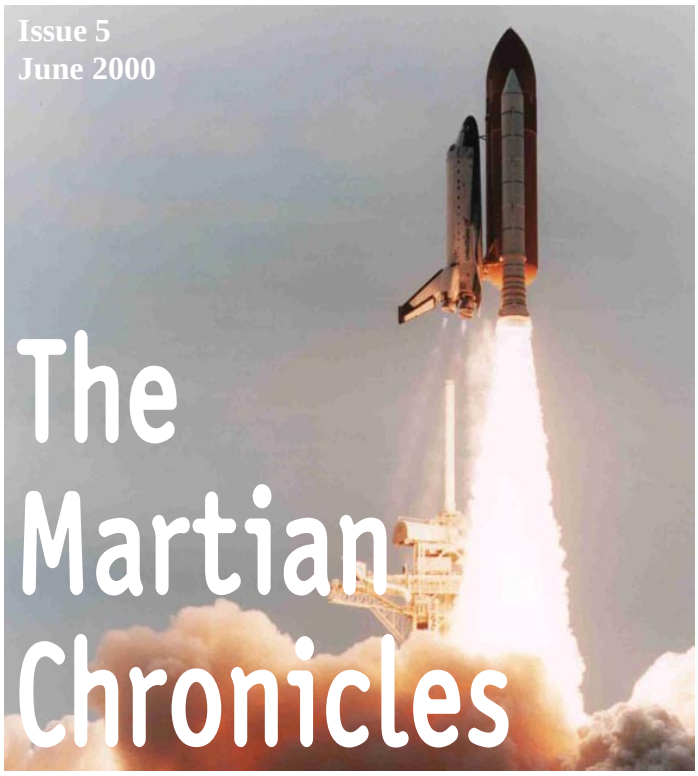
http://chapters.marssociety.org/youth/



Contents

Dear Reader,

This is the newsletter of the **Mars Society Youth Chapter** and the **MIT Mars Society Chapter**.

The newsletter is intended to excite youth about the exploration and near-future human settlement of Mars.

Please distribute freely!!! To be added to the announcement list, or to receive paper copies for distribution, contact Margarita <mmm@mit.edu>.

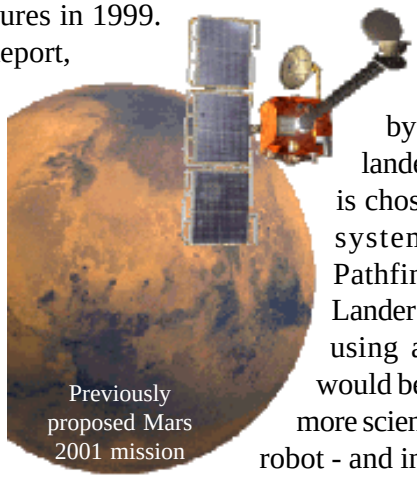
Send your submissions for the Newsletter!

Enjoy The Martian Chronicles!
Sincerely,
Margarita Marinova.

NASA's New Long-Term Mars Plans

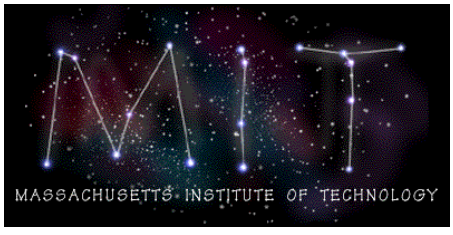
David Pinson

NASA has recently announced its revised plans for robotic exploration of the red planet following last month's findings regarding the two Mars probe failures in 1999. Those findings, documented in the Young Report, specifically named poor communications between NASA Headquarters, the Jet Propulsion Laboratory (JPL), and Lockheed Martin Astronautics as the largest cause of the failures. The report also concluded that both missions were underfunded by approximately 30%, and that this drove the communications breakdown by creating a perceived atmosphere where any cost-increasing yet risk-reducing ideas were 'unwelcome'. It is likely that the cause for the Mars Polar Lander failure could have been caught if additional tests were performed - tests which could have been conducted if more money was available.


Previously proposed Mars 2001 mission

Pressure to fly two missions to Mars in 1999 also helped to exacerbate the troubles. In the end, the failures and the report have resulted in the cancellation of one of the two planned missions to Mars in 2001, and a decision to reduce costs on space probes by using tried-and-true technology.

The recent announcement by NASA stated that only one mission will by launched in 2003, either an orbiter or a lander. In addition to that, if a lander mission is chosen it will use the same airbag landing system used successfully on the Mars Pathfinder in 1997, unlike the Mars Polar Lander which failed last year attempting to land using a new unproven system. The lander would be substantially more advanced and have more scientific merit than the Pathfinder Sojourner robot - and indeed many tests have been conducted terrestrially of such rovers both at JPL and elsewhere. The idea of building upon successful technology initiatives to save costs is seen as a more effective way to streamlining Mars probes than by simply chopping the budget.



Produced by: **MIT Mars Society Chapter**
Mars Society Youth Chapter
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Massachusetts Institute of Technology

The Heavy Lift Challenge

Luke Colby

As we all look forward and dream of manned missions to Mars, we will face many challenges both technical and political if we are ever to set foot on the red planet. Of those many challenges, one is lifting heavy cargos into low earth orbit, and beyond. Before we can go anywhere outside the confines of Earth orbit we must revive or re-invent the equivalent of the mighty Saturn V rocket. A frightening fact that we must come to grips with is that no country in the world today possesses a working launch system that has the power to send humans beyond Earth orbit. Sadly, the production lines for the Saturn V and the Russian Energia (similar in power to the Saturn V) were shut down just as we were beginning to realize the potential that these powerful rockets possessed.

I mention all these troubling facts because they must be understood in order to see the problems we must overcome before we can even think about going to Mars or back to the Moon. Fortunately, the situation is not as grim as one might at first suppose from the facts above.

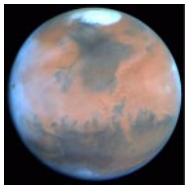
There are in fact several alternatives to re-incarnating the Saturn V, which utilize components of existing launch systems with only slight modifications. This article discusses two such possibilities derived from the current space shuttle launch vehicle.

Ever since the space shuttle program was started back in the late 70's – early 80's, engineers recognized the fact that we would eventually need powerful launch systems that could lift cargoes into space that were too heavy for the space shuttle. As a result, while designing the space shuttle launch system, several concepts were created that would allow the shuttle's external tank and solid rocket boosters to be used as a booster for cargoes other than the space shuttle. One such design was the "Shuttle C" which was essentially the space shuttle booster with the orbiter replaced by a cargo container with retrievable engines on the bottom (see figure on opposite page).

This elegant, simple, and practical design could be used to lift much larger cargoes into orbit. Unfortunately, the draw back to the design is that the interior diameter of the cargo container is not much greater than the orbiter cargo bay. This requires the habitats, cargo containers, etc. to be long narrow containers - a rather limiting scenario.

Not to worry though - another possibility exists. Heavy lift boosters can be made out of existing production rockets by putting the cargo on top of the space shuttle's big external tank, similar to the way cargo is carried on the smaller Titan IV, which is used for lifting large satellites into high orbits (see figure on left). This design is perhaps the most promising for modifying the space shuttle, because it allows the cargo faring to be even bigger than the diameter of the large external tank, which is already 27.6 feet in diameter. In fact, when Dr. Zubrin, who is best known for his revolutionary "Mars Direct" plan, was working at Martin Marietta (now absorbed by Lockheed, hence the new name Lockheed Martin) he and his colleagues designed a modification of the space shuttle booster stack that could carry a tuna can shaped Mars habitat module and upper stage booster into low earth orbit (LEO). This modified booster, *Ares*, could lift 121 metric tons into LEO or 45 metric tons on a Mars trajectory - enough for the large habitat that would be needed for the long trip to Mars. Further, without great modifications, this booster could carry the Earth Return Vehicle (ERV) in its payload bay as well. So, all the launches to Mars could be made with one vehicle that, once developed, would provide us with a powerful booster based on proven technology, which

3rd Annual Mars Society Conference



Ryerson University, Toronto, Canada

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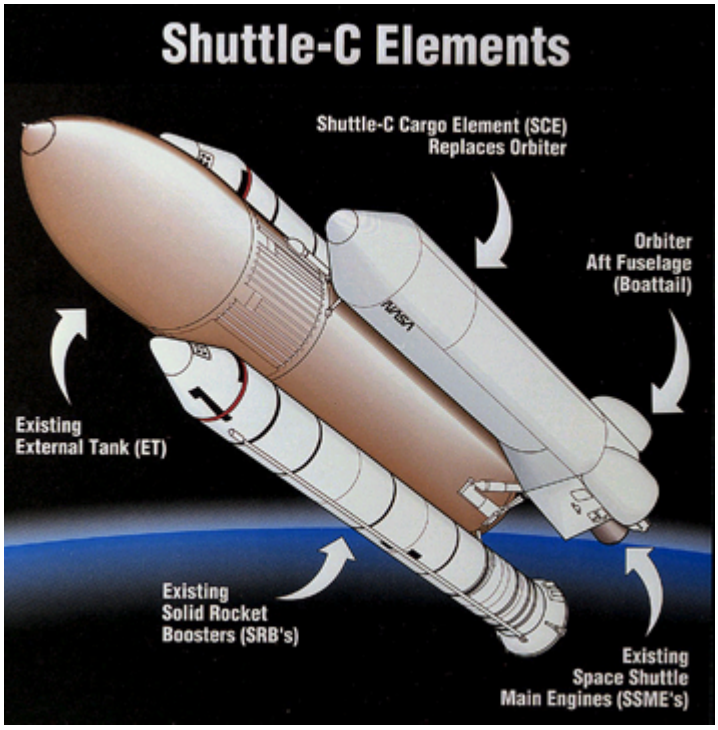
would be cost effective. While there are a few technical issues that would have to be worked out with this design, such as how to retrieve the engine pod (that must be reusable to be cost effective) without damage, much of what is holding back the construction of this simple design is politics and financial issues. At this time, NASA is spending large fractions of its budget (about 70%) on keeping up the aging fleet of space shuttles and building the International Space Station. However, there are already plans underway to devote money to designing new launch systems, including a heavy lift launch vehicle. These funds are meant to be distributed to private companies which will conduct the R&D.

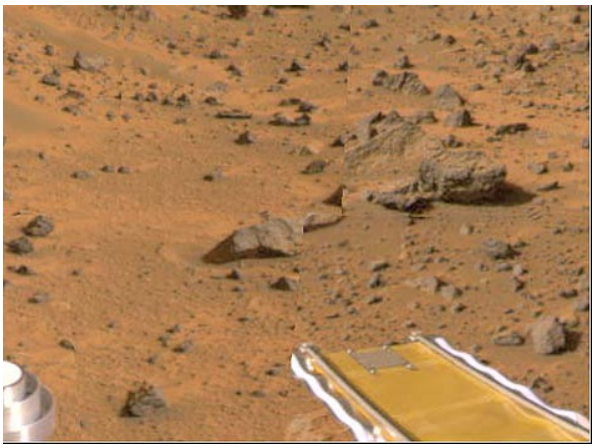


The two booster designs I have mentioned are only two out of many possibilities for a heavy lift booster capable of taking us beyond Earth orbit, but they are two of the most probable because they require the least new technology and research, which translates into less cost, which in the end is what governs much of the aerospace industry.

The Search Continues

Brett Cochran

The creature crawled along on its six legs at a slow pace. It had nowhere important to go, it simply was doing what it had evolved to do. Today, however, was no ordinary day. It was not paying much attention to the silver cylinder dropping from the sky, fire shooting from its bottom. The creature looked up and saw the danger and quickly crawled inside its shell that looked almost exactly like a rock. It provided protection from the cylinder that landed a few meters away. Three figures emerged from the cylinder.



"We did it, we are the first humans on Mars," exclaimed the commander.

"It seems unreal!," cried the biologist.

"Well I want to start on the objectives now. We only have 6 months here," said the stern geologist.

The three astronauts got to work immediately. They explored their landing area extensively. They left almost no rock unturned. The 6 months seemed to fly by.

The creature saw with its three eyes the white figures were picking up rocks and taking them away. It feared for its life. It could go for 8 months without food or water, an adaptation to the bizarre and unpredictable Martian weather. It remained motionless.

The three astronauts climbed back into their spaceship, sad that their 6 month search for life came up negative.

"I don't understand," shouted the biologist, "this spot was the most likely to have life."

The commander said, "It is ok. We simply have to keep searching. Many more places to explore on Mars! Each more fascinating than the next! We have to keep searching! Just hope people back on Earth don't stop the support for missions once they hear the news. There has got to be life somewhere out in the cosmos."

"There is nothing," replied the biologist, "absolutely nothing." He then kicked the first rock he saw. It sailed swiftly through the thin atmosphere.

The creature felt like it had just been kicked and it was now flying through the thin Martian air. When it landed it could see the spaceship was much farther away now. The creature extended its legs out of its shell now that the danger was gone. It was hungry from hibernate so long. As it began to crawl away it saw the cylinder rise into the sky and disappear.

Meet the Scientist
Dr. Chris McKay

Astro-geophysisist

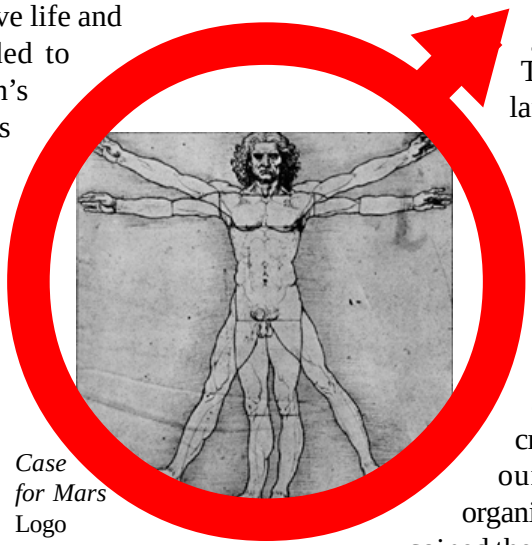

Dr. Chris McKay
collecting data in the
Gobi Desert in Mongolia

Q: What are your main research interests?
A: My main research interest is in the origin of life on Earth and the possibility that life might have originated on other planets as well.

Q: How do you find a connection between all the fields of science and incorporate so much engineering and mathematics in your research?
A: Life and planets are two very big topics and understanding how life might have originated on a planet encompasses many fields of science. In terms of engineering, missions to investigate possible life on the other planets requires engineering and instrumentation work as well. ... a little bit of everything.

Q: What did you study in undergrad and grad? How did you decide what to study?
A: As an undergrad I studied physics and mechanical engineering. I think this was a good choice for me since it was a good foundation for all the broad research approaches needed for my current research.

Q: How did the Mars Underground get started? What was the group's main goal/motivation?
A: When Viking landed on Mars in 1976 it seemed to indicate that Mars did not have life and yet had all the elements needed to support life. Motivated by Sagan's original suggestion some years earlier of terraforming Venus, two other graduate students and I started talking about the possibility of terraforming Mars. A few years earlier I had read a small book entitled *Project Icarus*, about a class at MIT that had looked at the feasibility of deflecting an asteroid on a collision course with the Earth. Inspired by that, I suggested we do a class project on terraforming Mars. Due to bureaucratic issues which I no longer remember I was actually listed as the instructor of this class and at the first class meeting we had more than 20 students (only one student was formally enrolled). In addition to terraforming Mars we also considered human exploration as a step toward terraforming. However we really began to take the issues of human exploration seriously when Dr. Charles Barth, the director of the Laboratory for Atmospheric and Space Physics (in which I worked), suggested that we should prepare a report on human exploration of Mars that he would take to NASA HQ.

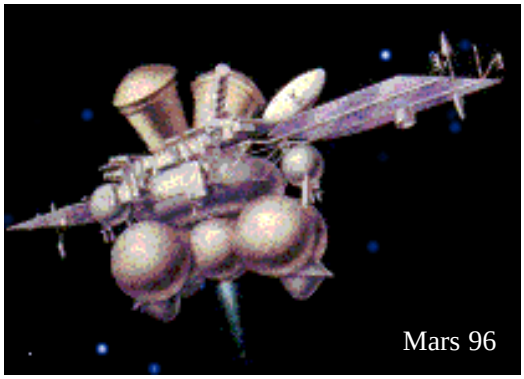

Case for Mars Logo

Following this we became more focused on the issues of human exploration, in situ life support and the establishment of a permanent self-sufficient human settlement on Mars. At Leonard David's suggestion and with encouragement from Stan Kent we decided to hold a conference. Originally the title of the conference was to be "The Case for Man on Mars" taken directly from a paper presented earlier by Dr. Ben Clark of Martin Marietta. However Stan insisted in a telephone conversation with me that "Man" was not acceptable. In a rush and having no good alternative we just turned it into "The Case for Mars". The first Case for Mars conference was largely organized by Tom Meyer and Carol Stoker. Carter Emmart drew the logo based the patch that appeared on the space suit of the astronauts on the cover of the book "The Earth is Near" which I had just read. Penny Boston edited the proceedings.

The first conference was successful and several people suggested that we create an organization. But this had not been our goal and we steadfastly refused to organize or become official. Leonard David then coined the term the "Mars Underground" to refer to the Case for Mars and its associated activities.

Q: How did your involvement in the Mars Underground impact your life and career?
A: When I first became interested in the question of terraforming Mars I thought it would be an interesting class project but not more. I would have been surprised if

I was told that I would end up working on the subject of Mars and the question of past present and future life on Mars for the many years to come.


Mars 96

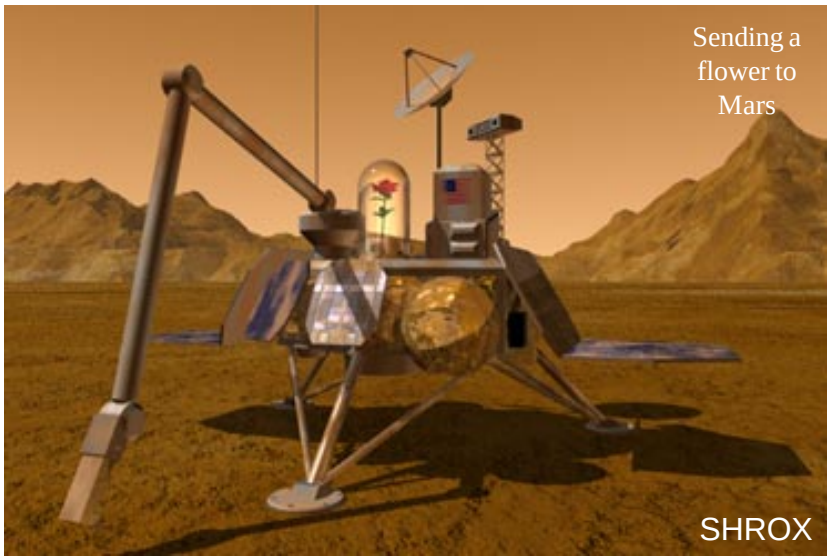
Q: What is the connection between the Mars Underground and the Mars Society?
A: Dr. Robert Zubrin came to one of the early Case for Mars meetings. He was a young engineer with bright ideas. A few years ago he wrote a book entitled *The Case for Mars* in which he outlined his plan for human missions to Mars. This book became a best seller and many people suggested to Bob that he form a Society to push for human exploration of Mars. The Mars Underground had never been a formal organization or had any intention of becoming one. So for all intents and purposes the Mars Society that Bob formed took over the activities of the Mars Underground.

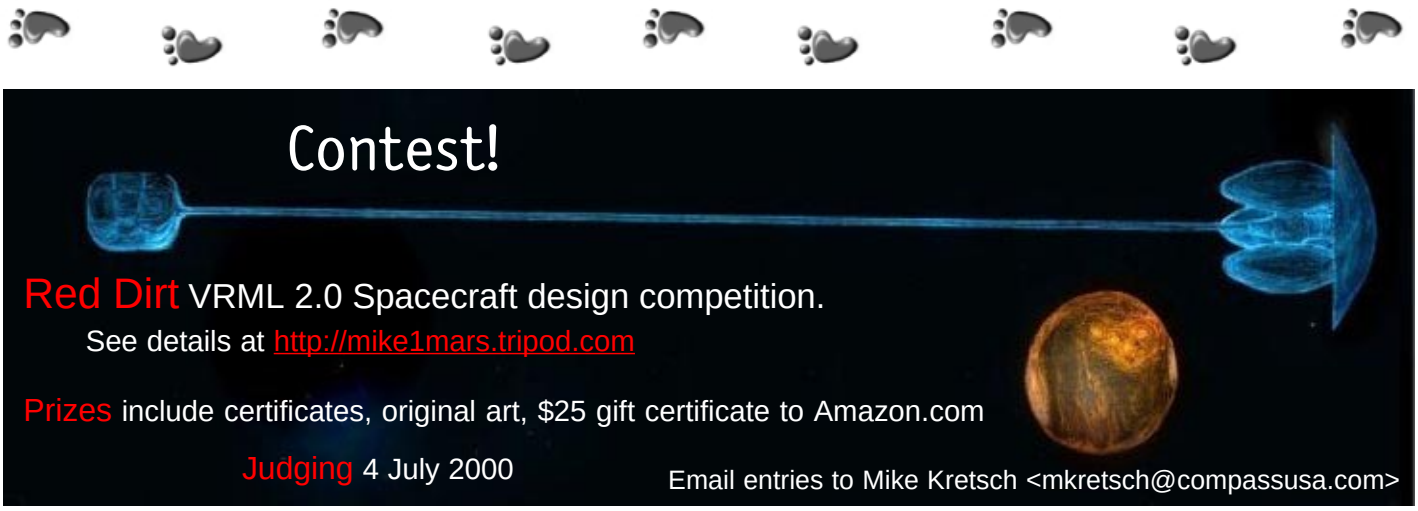
Q: What do you think is unique about the Mars Society compared to other space advocacy groups?
A: The Mars Society is unique in that is has the potential not just to advocate for missions but to bring the technical and scientific expertise together to make missions possible.

Q: What Mars missions have you been involved in and how?
A: I have been involved in analysis of data from every Mars missions from Mariner 9 onwards. However I have only had direct involvement with one instrument (MOX) that was built for the Russian Mars'96 mission (which failed).

Q: What is an experiment that you think should be part of the upcoming robotic missions?
A: A goal for the near-term robotic program should be to send a seed to Mars and to grow it into a full plant - perhaps a flower - using to the extent possible the sunlight, soil, and nutrients available in the martian environment. The carbon dioxide and water for the plant would be obtained from the martian atmosphere and the natural sunlight on Mars would provide for photosynthesis. Because of the lower pressure on Mars the plant would need to be in a small pressure vessel - its own little space suit.

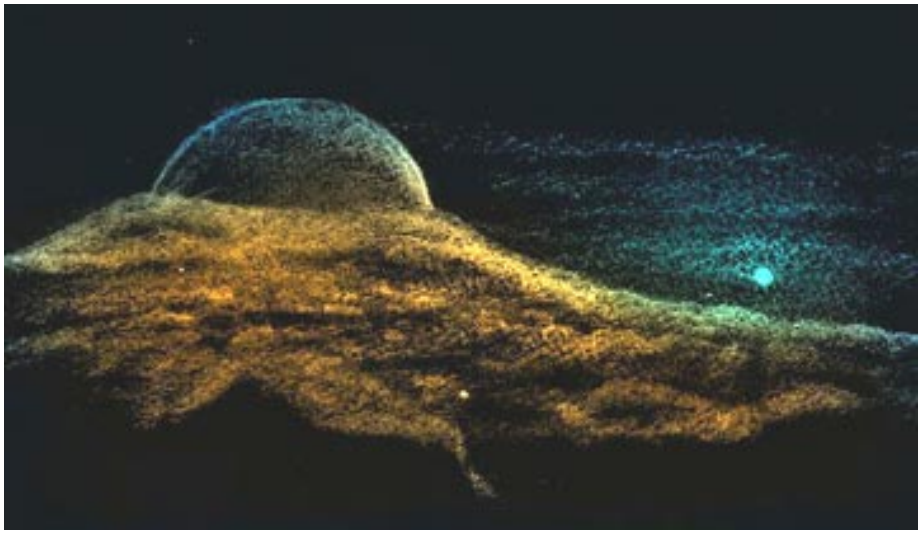
A clever design of this miniature greenhouse would allow light to enter and, true to its name, provide greenhouse warmth during the day. At night the growth module may need to draw on heat generated by the main spacecraft to keep the plant warm. The plant's growth and flowering would be monitored using the lander camera. Initial designs by groups at the University of Colorado and JPL have shown that such a unit can be constructed. We could send life to Mars on the next lander.


Sending a flower to Mars
SHROX



Dirt to Build a Habitat

Mike Kretsch

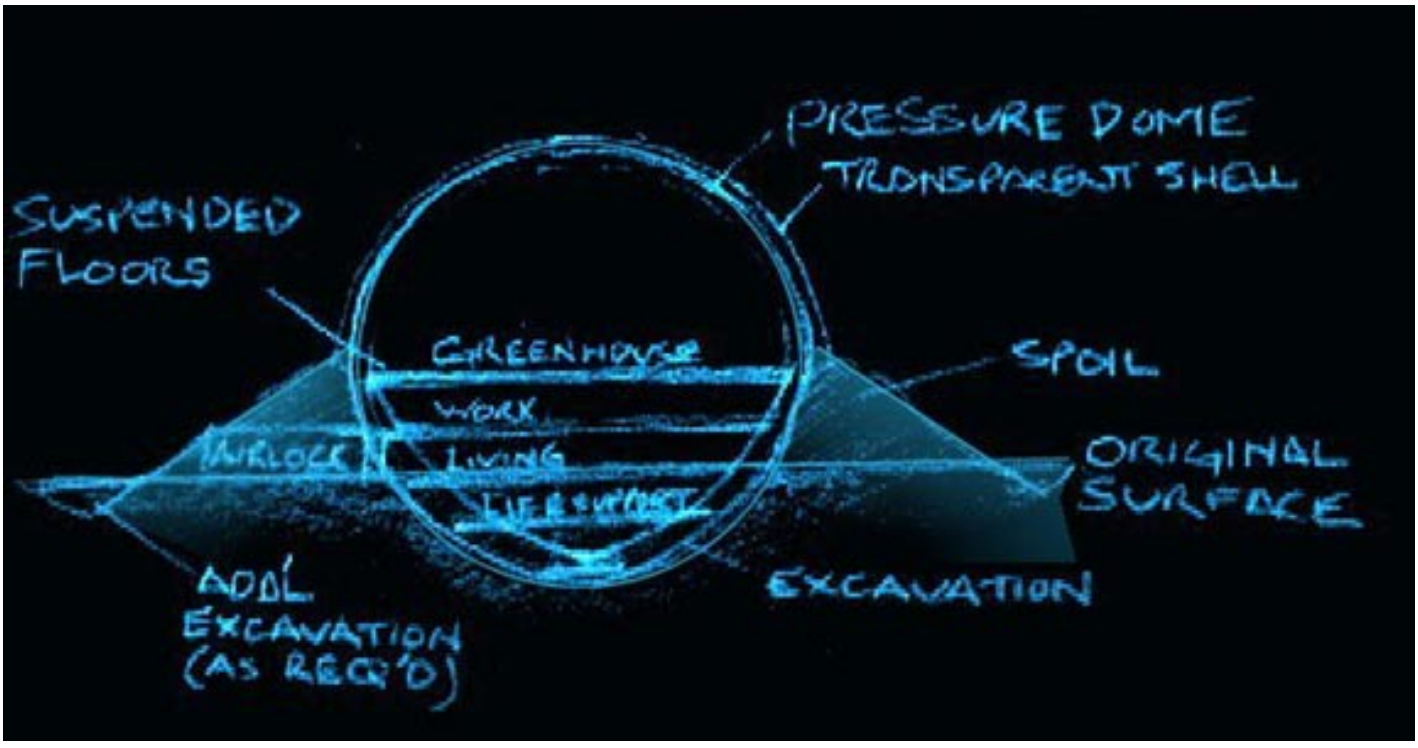


Lets say you're thinking of building a habitat on Mars. How much dirt do you need to move? Before you get bogged down in the calculus, consider the method many engineers use. The method is called Average End Area. It is especially good for irregular shapes like those found in the real world. In this example, let's assume that the habitat is roughly spherical and the surrounding mound of dirt slopes from midway up the sphere to original ground. Start with a contour map of the site you want to build on. Then plot the contours of the inside of the sphere up to the top of the surrounding mound, then down to original ground. Now you need to determine the area inside each contour. If you're working on graph paper, you can count squares. Make a table with the elevation and areas (square feet), average between the elevations, multiply by the difference in elevation (between contours, dFt), and add these numbers.

Make one table for dirt below original ground, and another for dirt above original ground. The dirt below is called "cut". The dirt above is called "fill". Some of your fill can be from the cut. See how close you can make the cut and fill to each other by adjusting the elevation of the base of the sphere.

Example: Cut Volume Mars Habitat 1

Elevation	Area	Average	dFt	Volume	Sum
1020	10				
		55	4	220	
1024	100				
		140	4	560	
1028	180				
		185	4	740	
1032	190				
		195	4	780	
1036	200				
					2300 cubic ft



The Recluse

Chapter IV: Bullet

Rich Reifsnyder

Jason Blake had been traveling in interplanetary space for four months and was starting to get bored. When he had packed his vessel for the journey to Mars, he had supplied several CD's filled with thousands of MP3's, textfiles of bestselling novels, and videogames. He thought if he surrounded himself with information he could spend the rest of his life, on the ship and the Martian surface, soaking it up. But it soon got tiring.

His daily routine was simple, but monotonous. Each night he strapped himself into his couch in the cockpit and slept. Each morning he woke up and was forced to run through a systems checklist lasting almost an hour before he could even have breakfast. He ate breakfast — sticky, gummy oatmeal, stuff that wouldn't float off the plate — after he sent the checklist report to MC, and Cynthia, the Mission Control engineer, invariably complained that Blake had missed something.

Then he set up the treadmill and exercised for 2 hours. He knew his muscles were getting weak - he could no longer carry his own weight on Earth, but he was determined to carry his own weight on Mars. He wanted to be able to walk off the ship on his first day.

Then he "showered" with a sponge to rub the sweat off. Then he went back to the cockpit and ran another checklist. Then two more hours of exercise, and another sponge shower, and another checklist. Then lunch.

After lunch he would play videogames for one hour. Then yet another checklist. After all, in the Space Shuttle there was someone at the cockpit at all times.

After that checklist he would spend two hours studying engineering diagrams. He had been lucky so far, as every failed piece of equipment had an identical, modular backup that could be swapped out. But he didn't always know how to fix the damage that would render the useless equipment as good as new, and Mission Control couldn't talk him through it anymore because the two-way time lag in radio communications was nearly ten minutes.

Occasionally there was a hardware failure on the outside of the ship that forced Blake to run another EVA. He had gotten used to working in space by now — in fact, rather than perceiving the cabin as a protective womb shielding him from the infinity of space, Blake now saw it as a suffocating cage which he would gladly leave at every opportunity. He loved looking up at the stars and imagining it was a night sky on Earth. The illusion worked pretty well, if he didn't look down and see that there was no ground beneath him.

After a fifth checklist, he sat down at the computer and wrote something. Sometimes it was part of a novel — he had been writing several uncompleted novels simultaneously — or a short story, or a poem, or even a free-writing exercise to clear his mind. His psychiatrist back on Earth had often said that he could relieve stress by writing his thoughts down in a journal, but Blake hadn't really believed that — until this voyage. Cooped up in a van-sized vehicle for four months, Blake needed all the stress relief he could get.

After two hours of writing, he completed one final checklist and then went to bed. Dr. Palmer, the flight surgeon, insisted on eight hours of sleep every night, although Mission Director Stratton always worried that something would go wrong in those eight hours.

On Day 131, as Blake lay sleeping, something did go wrong.

Blake's ship had two hulls. On the inside was a thick hull to provide structural support and hold in the atmosphere. Separated from it by layers of insulation was a much thinner outer hull known as the "Whipple shield," named for an Apollo engineer named Fred Whipple. It was designed as a barrier against meteoroids.

Small meteoroids don't slice through spacecraft hulls as most people think; they explode on impact, converting their kinetic energy into heat and vaporizing a tiny crater-shaped portion of the hull. The Whipple shield was a sacrificial hull layer designed to absorb the impact, leaving the inner hull intact. Every few days Blake would hear a tiny 'ping' as a meteoroid the size of a sand grain would gouge a tiny hole in the Whipple shield.

But on the 131st night of his voyage, a meteoroid the size of an apple seed hit the hull with a 'thunk'. The heat and vibrations drilled through the outer hull and the insulation straight to the inner hull.

Blake had become a very heavy sleeper on this voyage. The whirr and rattle of the air conditioners failed to wake him up during the night. On this particular night, he might also have slept through the unusual high-pitched whine that sounded like a tea kettle.

What finally woke him up was the blaring automatic alarm and flashing red lights. "Warning," chanted the computer, "Rapid depressurization. Air pressure at 91 percent. Warning. Rapid depressurization. Air pressure at 84 percent. Warning. Rapid depressurization. Air pressure at 75 percent..."

To Be Continued...

Mars Q&A


Over Olympus Mons

Q: How long do you think it will take for the greenhouse effect to take place in terraforming Mars? (Peter)
A: This depends on what method is used. If an event such as the impact of large meteorites is invoked in triggering the greenhouse effect - then timeline is quite uncertain. We know very little about the composition of the soil, and how much carbon dioxide would be release as the temperature rises (this has a positive feedback.) However, if greenhouse gases are used, the timeline simply depends on the rate of production of the gases. Greenhouse gases start working immediately and can very quickly warm up a planet if they are produced at large enough quantities. Current estimates taking into account a reasonable rate of gas production suggest that about 100-200 years would be required to raise the average temperature on Mars to about 0 degrees Celsius (32 Fahrenheit) ± 15 degrees Celsius. - Margarita M.

Q: Now what exactly are the people going to live in and what is the inside like? (Marie Lewis)
A: Good question, but the answer really depends on what stage in the process of our Mars exploration and colonization you are talking about. If you are asking about the first pioneering astronauts going to Mars, the answer is; not much. They will most likely live in a "tuna can" shaped habitat, probably with two floors containing private sleeping quarters, a common area for dining and other group activities and then lab areas for experiments and supply storage. This "tuna can" will be a cramped work environment to live in, but nothing Submariners don't deal with for months on end under Earth's oceans. Now, if you are referring to later in the colonization of Mars, people will probably live in interconnected domes and greenhouses that are modular in construction, so new sections can be added on as needed. Eventually however, we will have the industrial infrastructure on Mars to start building larger habitats out of Martian made steel and plastics. One possibility for a full blown colony that has been proposed, is to roof over a section of a canyon on Mars with glass, making one huge shopping mall like hall. This glass roofed canyon would have houses built into the rock walls on either side, and grass, trees and running water filling the canyon floor, making lush parks for the inhabitants to enjoy. So to answer your question generally, humans will start out living in cramped utilitarian habitats that will bring them from earth and serve as their home on Mars. But, as we colonize the planet, we will use our ingenuity and skill to construct beautiful colonies that bring a little bit of earth to a red dust ball 100 million kilometers from home. - Luke Colby

The Mars Society Youth Chapter was created to provide Youth the opportunity to become more involved in the Mars Society and other Mars-related issues, and to provide a more effective outreach effort to other Youth. http://chapters.marssociety.org/youth/

The Mars Society is an international non-profit organization committed to furthering the goal of robotic exploration and human settlement of the Red Planet. www.marssociety.org