# Mars: An Investment in the Earth

written by Steven Wintergerst on June 20, 2007

Many people today look at the space program, and wonder why we even bother to fund it at all. There seems to be no return on the material, and manpower sent into the sky. I am one of these people. Current space exploration focuses on studies into the effect of zero gravity on human beings, and other life forms, a study which will never be of any importance except to people and plants subjected to zero gravity.

The early days of the space exploration was a different story altogether. In those early days, NASA did not have all of the equipment it needed for effective space operation. NASA didn't even know what all of that equipment was. In those days, NASA had to develop all kinds of new technology, new insulation, new lubricants, new flexible materials, new clothing, and new electronic components.

From these early days of NASA, we have all kinds of silicon products, from silicon lubricant to silicon implants. We have new clothing materials. We have new mylar insulation that allows us to have more efficient air conditioning, and more effective firefighting outfits. We have hardened electronic components which allow reliable operation of communication, weather, mapping, and cable satellites.

The space program also popularized a number of unpopular technologies that make our life easier. Velcro, zippers, microwave ovens, and the miniaturized communication technologies needed for cell phones came from this.

Currently, NASA is staggering under its own weight. No serious challenges have arisen, so no new technology is being developed. What is needed is a new challenge to promote new technology. Space itself is pretty much the same everywhere, so a new field of research, such as a planet, or moon is our key to new technologies.

The Planet Mars could serve as an admirable new field of operation. The planet is fairly earthlike. Nowhere else in the solar system could producing fresh vegetables be easier. They say that the way to a man's heart is through is stomach. I would argue that the same is true for both sexes, so that NASA should be able to expect Mars crews to appreciate this field of operation more than others. With good crew morale, prolonged research is possible.

As to crew safety, Mars is the only planet with both an accessible surface, and an atmosphere. This atmosphere would shield the crew from a fair percentage of harsh sunlight, and other radiation. Such a benefit could not be achieved on an airless world, and would require advanced capabilities on any other world. In short, Mars is about as safe a place for EVA as Earth orbit, probably safer, since the magnetosphere of Earth can protect against radiation only. The Mars atmosphere can protect against radiation and micrometorites to some degree.

The surface of Mars has a few dangers peculiar to itself. Dust storms can blanket the surface. Dust devils can whip about something like small tornados. There is also wind, surface rocks, and a dangerously low atmospheric pressure.

Such dangers are not really new though. The winds on earth are much more dangerous, as are the dust devils, tornados, and dust storms. The rocks too, are probably more dangerous, since gravity on earth accelerates a falling body toward them faster. The danger of extreme cold is not much different from Antarctic cold, and the danger of low atmospheric pressure is similar to the vacuum of space. Mars does not actually have new dangers, just a new set of familiar ones, which we have been able to meet, and counter before.

Seeing that Mars presents no true barrier against exploration, let us consider some of the things that might be more useful on Mars, in order to consider what sort of new technologies Mars exploration might provide for us. Below, is a list of some fields of research that might bring about new practical materials for use on Mars. Certainly, this is not a complete list. We will never know everything that will be developed until it has been developed.

PROSPECTING: The search for water on Mars will be an extremely important endeavor. Looking for subsurface water on Earth is still rather hit-or-miss. On Mars, there is an entire planet, with a totally different hydrological process. .

Other materials, such as ore grade metals, petroleum compounds if they exist, and other materials will also be desired. More effective means of determining where these materials exist, and how they can be obtained will be critical. Many of these items will be available only through mining.

Mars has undergone a different volcanic, tectonic, and climatic history from that of the Earth. The lack of manpower, different needs, and unique history of Mars will likely force us to reevaluate existing methods and theories of prospecting. New challenges will probably produce new knowledge, and new methods that can in turn be used on earth.

The different volcanic, tectonic, and climatic experience of Mars may also provide a source of more unique minerals, allowing for materials with unusual properties. The quest for new materials is likely to have only limited success, and few specimens. Discussing them here must be hypothetical, and only a few examples are worth mentioning. One such example may be in the gemstone field. Mars has a weaker gravitational field, and a less active tectonic history. The pressure, temperature, and time needed to produce some gemstones may be absent. However, with virtually four billion years of climate changes over a stable surface, I suspect that sedimentary materials will be highly specialized, and unique.

Mars might have a relative abundance of unique opals. Opals are formed when hot springs undergo repeated periods of dryness, and wetness. Opals are composed of silicon dioxide, water, and various trace impurities that produce unique properties. On Earth, most opals are more than 60 million years old, making it difficult to find surfaces where they can still be found. Much of modern opal is located in regions of former sea beds.

On Mars, most of the planet’s surface is far more than 60 million years old, and all of Hellas, as well as the northern basin are believed to have once been sea beds. There are many extinct geothermal springs throughout these regions, and due to the low atmospheric pressure, water can only remain liquid for brief periods of time, ensuring periods of dryness, and wetness.

Opals are actually composed of tiny spherical deposits of silicon material. This is another reason I expect opals to be found, for in this regard we have actually already located some. The MER rovers found a section of bedrock that contained large spherical inclusions, which the rover team dubbed “Blueberries.” Chemically speaking, these "blueberries" are opals, although the large size of the spheres indicates that these particular "opals" would probably not be of gemstone quality..

Gemstones, being part of the fashion world, and not the engineering world tend to have peculiar value systems attached to them. On Mars, it is possible that various unique types of opal could be found, and the difficulties inherent in shipping them back to Earth could artificially enhance their rarity, and therefore their price, until a Martian opal would be worth far more than its weight in gold.

At such exorbitant prices, it may become economically feasible to ship opals from Mars back to Earth, and with an exportable good, people will look into more feasible modes of transportation.

If a cheaper mode of transportation were developed, the price of these opals could decrease, but the original rarity might live on in the minds of consumers, making it a popular jewelry for the masses, and ensuring a continued demand for the material, something like what pearl culturing techniques have done for that industry. With opals however, there is a limited supply, so the price for Martian opals might continue to slowly rise as they became rarer, making the industry, and the item a solid investment if they catch on.

RECYCLING: In most cases, it will not be economically feasible to transport goods back to earth for sale. They will have to be used locally. Likewise, the sooner Mars can support itself on locally produced goods, the better. Red Mars by Kim Stanley Robinson features a number of mining groups looking for fresh supplies of metals that Earth has exhausted. Such a situation is patently absurd.

It is cheaper, and easier to recycle metals on earth than it is to mine them. Unlike helium, or hydrogen, once a metal is “used” on earth, it does not boil off into space, but merely becomes a recyclable waste material. Even if we should find some way of entirely disposing of our metallic resources, our active plate tectonics, and huge iron-nickel core ensure us of a supply of metals.

On Mars, the iron-nickel core is much smaller, and inactive. Obtaining metal from anywhere but near-surface deposits will require enormous digging on a scale that is not made much easier by the lower gravitational pull of the planet.

Since excavation equipment tends to be massive, shipping it to Mars will be difficult. Much of this equipment also requires some precision manufacturing for optimal performance. Thus, it would be far more desirable on Mars if the items used there could be re-used, or recycled with ease.

The fact of the matter is that on Mars, things will stay on the planet, and will get re-used. This will require a slightly different mind set from the current American ideas. Perhaps it will even help us to break the awful chain of intentionally designing things for scheduled obsolescence.

RENEWABLE ENERGY: Mars is not likely to have much in the way of fossil fuel deposits, and even if it did, burning them in the Martian atmosphere would be difficult. Most of the fissionable materials on the surface have decayed over the long history of the planet, so that nuclear energy will probably rely on fuels shipped from earth, undoubtedly against strong environmental opposition.

Without nuclear, or fossil energy sources, Mars explorers will have to turn to renewable energy sources for their power needs. While the situation will be similar most anywhere else in space, Mars has a unique situation. The martian atmosphere will filter the light that could reach solar panels on the surface, so Mars explorers will need to tweak their solar panels, in efforts to capitalize on the different spectrum, and to increase overall efficiency.

Mars also allows for other forms of renewable energy. With an atmosphere, windmills are possible. On earth, current windmills are already becoming competitive with fossil fuels, so Martian power production need not wait for better solar energy.

New discoveries are also strongly pointing to the possibility that Mars still has an active hydrosphere. Certainly, without rain, rivers, or oceans, this hydrosphere does not allow us to use current technology to capture energy from it, but research and ingenuity may produce a new device for capturing the power of the Ice caps, or tapping energy from debris-covered glaciers. Getting useful quantities of energy from such sources may not be possible, but if such a device were made, the lifestyle of people living in the north country of earth might be dramatically improved.

SURFACE RADIATION: While radiation on the surface of Mars is lower than elsewhere in space, it is still higher than on Earth. New radiation shielding technology would therefore be desirable, both on Mars, and during the transit to Mars. Such technology could be useful for all other space travel activities, especially in EVA suits.

On Earth, this radiation shielding would probably go to more mundane tasks, such as new CBR suits for the military, for nuclear plant workers, nuclear accident cleanup crews, nuclear waste dump sites, and X-ray protection for patients, and doctors. This technology might even be applied to aircraft.

In The Case for Mars, Robert Zubrin claims that on the surface of Mars, the atmosphere can protect from cosmic background radiation, and normal levels of solar radiation, so that radiation shielding would be necessary only during solar flare events. Some argue that this claim is doubtful. However, if the claim is true, it may spur interest in better solar flare detection, and temporary shielding measures. Both fields of research have applications that should make existing satellites and telecommunication devices more reliable. On Mars, such a situation would bode well for terraformers, and any large-scale agricultural endeavors, whether under domes, or under the sky, and might more easily allow them to develop radiation resistant crops, or large scale temporary radiation shielding. On earth, large scale temporary radiation shielding might make cities less vulnerable to the threat of nuclear holocaust.

MEDICAL: Mars is very cold, and has an extremely low surface pressure. Medical emergencies on Mars could include frostbite, hypothermia, asphyxia, decompression sickness and other strange medical emergencies that the severe low pressure could cause. Improved treatments for these maladies could be developed.

Mars also has an abundance of very fine oxidized dust particles. This dust is likely to get in everything, and may lead to health problems related to respiratory diseases. A presence on Mars may lead to a new impetus to develop ways to screen for, and treat asbestos exposure, black lung, smoker’s lung, and perhaps even lung cancer.

Alternately, new ways to protect against these very fine particles might be developed. Filtering out such small particles might provide more efficient methods to protect against bacteria, viruses, or even chemical gas agents.

ROBOTICS: The population of Mars is likely to remain small for quite a while. What with the small, but actual danger of radiation may favor indoor activities for these people. Even indoors, human activity on Mars is probably too valuable to waste operating robotic rovers. Humans on Earth can operate robots, but there is a half hour time lag between commands.

Robotic exploration on Mars will continue to be an important activity, if for nothing else, simply because it’s a big planet, and we want to have a better look at it. Robotics for more practical purposes will also likely proliferate, and the benefits of these technologies will be spread to the private sector on Earth as well.

Robotic transportation for supplies, robotic exploration, robotic construction, and other similar venues of mechanization would make for a world with virtually no grunt labor. Truck drivers, construction workers, even Steve the Animal planet guy would be out of work. Maybe this is bad, maybe this is good. It all depends on how the society itself adjusts.

Hopefully, the price of commodities would go way down, since no wages were being paid. Hopefully also, people would be able to learn some other livelihood. What that is, I still don’t know. Frankly, I’m having trouble earning a livelihood myself, so don’t look to me for answers.

WEATHER PREDICTION: Mars has weather, the Moon does not. Except for the dust devils, this weather is not a major concern to surface dwellers, but if aviation of any sort is to be effective, knowledge of this weather is essential.

Some equipment to map weather on either planet would probably be fairly similar, and there may be moderate reductions in cost, due to “mass production” of these tools. However, the main improvement may come in having records of weather patterns from two worlds. This might allow for a better understanding of the actual factors involved in creating the weather, as well as a way to double check some values.

Some people have suggested terraforming Mars. Most people do not realize the sheer scale of such an undertaking. Such a plan is likely to take several hundred years, and will involve enormous changes in the climate, atmospheric pressure, and atmospheric composition.

Terraforming will convert the Martian atmosphere into the atmosphere of another world entirely, allowing us to have climatic data on not just two worlds, but on many, and should make weather prediction, or even modification, a far more accurate science than it is today.