such excitement from young minds.

Chuck's presentations covered many of the latest missions, like Curiosity, and prior mission architecture concepts, like Dr. Zubrin's Mars Direct, so that students could understand what it might take and what is the most effective. He also discussed how much NASA, ESA and other international agencies have deployed in terms of missions over the past 40 years to learn more about the Red Planet.

The high school level presentations given were entitled "Mars Generation: What's in This for Them?" Topics in the conversation included how the future of Mars exploration was sitting in the chair right next to them, noticing that their peers are potentially the next Martians. The younger generation of folks of our great nations on Earth today will be the first Martians and ancestors of the future generations to inhabit the Red Planet, and they need to understand what is at stake and where the opportunities are.

Special thanks go out to Springbrook Elementary teachers Natalie Hoyle, Kristin Colman and Nancy Mores for facilitating the accommodations and bringing over 200+ students to the hosted presentations. Special thanks also go out to Girl Scout Troop 916 and their leader Kerstyn Lott for helping to produce scaled and painted models of Mars and the moons, Phobos and Deimos, and for handout displays at the school's presentations. We would also like to thank Neuquén Valley High School teachers Paul Vandersteen and Nick Marasco for allowing us to host a forum at Neuqua for over 90 minutes, with over 100+ junior and senior students, in their amazing facilities. It sounds like TMS will be back next year for another round with students and speeches. Chuck already has requests from multiple other school systems in the Chicagoland area. He is also receiving invitations to present his talks about Mars in Midwest cities like Minneapolis, St. Louis, Milwaukee and Madison. Look for him in a city near you.

Coming up soon, the 16th Annual International Mars Society Convention is being held in Boulder, Colorado, August 15-18, 2013. As part of this, the Education Task Force will be hosting the 2013 Mars Society STEM Education Event on Saturday, August 17th and Sunday, August 18th. This two-day event is free of charge to kids of ages up to 18 years old. There will be interactive activities for children, as well as presentations and special guest speakers.

Chris Nye, a member of UC Boulder's Students for the Exploration and Development of Space (CU-SEDS), will also be hosting many interactive activities, such as Alka-Seltzer rockets to Mars, making Mars craters, digging for a Martian fossil, yummy Mars-mallows and much more. In addition, the Mars Foundation will be on hand, giving a 3-D printing demonstration. Astronaut Abby, who wishes to be the first astronaut to Mars, will be speaking about her quest. Mars Society President Dr. Robert Zubrin will also address the audience about the importance of Mars education and exploration.

Another part of the STEM Education Event will involve Chuck McMurray launching the Youth Rover Challenge (YRC), geared toward middle and high school students (grade levels 8 to 12 will be invited). The Youth Rover Challenge program will consist of two levels of competition to get kids started earlier and prepare them for the University Rover Challenge (URC) program currently organized by the Mars Society and held annually at the Mars Desert Research Station in Utah.

These are just a few of the outreach projects that the Mars Society's Education Task Force has been involved with recently and will be organizing in the near future. There is much more under development and in the planning stage. If you would like to get involved or if you have any suggestions, please contact: nicolew@marssociety.org.

Spotlight On...

Dr. Jonathan Clarke

Kerri Beauchesne

Image credit: J.Clarke

Meet Dr. Jonathan Clarke, a member of the Mars Society (TMS) Steering Committee and President of Mars Society Australia (MSA).

Since childhood, Clarke has been fascinated with space exploration, and particularly with Mars. "Some of my earliest memories are of looking at pictures of the far side of the Moon from Luna 3, and of the Mercury program," Clarke says. "Mars was always the next step after the Moon, so I read all I could about Mars and going there." One of his first geology reports was on Mars, and he wrote a story about the first expedition.

Discovering that all plans to send humans to Mars had been put on hold was a major disappointment to him. Nevertheless, "Mars was still always on the backburner of my mind," says Clarke, "and I still read all I could about Mars, be it fact or fiction." When he learned in 2001 that MSA was looking for people to lead an expedition to central Australia to look for Mars analogue sites, he volunteered. "The expedition was a great success," he says, "and I have been involved ever since."

Since joining MSA in 2001, Clarke has participated actively in Mars advocacy and scientific work, including numerous expeditions related to Mars analogue research. In Australia, for example, he took part in the Jarnitmarra expedition (2001), Expedition 2 to Arkaroola (2004), and Spaceward Bound Australia, MSA's joint educational venture with NASA (2007 and 2011). In the United States, he was involved in three separate expeditions (2003, 2009, and 2010) to the Mars Desert Research Station (MDRS), the Mars Society's Mars analogue site in the Utah desert. Additionally, he has worked with the Mars-Oz project group, which has designed an Australian Mars analogue research station, and with the British Interplanetary Society on a Mars polar

station study.

Until human scientists set foot on Mars, we must rely heavily on insights gained from such terrestrial analogue sites, which is why Dr. Clarke's scientific expertise is so valuable. A geologist with thirty years of field experience and research, Dr. Clarke has studied sites all over Earth, on five continents and under three oceans. His work crosses most of the geoscientific disciplines, including mineral, coal, and petroleum exploration, groundwater, paleoecology, sedimentology, geomorphology, and regolith geology. "This gives a very broad base for understanding the geology of Mars," says Clarke, "how Mars would be best explored geologically, and the application of geosciences to solve specific problems."

Such work, carried out in collaboration with many international organizations and university research groups, is what Clarke considers the greatest strength of TMS. "Other space groups talk about things; the Mars Society does things," Clarke says. "MDRS in particular is a flagship of the international role of TMS."

Clarke is an important international voice on TMS's steering committee. He sees himself as representing not just Australia, but also other small countries with little or no formal space activity, but which share the vision of the human future on Mars.

This spirit of collaboration has infused Clarke's work over the years with MSA. He has helped to develop ties with such groups as the National Space Society Australia, the Australian Centre for Astrobiology, the Commonwealth Scientific and Industrial Research Organization (CSIRO), the Australian Centre for Space Engineering Research, the federal Space Policy Unity, and researchers at various universities. Overseas, they have built relationships with NASA's Ames and Johnson centers and with the European Space Agency (ESA). Perhaps the best collaboration, however, is within MSA itself. "We have wonderful, motivated people from all walks of life who contribute enormously to MSA," says Clarke.

As president of MSA, Dr. Clarke sees his role as three-fold: providing a vision for MSA in Mars-related research, education, and outreach in the region; maintaining high-level contact with other space organizations in Australia and overseas; and ensuring that the organization works toward balanced budgets. Their current projects include an expedition to Arkaroola in 2014, completing the Marsupial analogue pressurized rover, and securing funding for Mars-Oz.

Other space groups talk about things; the Mars Society does things. MDRS in particular is a flagship of the international role of TMS.

Funding is one of the knottier problems he faces, since Australia has a minimal civil space sector. "We have no shortage of good ideas," Clarke says, "but getting funds for them is very challenging." Recruitment is also crucial, "to get enough people to complete the tasks we have taken up."

Such practical realities have forced a shift in perspective in both TMS and MSA over the years, according to Clarke. "There was a widespread sentiment when things started that we were going to singlehandedly turn things around and get people on Mars in a decade," he says. "I think we are more realistic now, recognizing that building the public acceptance of and support for human missions is a much larger job than originally envisaged, and that our role, while it is important, is to be one voice amongst many."

As the Mars Society continues to evolve, Clarke would like to see it work more closely, when possible, with the many other Mars groups that exist and to build closer relationships with various space agencies and universities. In particular, he would like TMS to work towards a serious research program at FMARS, using it as a platform for long duration human factors research, with durations that more closely resemble those that would be spent on the Martian surface.

He would also like to see continued improvements to the facilities at MDRS, and Down Under, he would like to see the Mars-Oz facility funded and built. "Not only is this a very different environment from MDRS and FMARS," he says, "but it explores a horizontal lander configuration for the habitat and thus has the potential to complement the other facilities' work."

At the leadership level, he says, "We should work towards greater openness, transparency, and accountability in our management, and greater professionalism in our operations, ensuring that we continue to make a valuable contribution towards the vision of people on Mars."

Although he brought a wealth of expertise with him, Clarke feels that his work with MSA and TMS have increased his knowledge of Mars and Mars missions, of astrobiology, human factors, and analogue research by orders of magnitude. At a practical level, he says, "I have gained considerable insight into what volunteer associations can and cannot do, especially in the Australian context."

One of Clarke's greatest joys in working with MSA and TMS has been the opportunity to play a small part in the push to establish a human presence on Mars. Along the way, he has developed personal friendships with Mars-oriented people all over the world, including the United States, Canada, Russia, and many European countries, not to mention closer to home in Australia and New Zealand. "These people have been a support and an encouragement in a great many ways," Clarke says.

Dr. Clarke resides in Canberra, Australia's capital and works as a geologist for a national agency. His wife Anna is also a member of MSA, and they have two adult daughters.

Mars Desert Research Station: A Season in Photos

The Mars Society's Mars Desert Research Station (MDRS) recently concluded its twelfth annual field season, which ran from December 2012 through May 2013. The MDRS facility in southern Utah serves as a field base to teams consisting of five to six crew members, living in relative isolation in a Mars analog environment for two-week rotations.

The research being carried out by MDRS crew members is intended to help prepare for a humans-to-Mars mission in the near future. Some of the work involves studies in the field of geology, engineering, bio-medicine, atmospheric studies, nutrition, astrobiology, robotics, astronomy and communications.

To give you a closer look at the Mars Desert Research Station and a better sense of its purpose, we have put together a sample of photos from the 2012-13 field season. To learn more about MDRS, please visit our web site http://mdrs.marssociety.org.

Russian crew being welcomed to MDRS by Dr. Robert Zubrin (2nd from left)

Crew members preparing to leave an airlock on an EVA

Crew members tending to plants inside GreenHab

Russian crew members with national flag outside of Mars hab

Crew members testing an emergency transport during an EVA

Celebrating the holidays inside the Mars hab

A crew member using the lab inside the Mars hab

Crew members testing a dry river bed

A crew member using the Musk Observatory

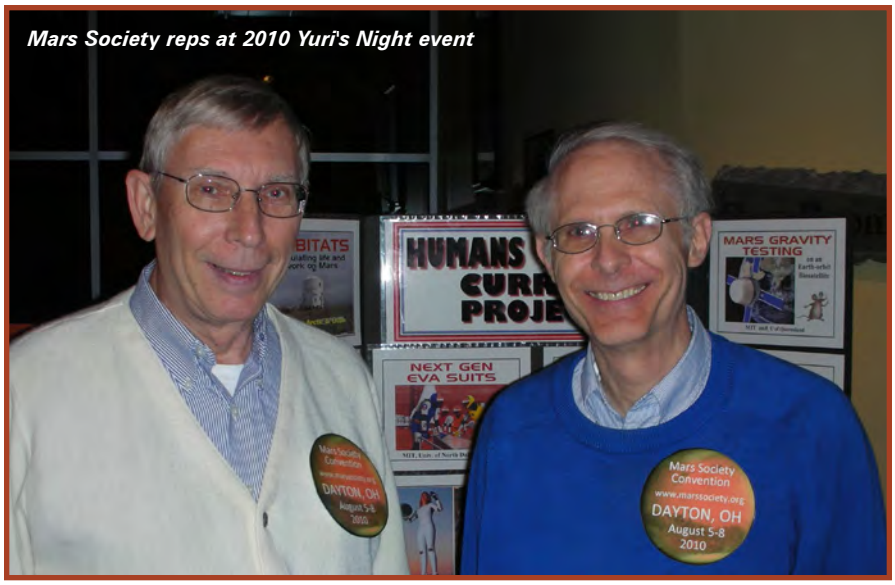
Two crew members climbing out of a small canyon

Crew members getting caught up on work inside the Mars hab

Returning to the hab.

Chapter Close-Up: Ohio

Jerry Black



Mars Society reps at 2010 Yuri's Night event

Image credit: J.Black

The Ohio Chapter of the Mars Society was founded in 1998 (the same year as the Mars Society) by Tam and Patt Czarnik. Although Tam and Patt moved out of state many years ago, the chapter has remained strong and active. In 2010 the chapter planned and hosted the 13th Annual International Mars Society Convention in Dayton, Ohio. As part of the convention the chapter held a highly successful educational event dubbed "Mars Camp" for kids K-12 and their families.

The chapter has always concentrated on public outreach events in lieu of holding regularly scheduled meetings. Every year the chapter takes part in more than a dozen such events. In the past year the chapter gave presentations to several adult groups including the Cincinnati Astronomical Society, the Regional Engineers and Scientists of Cincinnati, the Metallic Club (a retired men's organization) and the Fairborn library. However, our main focus has been with kids K-12 and their families. These included two talks at TechFest in Dayton, talks for several classes of 3rd graders at the SOAR event in Dayton, talks for six different classes of 5th and 6th graders at Loveland Intermediate School and a talk at ScopeOut at the Cincinnati Observatory (a family oriented astronomy event). Most of these "talks" were interactive, with lots of participation by the kids.

...our main focus has been with kids K-12 and their families.

Besides giving talks, the chapter sets up display tables at several community events each year. This provides the opportunity for informal conversations with interested participants who stop by to look at the display. Recent events with Mars Society display tables include Apollo Rendezvous (a Dayton astronomy event), TechFest, ScopeOut, Space Day in Sharonville, and Space Fest at the Museum of the U. S. Air Force. For the display events and talks, the chapter has developed several posters and a variety of handouts. The current content of these are available to other chapters for the asking.

Other events in the past year have included the Regional Science Fair at the University of Cincinnati, where the chapter funded special first and second place prizes and provided judges to pick the winners of these prizes. Also, three runners from the Ohio chapter took part in the iSpace 5K run to benefit STEM (Science, Technology, Engineering, and Math) education.

Most of the events have taken place in the Cincinnati and Dayton areas. Jerry Black is the chair of the Ohio chapter and is assisted by Lyle Kelly (the chair of the Cincinnati branch) and Patrick Craig (the chair of the Dayton branch). Other volunteers who helped in the past year include Carlos Glender, Tom Chatterton, Craig Jarratt, Karen Rockich and Otis Moreman. Also Geoffrey Landis has publicized space related events in the Cleveland area.

The chapter uses a Yahoo based E-group to share news and information, has an Ohio Chapter page on Facebook and supports an Ohio chapter web site. Thanks to the Ohio Chapter and its membership for spreading our message. On to Mars!

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.

THE MARS SOCIETY

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