THE MARS QUARTERLY

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15TH ANNUAL INTERNATIONAL MARS SOCIETY CONVENTION

PASADENA, CALIFORNIA, AUGUST 3-5, 2012

IN THIS ISSUE

Cover design by Caitlin Folchman-Wagner.

FROM THE FLIGHT DECK

Welcome back to the pages of *The Mars Quarterly*, which has been on a brief hiatus due to scheduling issues. As this issue goes to press, we are gearing up for our 15th Annual International Convention which will be held at the Pasadena Convention Center, August 3-5. The convention will continue into the evening hours of August 5, so that attendees can join us in viewing the landing of the Mars Science Laboratory - *Curiosity.* The convention hall will also be hosting The Planetary Society on August 4-5, and this conjunction of space advocacy organizations is an extraordinary opportunity to enjoy the best of both. Register today at: http://home.marssociety.org/2012-convention-registration/.

In this issue we offer interviews with NASA scientists Christopher McKay and John Callas, as well as Gernot Groemer of the Austrian Space Forum. We invite you to read beyond our pages to fully understand the extent of their respective contributions to Mars research and exploration.

See you in Pasadena!

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A Space Program We Can Believe In

Robert Zubrin

First published at SpaceNews on May 21, reprinted with permission.

The current administration says it wishes to set a course towards sending humans to Mars. If it does, here are the essential features that such a program needs to have in order to succeed.

1. The Mission Objectives Must Be Worthwhile.

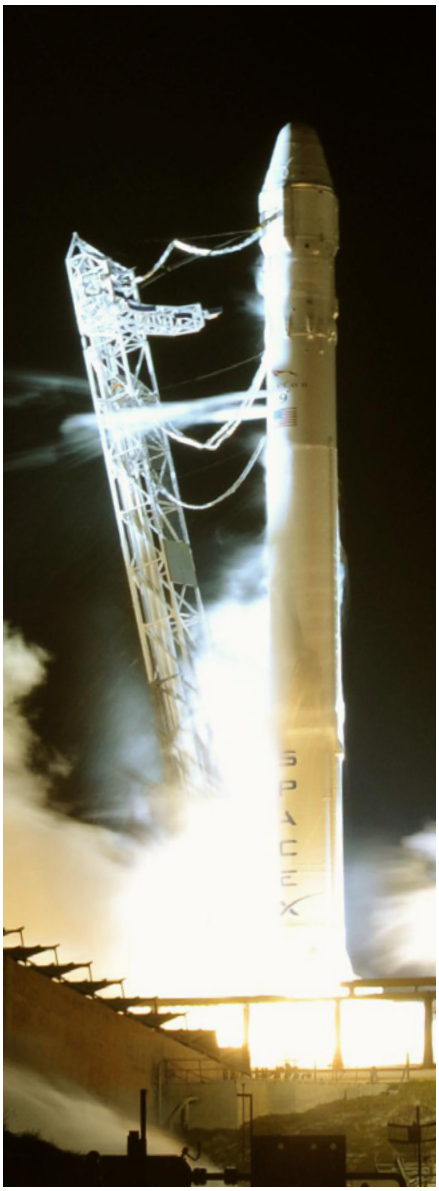
The reason to send humans to Mars is not to set a new altitude record for the aviation almanac. Rather it is to conduct serious exploration that will resolve the questions of the potential existence and diversity of life in the universe and open a new world to human settlement. Therefore missions that do not actually land on Mars, or only stay for brief durations, are to be shunned. There is no point going to Mars unless you can do something useful when you get there. If the program is not solidly based on such a rational foundation, it will be cancelled long before it ever goes anywhere.

2. The Mission Must Be Proximate.

Claiming one is setting a goal of sending humans to Mars in the year 2047, or some other far future date, is risible. No one living several decades hence will know or care what today's NASA's officials chose to put into their schedules, and to assign the mission to execution by such people is simply to avoid commitment. For the program to be real, it needs to be planned in a way that will allow it to be flown by people who are in the astronaut corps today, not by generations yet unborn. Furthermore, for the program to have any chance of success, it must reach its objective within a limited time. Otherwise the political conditions that allowed it to be launched will almost certainly disappear before it reaches its goal.

3. The Mission Plan Must Be Practical.

The right way to do engineering is to take the simplest approach possible, with the fewest needs for new technologies. The wrong way is to take the most complex approach, with the maximum expenditures for new technologies. The Mars mission should thus not be designed for the purpose of justifying the complete assortment of NASA or industry advanced technology efforts seeking funding. Running a program that way is like running a company with its expenditures determined by its vendors. Practicality furthermore requires that the mission be designed around technologies that are either in hand or clearly feasible. Making the mission dependent upon fantastical futuristic systems, such as gigantic 100,000 kilowatt nuclear electric spaceships is simply another way of insuring that it never happens.



Julian Leek

4. The Mission Leadership Must Not Be Feckless.

It is essential that issues be dealt with as problems to be solved, rather than as excuses for avoiding action. Thus, for example, NASA needs to stop hiding behind the cosmic radiation and zero gravity health issues as excuses for not going to Mars until unobtainable propulsion systems are available. More than half a dozen astronauts and cosmonauts have already received cumulative cosmic ray doses during extended stays in Earth orbit without harm. Zero gravity health effects can be avoided by rotating the spacecraft to create artificial gravity.

5. Mission Success Must be the Highest Priority.

That may seem self-evident, but it is not. The achievement of mission success requires really flying the mission (see relevant points, above). Furthermore, placing the highest priority on mission success means placing mission success above crew safety. There are an unlimited number of candidate technical improvements, precursor missions, and test programs that could potentially marginally improve the safety of the first Mars mission crew. But if all, or even a significant fraction of them, were attempted, the mission would never fly, and we would guarantee program failure achieved at infinite cost. Precursor activities might improve the chances of a given Mars mission, but they come at the cost of reducing the number of missions that can be flown, and they certainly cannot be allowed to proliferate to the point where they

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Red Dragon Mission

A Discussion with Chris McKay

TMQ I understand from reading several media reports that you coined the name *Red Dragon*.

CHRIS No, I didn't. John Karcz's partner suggested it. I was the one who put it in the press. But John came in one day and said he was talking with his partner and she said "Why don't you call it *Red Dragon*?" Nobody did anything with it, and then one day when I was talking with a reporter, the conversation with John came back to me, and I said "We're calling it *Red Dragon*."

TMQ What is *Icebreaker*?

CHRIS *Icebreaker* is a payload, and *Red Dragon* is a mission concept for a particular capsule for landing on Mars. *Icebreaker* is a drill and a bunch of instruments that can go to Mars on many different capsules. In fact *Icebreaker* was designed with *Phoenix* as the carrier spacecraft. But it could go on *Red Dragon* - a SpaceX capsule; or it could go to Mars on a *Phoenix* lander. If someone else came to me with another spacecraft that was going to Mars, I'm sure I could figure out how to strap *Icebreaker* on to it as well. So *Icebreaker* is effectively a drill and some instruments.

The name *Icebreaker* also wasn't invented by me. It was invented by Roy Nakagawa who was our project manager a couple of years ago, but who now works for The Aerospace Corporation. The alternative name suggested by the guys working here at Ames was "Bruno". Choose between those two! I chose *Icebreaker*. So in both cases I didn't come up with the name, but I chose it so to speak, and pushed it forward.

TMQ What are your potential landing sites?

CHRIS For *Icebreaker*, we want to go back to where *Phoenix* landed, because we think that is the best place on Mars to search for evidence of life. There we have ice close to the surface such that it could warm up and become suitable for life at high liquidity and it is accessible. Ice can preserve bio-markers, if there is life. The low elevations of the northern plains contains ice that if warmed up, would form a liquid and be stable, unlike the southern plains where the pressure is too low and the ice would go to vapor. Being near the poles with high liquidity, the *Phoenix* site would get as much sunlight and as high a

NASA

liquidity as the Earth's polar regions get now and refine life on Earth's polar regions. So we think that the best place to find evidence of recent life on Mars is at the *Phoenix* landing site, so the target site for *Icebreaker* is right now is on top of *Phoenix*, and I will take the cheapest and most reliable spacecraft I can find. To me *Red Dragon* or *Phoenix* are just taxi rides - that's just how I get my instrument to the field. Price and availability are factors. I have a payload, an instrument that I want to get to Mars, and I don't care how I get it there.

TMQ What type of analytical lab you are designing?

CHRIS The key part is the payload. There are two pieces that really matter. One is the drill because the frozen ground is very hard and the only way to get into it is with a drill. A shovel, a spade, an arm, they just won't work - as *Phoenix* found out. So the key bit of technology that allows us to sample inside the ice is the drill. Our drill has to be over a meter long so we can drill very deep into the ice - deeper that anyone has ever gone on Mars. The drill has been built and is in Honeybee Robot Company's shop in Pasadena. That is the first and most important part of the *Icebreaker* payload.

The second key part of *Icebreaker* is an instrument called the 'Signs of Life Detector'. The acronym is SOLID. It is being built in Spain and will detect the bio-markers of life.

TMQ How does it do that?

CHRIS It detects life using amino assay technology. It will have a microchip on which we will attach literally hundreds of individual molecular sensors that are tied to specific molecules like DNA and proteins, and so on. When those molecules are present they bind, lock and key, and that turns on a little florescent tag that will allow us to determine what molecule has been detected.

TMQ Will you also be assessing subsurface habitability?

CHRIS Right. We are interested in the search for life and searching for bio-markers, but we will also want to understand the environmental context. We have a lot of other instruments that will tell us: Was there salt here? Was there water here? Did the ice ever melt? And so on. So that is trying to understand habitability.

TMQ What else will the ice tell you? Will you be establishing an ice record or the climate history of Mars?

CHRIS We may get that information, but for me those are of secondary, even of tertiary interest. I'm interested in the search for life, and we will do that with bio-markers. Now we will get a lot of other

SpaceX

information too, and will probably write a lot of other science papers, in addition to the discovery of life. As far as the mission goes, I hope we will have discovered evidence of life, and knowing 10 million years ago that the climate was different - these other science goals will simply pale by comparison.

TMQ Dragon isn't large enough to carry a rover, so how will you deploy the drill?

CHRIS The concept right now is to have a little trap door at the bottom of the capsule, so when we land the drill will go straight through the bottom.

TMQ This is not a sample return mission, correct?

CHRIS No. Whether it goes on the *Phoenix* spacecraft or on the Dragon, it will do all of its analysis *in situ*; all it will send back is data.

TMQ What type of instruments will be on board doing the analysis?

CHRIS SOLID is the main instrument. It will process the data and send it back. There is a laser inside SOLID, but nothing like ChemCam. MSL will come up to many rocks and will use ChemCam to decide which rocks to pick up, whereas we are just drilling down. So we don't need to do any selection. We land, turn on the drill, and down we go.

TMQ What's the timeline? I understand the first Discovery-class vetting process is closed. What targets do you have to hit for the next round?

CHRIS Yes, we are shooting for the next Discovery round, which is likely to be a mission in 2018. So right now we are doing trajectory analysis and plans for a 2018 mission. Cost is the primary target – and not just payload cost, but the whole thing. That's why I am encouraging *Red Dragon* and *Phoenix* as spacecraft. I will also keep looking, because when I go to HQ, it is the cost of payload, reliability, and the cost of the spacecraft. Most of the cost is the spacecraft. That's why we missed the last round – the spacecraft cost was too much. That's when I started looking for another taxi – the fare on this taxi was too high. And the curious thing is, if you have another taxi, the fare on the first taxi goes down.

TMQ What are you working on right now?

CHRIS We are working on the payload – developing the drill, the sample transfer system, and all the instruments to work them into a single coherent package. We are testing it in two places – one in a Mars chamber in Pasadena that is the size of a VW bus – a huge vacuum chamber; and two, we are testing it in Antarctica, which is the coldest, driest environment that we know. We want to get the payload ready, and we encourage spacecraft companies to build spacecraft. Eventually we will hitch a ride.

TMQ Who is the decisionmaker on the mission, and when will a decision be made?

CHRIS The key decisionmaker is the Associate Administrator for Space Science – John Grunsfeld. By the time he gets it, it will have gone through several committees, but he will make the final decision. A final decision will likely be in 2014 – four years before launch. Once he says go, we will have four years of frenetic activity before we launch.

TMQ Is there any back and forth between your office and SpaceX right now regarding payload size and design?

CHRIS Yes, we have teleconferences every week to determine payload accommodations – we need to determine if Dragon can carry the payload. We haven't committed to doing it with Dragon, but we need to determine if Dragon is a viable option with the *Icebreaker* payload. We know that the *Phoenix* spacecraft is a viable option - we have already determined that. Dragon is cheaper, but we need to determine if it is technically viable, and that's what we are doing right now.

TMQ At what point does the door close on the mission concept?

CHRIS We have about a year. There have been rumors that other spacecraft companies would be getting into the business, and so we are very interested in that. If I hear of another company, I will call them up and ask them if their spacecraft can carry my payload. The more potential rides I have, the happier I will be.

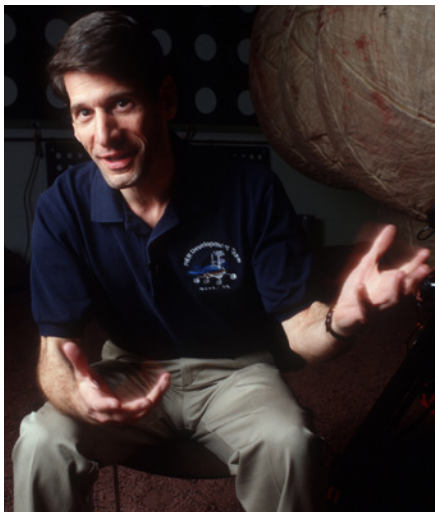
TMQ Is it possible that you might end up riding with an international partner?

CHRIS We will not have an international launch or an international spacecraft – partly because no other country has landed on Mars successfully. The Russians have tried and the Europeans have tried. In terms of building instruments, our international partners have done a great job, but for my precious payload, I won't deviate from U.S. launchers, and I believe HQ will require it.

Christopher McKay has a Ph.D. in AstroGeophysics from the University of Colorado in 1982. His research focuses on the evolution of the solar system and the origin of life. He is also actively involved in planning for future Mars missions including human exploration. He has been involved with polar and desert research, traveling to the Antarctic Dry Valleys, the Atacama Desert, the Arctic, and the Namib Desert to conduct research in these Mars-like environments.

A Discussion with John Callas

PROGRAM MANAGER: MER



TMQ John, please tell our readers a little bit about yourself.

JOHN I grew up in Massachusetts, and attended Tufts University School of Engineering where I earned a bachelor's in science and engineering. After that, I attended Brown University and earned both a master's and PhD in physics. My first job out of school was working at JPL. I had always had a passion and love for robotics exploration, and so JPL was the natural fit for me - and here I am.

TMQ What is your current position at JPL?

JOHN I am the project manager for the Mars Exploration Rover project, operating two rovers on the surface of Mars: Spirit and Opportunity. Spirit lasted over six years for a 90-day rover, but eventually the environment took her away from us and we had to say goodbye. Opportunity continues to operate very successfully on the surface. My job now is to keep Opportunity going, and to continue that exploration for as long as possible.

TMQ Opportunity is currently* in the southern hemisphere of Mars gathering sunlight for those dusty solar arrays?

JOHN Right, we are just south of the equator. We are only a couple of degrees south latitude, but that means that the sun is in the northern sky. To maximize energy production, we position the rover by parking it on a slope to tilt the arrays toward the north. These rovers were never designed to go through winter; they landed in the summertime - originally only for a 90-day mission; so we never had to worry about this kind of thing. But as the missions have gone on, it has become an issue with each season - and the rovers are affected by dust on their solar arrays. We have been benefiting from wind cleaning off dust at unpredictable intervals, but there is a lot of dust on Opportunity's arrays right now. That means this winter is the first winter of the five that she has been on Mars where we actually had to take active mitigation where we deliberately parked the rover. We did this for Spirit for her second, third and fourth winter, and now we are doing it for Opportunity. There is still quite a bit of dust on the arrays that has not been cleaned off by the wind.

TMQ When will Opportunity be in motion again?

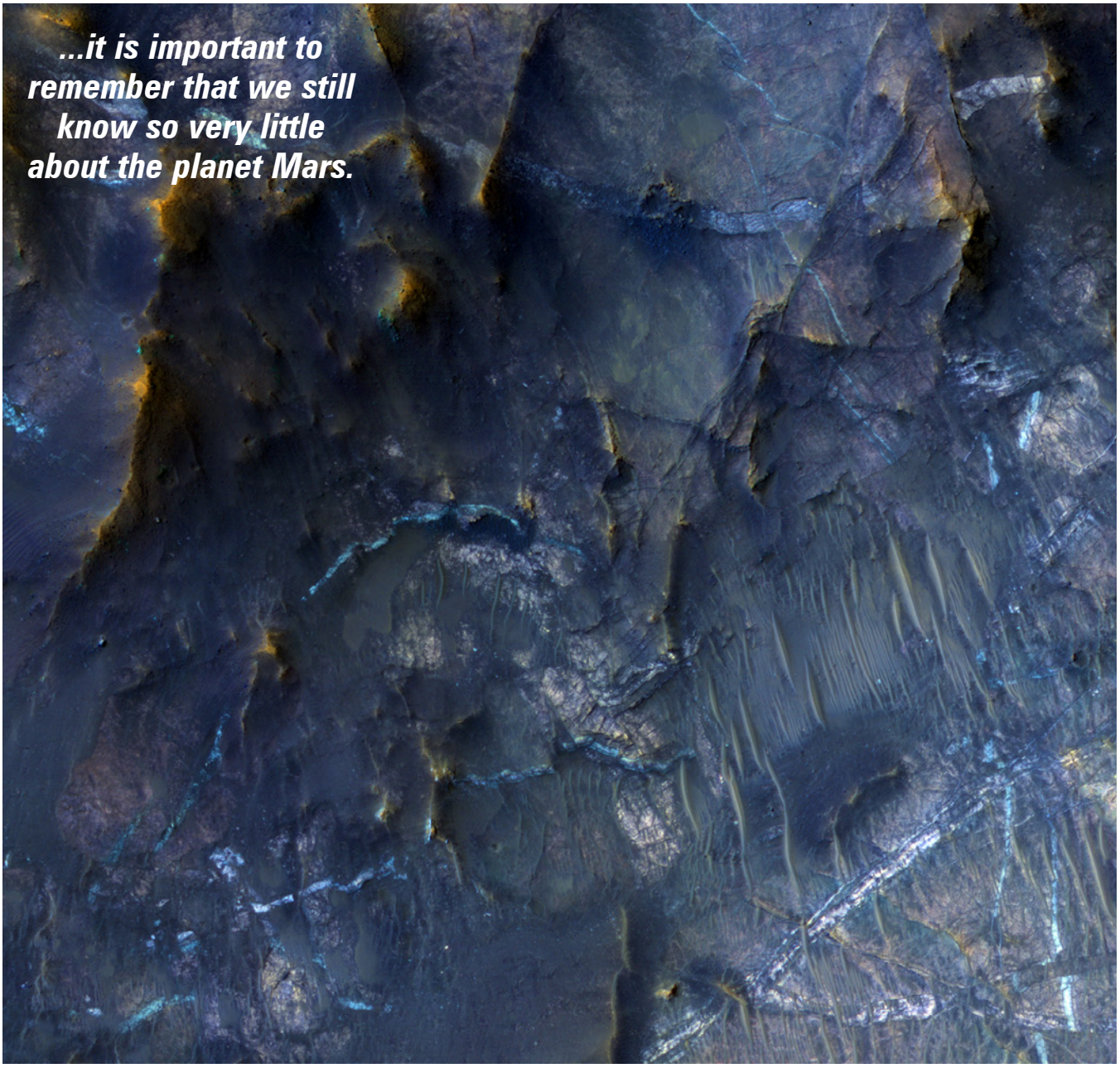
JOHN We can't say exactly because it depends on whether we get any dust cleaning on the arrays. If the arrays were cleaned today, we would be moving tomorrow. Right now the estimate is the first of June, when we will continue the exploration of Endeavour Crater.

TMQ Will Curiosity also require the cleaning of solar arrays?

JOHN Curiosity has an entirely different power system – it uses nuclear power - so they avoid this situation altogether. But they do talk about mitigation strategies for future missions that might be solar-powered on the surface of Mars. The challenge is that you are not sure whether any of the techniques you might envision will work. There is one theory that dust clings electrostatically. If that's the case, it's just like trying to sweep off those annoying Styrofoam pellets you get in a shipping box that cling to your skin electrostatically; you try to remove them, but they just cling there. So they do look at active techniques - whether they could have a solar array that you could re-deploy or that you could tilt, or maybe a windshield wiper mechanism for dust removal.

TMQ What does the team do while the rover is stationary, in contrast to what it does when it is in motion?

JOHN This winter for Opportunity has presented us with a unique and exciting opportunity, and that is to track the radio signal from the rover. When the rover is stationary on the surface, the Doppler signature we see in the radio signal is now a proxy for the motion of Mars. By tracking that very precisely, we can actually infer the rotation of Mars and the position of the spin axis of the planet. And so we have been measuring the precession rate of Mars. It was last measured in the *Pathfinder* days back in 1997. By getting the rate of precession, one can get a measure of the moment of inertia of Mars. This is important because the moment of inertia tells us about the mass distribution within the planet, potentially the size of the core, and if we can tease out the nutation, which is the small wobble in the precession rate, we might even be able to tell the fluid state of the core. This a technique very similar to what you do in the kitchen if you want to find out if an egg is raw or hard-boiled, you spin it - and if it spins freely you say "Ah hah! It is hard-boiled", but if it sloshes, then you say "Ok. It is a raw egg." Planets do the same thing. If Mars has a fluid core there should be



NASA/JPL/University of Arizona

a certain amount of slosh in its rotation. It is a very small, small signal, but tracking the rover's radio signal which is now fixed on the planet, we can try to tease out that signal, and so that is one of the things we are doing now that the rover is stationary.

TMQ How is the rover operated?

JOHN We don't control the rover in real time because radio signals take too long to get from Earth to Mars and back again. At the shortest, a signal is only about four and a half minutes; but at the longest, it is 21 minutes. What we do is send instructions to the rover almost every day. Typically, the rover sleeps at night to conserve power. When the rover wakes up in the morning, we send it a set of commands, and then the rover autonomously will carry out the instructions over the course of the day - and that includes driving. So we have to have a rover that first of all will keep itself safe; and secondly, we have to send a set of instructions that the rover can actually execute. We have sophisticated tools here on the ground that take the same data the rover has - the rover sends us all of its visual information. The images it has taken are stereo generally, so that means we can review certain data in three dimensions. We have tools where we can view the data in 3D and by driving a virtual rover in that 3D model, it helps us to generate a command that we would send to the rover to carry out driving.

TMQ If you see something in the data from the previous day that you think is worth going back to look at a second time, that has to come in the next day's data stream?

JOHN That's right. We are a very reactive, non-deterministic mission, in that we don't know what we are going to do today until we have seen the results of yesterday's activities. So we do react to what we have seen and discovered on the surface of Mars.

When the rover is driving, we can drive it in a mode in which we give full autonomy to the rover and we let the rover make decisions - and most are based around keeping itself safe. We do have a mode where we can say we want it to drive to a particular waypoint in the distance, and then the rover will plan how it actually has to drive to get to a particular point. It uses its knowledge of the terrain, it takes images, generates terrain maps; from those, it generates hazard maps and course plots, and drives along that route, updating its progress as it goes and sees whether it can continue along that route, or whether it has to make a change based on new information to get to its target.

TMQ What is the rover's onboard computer storage capacity and processor speed?

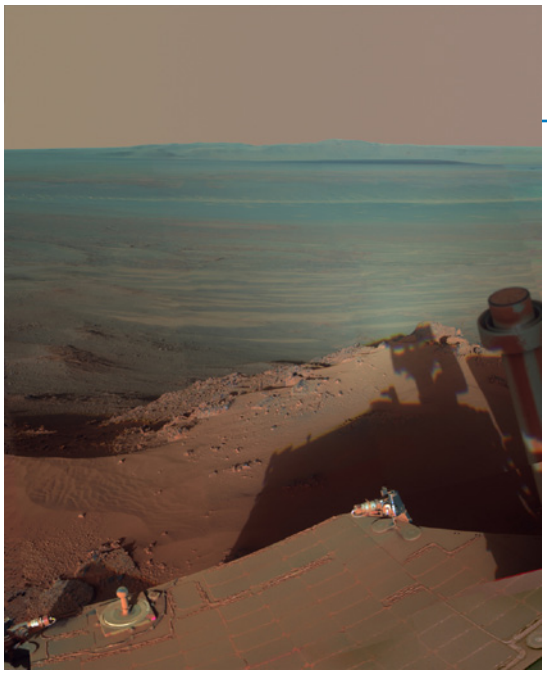
JOHN It is remarkably slow. It is a 20 MHz processor so it is 1% as fast as the processor in your smartphone. This is one of the limitations we have on Mars, because when we drive it in its autonomous mode, it takes a lot of compute power. And so the rover has to stop, take some images, take several minutes to process those images, make a decision, and then drive again for another step. It can be quite slow. So we often use a combination where we look at the images so we can see that it is safe maybe 70 meters in front of the rover and we can tell the rover to drive blindly. In other words, don't rely on imagery, just spin your wheels a certain distance in a certain direction. And once that is completed, to start using autonomous navigation to drive the rest of the way, or as far as it can on the available time that is left.

TMQ Will you also be part of the Curiosity team?

JOHN I will not be directly involved in Curiosity, but many of the people involved in Opportunity will be.

TMQ How long will Opportunity continue its mission - is there an end date?

JOHN My job is to maximize the utilization of the assets we have on Mars, and even though this rover is eight years old now - well past its design line, it is still very capable. There is still a very exciting mission ahead. We tracked 34km on the surface of Mars to get to Endeavour Crater. Endeavour represents an entirely new mission for the rover. So it is almost like we have a brand new mission - an "Opportunity 2.0", if you will, because we are in much older terrain than we have been in the last eight years. There are signatures seen from orbit of types of minerals in the rim of Endeavour that represent some intriguing science targets - mainly the presence of clay minerals. We want to explore those clay minerals with Opportunity when we get clear of winter.



NASA

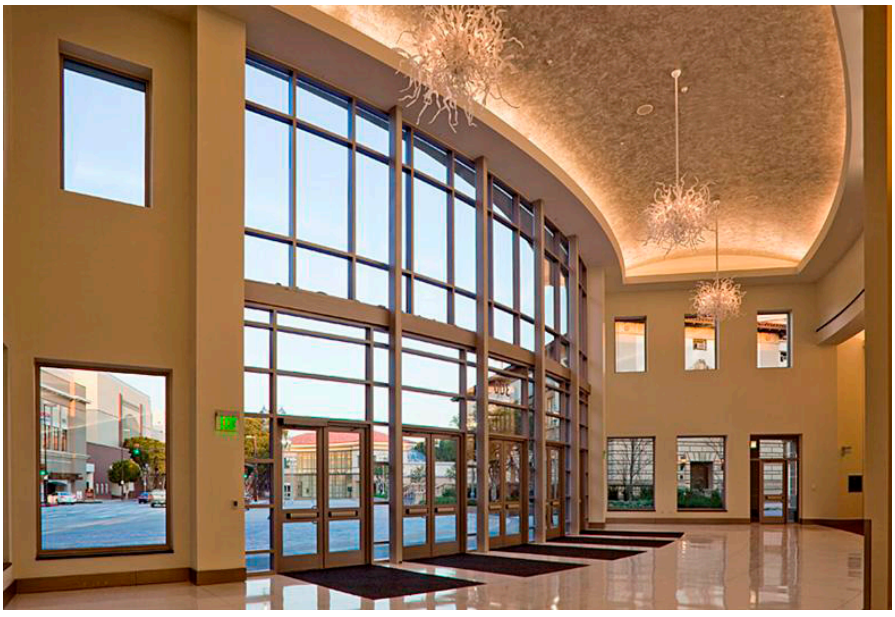
TMQ Are there any mission parallels with Opportunity and Curiosity?

JOHN I think it is important to remember that we still know so very little about the planet Mars. And you might be asking "Why should we bother with Opportunity when we have Curiosity, which is a much more capable rover?" It has fantastic instrumentation on board - the most sophisticated rover we have ever sent into space. The importance is that Mars is shrouded in mystery. What we discover at Gale Crater with Curiosity will likely be very different from what we discover at Endeavour Crater with Opportunity. It is important to have a diversity of exploration on the surface of another world. We've only explored kilometers of the planet, and that is like saying "I drove from L.A. to Barstow and so I know everything about the geology of the Earth." You can't make that claim on Earth, and you can't make that claim on Mars.

**Editor's note: This interview was conducted in March 2012, while Opportunity was stationary. At press time, it is currently mobile and investigating gypsum deposits on the rim of Endeavour Crater. For updates on the status of both Spirit and Opportunity, please visit: http://marsrover.nasa.gov/mission/status.html. A bio for John Callas can be found at: http://www.nasa.gov/mission_pages/mer/070628/callas.*

The 15th Annual International Mars Society Convention

The Mars Society is pleased to announce that it will be convening the 15th Annual International Mars Society Convention at the Pasadena Convention Center on August 3 - 5, 2012 in Pasadena, California. The annual event convenes key experts, scientists and policymakers to discuss the latest news regarding Mars exploration and efforts to promote a humans-to-Mars mission in the coming years.



Call for Papers

Presentations for the Mars Society convention are invited dealing with all matters (science, engineering, politics, economics, public policy, etc.) associated with the exploration and settlement of the planet Mars.

Abstracts of no more than 300 words should be sent for considerations by June 30, 2012 to: The Mars Society, 11111 W. 8th Avenue, unit A, Lakewood, CO 80215 or forwarded via email to: Marsabstracts@aol.com

Registration

Registration for the Mars Society convention in Pasadena is now open.

Rooms at the Pasadena Sheraton are available to convention attendees at a specially discounted rate of $99/night for single or double occupancy. To reserve a room, please call Tel. 626-449-4000 or visit the hotel web site. ***When making reservations, please note that the Mars Society convention is not being held at the Pasadena Sheraton, but rather at the Pasadena Convention Center.***

Speakers

http://www.marssociety.org/convention2012/speakers

For more details, please contact us: info@MarsSociety.org

PolARES

A Discussion with Gernot Groemer

TMQ: Gernot, please tell our readers about yourself.

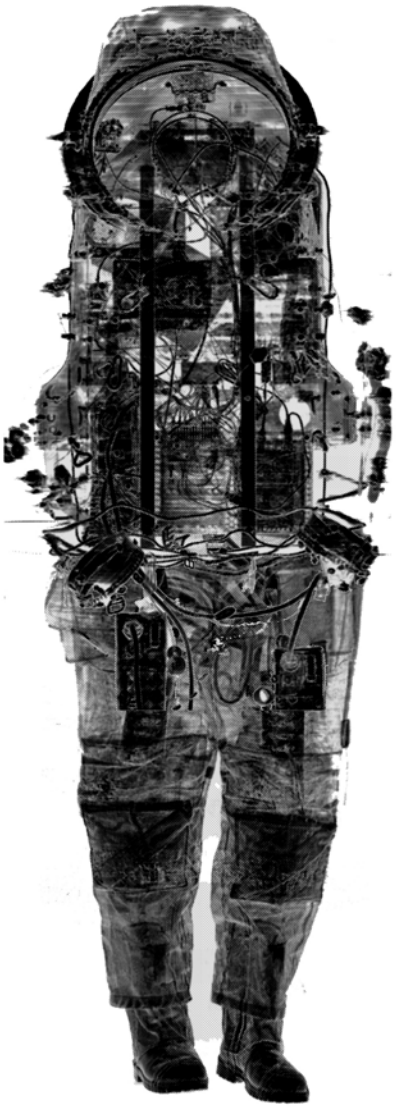
GERNOT: I'm a 37-year old astronomer, holding a PhD in the field of astrobiology from the University of Innsbruck. I went to the Mars Desert Research Station (MDRS) twice in 2003 (Crew 11) and 2006 (Crew 47). My participation in those missions basically co-defined my scientific career.

TMQ: Tell us about your experiences at MDRS.

GERNOT: During our 2003 and 2006 MDRS missions, we were looking into various science questions, ranging from robotic vehicles to extraction techniques and telemedical studies including human factors with cutting-edge vigilance monitoring studies. During the AustroMars mission in 2006, we had about one year of preparation, selecting the flight crew (and their backup) from 183 applicants and having a thorough science and engineering training over half a year. We also had a fully-fledged Mission Control Center which was staffed with roughly 20 people on a 24/7 basis monitoring our activities - so this simulation was fairly high fidelity when it comes to the decision making processes, the data flows and the flight planning procedures. A detailed account for this $200,000 USD mission can be found at the mission report under: http://www.oewf.org/cms/aid%3D732.phtml

TMQ: What is the PolAres program?

GERNOT: Upon return from our last mission in 2006, we decided within the Austrian Space Forum to focus on a specific aspect of analogue research



and that was spacesuit simulators, with a particular interest in creating a high level of realism and looking into the issue of planetary protection.

That means that if you're trying to find diminutive traces of extinct or extant life on Mars, such as molecular tracers, biologically precipitated minerals and similar, that IF you find something you need to be really sure it is indigenous and not a hitchhiker from Earth. In previous decades that was one of the major arguments of the robotics community telling us that we should send rovers only - to preserve the pristine nature of the samples. However, our life detection techniques have advanced a great deal since then. Our research group intends to challenge that paradigm and we try to demonstrate that the advantages of having a human explorer in the field assisted by robots is the way to go.

Since then, we have been developing the Aouda.X spacesuit simulator, a 45kg research-grade "spacecraft & computer to wear". Details can be found at: http://www.oewf.org/cms/polares_suit.phtml. This currently involves about two dozen engineers, medical people and IT specialists. Plus, we are also working on a rover called Phileas, and of course the planetary protection research. Luckily, my university highly appreciated the work we're doing and so we even got a fully-fledged laboratory for furthering our research.

In the course of our project, we had - until now – nine field campaigns with varying degrees of complexity, sometimes including hardware from dozens of external research institutions including the European Space Agency and Universities. As an example, we went to the Spanish Rio Tinto site, which is probably the world's best analog site for early and wet Mars. An account of this (including pics) can be found at: http://blog.oewf.org/en/2011/05/first-review-rio-tinto-2011-mars-simulation

TMQ: What has been your biggest accomplishment so far?

GERNOT: Having an operational prototype for the suit simulator. Science-wise we found out, that it is surprisingly difficult to take sterile samples on Mars. We now have a fairly clear (quantitative) understanding of the contamination vectors and have published that in peer-reviewed journals. The next step will be to investigate these vectors under field conditions in a more comprehensive manner after our pilot measurements.

Just recently we went into the ice caves of the Dachstein mountains in Austria emulating a subsurface EVA

on Mars and to see what the major challenges are. A great pictorial account can be found at: http://blog.oewf.org/en/2012/05/dachstein-mars-simulation-a-review-in-25-pictures/ The NASA astrobiology website has released a very nice account of that project: http://www.astrobio.net/exclusive/4789/exploring-mars-in-the-austrian-alps

TMQ: What's next?

GERNOT: The next step will be a large field campaign in the Northern Sahara of Morocco in February 2013 (MARS2013 - campaign). For more information, visit: mars2013.oewf.org

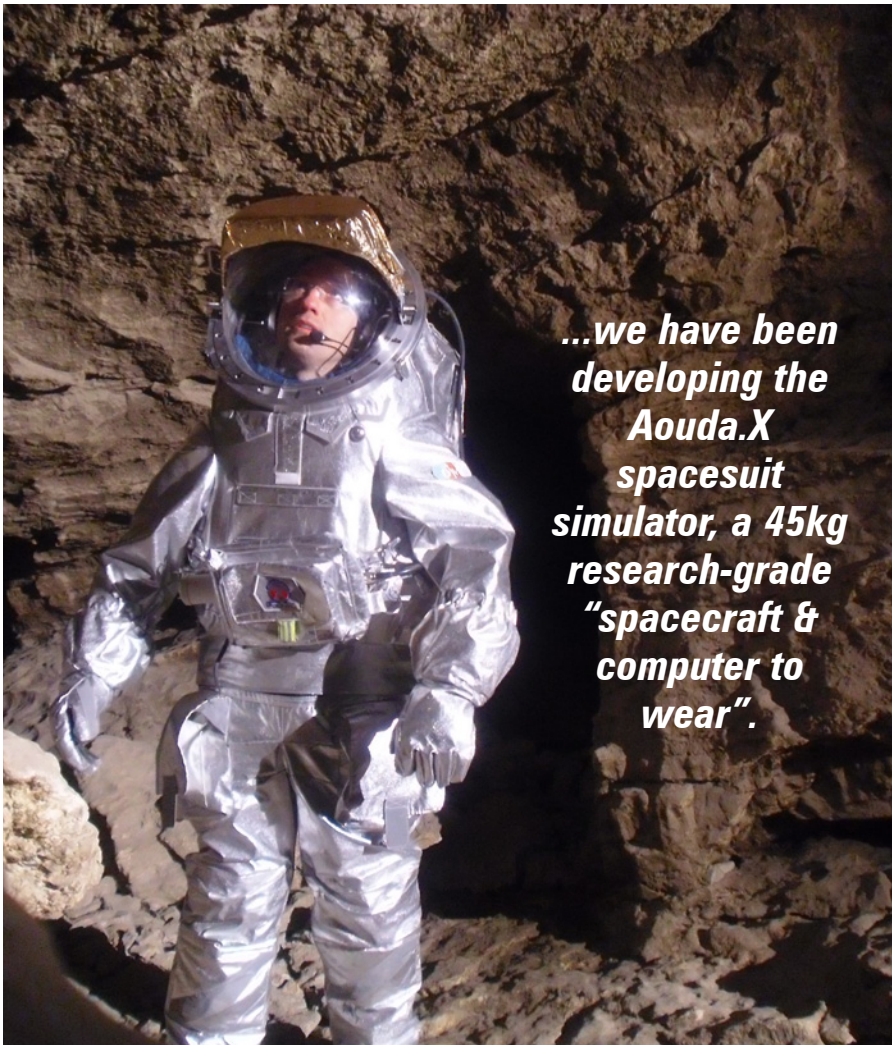
TMQ: Who funds these missions?

GERNOT: We have in-kind contributions from industrial partners, also some public national research money, plus donations. The reason why we are able to do projects is also due to a significant amount of volunteer work. We had the privilege to build a team with people who are real specialists in their "civilian" life: programmers, medical doctors, scientists and engineers – they have an impressive track record of previous technical projects, access to infrastructure and also add a lot of credibility to our programs. Plus, organizations like the Mars Societies and the Austrian Space Forum spend research money at least by a factor of 10 when it comes to spending efficiency.

However, as any grass-root organization, we heavily rely on private donations. Plus, for companies, we offer very interesting marketing cooperations due to fairly significant media exposure ranging from BBC to Discovery© Channel and others, especially in Europe.

TMQ: How can people contact you?

GERNOT: The easiest way is either via the website www.oewf.org, or via our social media sites, such as YouTube www.youtube.com/oewf or Facebook. Our general email address is: info@oewf.org.



...we have been developing the Aouda.X spacesuit simulator, a 45kg research-grade "spacecraft & computer to wear".

Simulated rescue

For further information about PolAres, please visit: http://www.oewf.org/cms/polares.phtml

THE MARS SOCIETY

OFFICIAL MEMBERSHIP AND DONATION FORM

Contact Information

Name _____

Address _____

City _____

State/Province _____ Zip _____

Country _____

Email _____

Contribution Information

Please check the amount of your contribution.
All donations of $1000 or more pay your dues for life!

__ Visionary..... $5000 __ Explorer $2000
__ Benefactor ..... $1000 __ Enthusiast $500
__ Friend..... $200 __ Donor..... $100
__ Other donation .....$_____

I'm donating $100 or more, please send an autographed copy of:

__ The Case for Mars __ Entering Space
__ Mars on Earth __ First Landing (a novel)
__ The Holy Land (satire) __ Energy Victory
__ On to Mars 1 __ On to Mars 2
__ Mars Songs CD __ How to Live on Mars

Membership Information

Please add to or upgrade my membership as follows:
(Please check the appropriate membership level)

__ Regular Membership: __ 1 year..... $50 __ 3 years ... $100
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__ Family Membership: __ 1 year..... $100 __ 3 years ... $200

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Mail with the enclosed envelope, Fax this form to 303-980-0753,
or Donate online at **www.MarsSociety.org**

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cut the number of actual exploration missions to zero. NASA's human spaceflight program is being done at a cost of tens of billions of dollars, funds which could save tens of thousands of lives if spent elsewhere. It therefore has a moral obligation to deliver. The mission needs to come first.

6. The Mission Needs to Be Initiated.

If the commitment is to be taken seriously, it needs to be initiated now. That means that rather than stop the robotic reconnaissance of Mars, it needs to be intensified, with probes of different types launched to the Red Planet at every opportunity. Furthermore, a practical plan needs to be drawn up for sending astronauts to Mars within a ten year time frame using available or attainable technology, and the agency's expenditures then need to be prioritized and directed towards actually implementing that plan. If the program is not started, it will never happen.

The American people want and deserve a space agency that is really going somewhere. Mars is the right destination, but if it is ever to be reached, the commitment needs to be real. Due to out of control deficits resulting from spending elsewhere in the Federal budget, there will soon be a strong imperative for cuts. A NASA without a genuine goal will be a prime candidate for the block. It is time for a space program we can believe in.

Dr. Robert Zubrin is president of Pioneer Astronautics and the Mars Society and the author of ***The Case for Mars****. His latest book,* Merchants of Despair: Radical Environmentalists, Criminal Pseudo-Scientists, and the Fatal Cult of Antihumanism *has just been published by Encounter Books.*

Registration for the 2012-2013 season at MDRS will be open soon

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 explor-ation 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.