Mars as an Investment in Earth

written by Steven Wintergerst on August 12, 2005

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 efficiently air conditioned houses. 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 it's own weight, no serious challenges have arisen, so no new technology is being developed. What is needed then, 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 an accessible surface, and an atmosphere. This atmosphere would shield the crew from a significant percentage of harsh sunlight, and other radiation. Such a benefit which could not be achieved on an airless world, and would require advanced flight 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 from radiation and micrometorites.

The surface of Mars, of course 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 accelerates a falling body toward them faster on earth. The dangers of extreme cold, and near vacuum are not much

different from Antarctic cold, and the vacuum of space. Thus, Mars does not actually have new dangers, just a larger 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 minerals, if they exist, and random products that I cannot think of will also be desired. More effective means of determining where these materials exist, and how deep they are will be so critical that I am virtually certain that better processes of prospecting will be developed.

Another contributing factor to developing more precise methods for prospecting will be the fact that Mars has undergone a different volcanic, tectonic, and climatic history. This will allow us to better understand what processes cause deposits of chemical, and elemental resources, and what processes are merely associated with them, which should allow us to better search for these items with less false positives.

The different volcanic, tectonic, and climatic experience of Mars may also provide a source of more unique chemicals, allowing for materials with unusual properties. One such example may be in the gemstone field.

I suspect that the lower pressure on Mars will promote less volcanic gemstones. Diamonds will probably be rarer on Mars. However, with virtually four billion years of climate changes, I suspect that sedimentary materials will be highly specialized, and unique.

For one thing, I would expect that Mars might have a relative abundance of unique opals. Opals are formed when hot springs undergo repeated periods of dryness, and wetness, and are composed of silicon dioxide, water, and various trace impurities that lend it various qualities. On Earth, most opal is more than 60 million years old, making it difficult to find surfaces where it 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 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 this silicon material, and 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.” These blueberries, are chemically, quite similar to opals, although the huge size of these deposits prevents the odd refraction of the sunlight which gives opals their gemlike quality.

Gemstones, being part of the fashion world, and not the engineering world tend to have unusual 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 in fact artificially enhance their rarity, and therefore their price, until a Martian opal would be worth far more than it’s weight in gold.

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

If a cheap mode of transportation were developed, the price of these opals would shrink dramatically, 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 the pearl culturing technique has done for that industry. With opals however, there is a limited supply, so the price for Martian opals would continue to slowly rise as it became rarer, making the industry, and the item a solid investment.

RECYCLING: 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 could never happen.

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 with a replenishing 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 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. This will place an emphasis on energy efficiency, and improved solar, and wind power generation. Such an emphasis may lead to the development of more effective clean energy sources that can be used on Earth as well as Mars.

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.

MEDICAL: Mars is very cold, and has an extremely low surface pressure. Medical emergencies on Mars could include frostbite, hypothermia, asphyxia, and whatever 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 dust particles. This dust is likely to get in everything, and may lead to health problems related to excess iron, or respiratory diseases. New procedures to combat these illnesses could be applied to Mine workers, and asthmatics on Earth.

Alternately, new ways to protect against these very fine particles might be developed. Filtering out such small particles might provide new procedures for protecting against bacteria, or even viruses.

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. 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.

Being able to map weather on two planets, rather than just one should provide better insight into the processes that actually cause weather. Therefore, prediction of weather on earth should become more accurate.

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.

In short, 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 a far more accurate science than it is today.