A man, a plan, a planet: Mars Direct

Hosted by the Astronomy and Space Exploration Society, Dr. Robert Zubrin recently spoke at U of T about his ambitious plan to get humans to Mars before the end of the next decade

Dan Rios
SCIENCE EDITOR

DAN EPSTEIN

Dr. Robert Zubrin is an ambitious man with an equally ambitious idea: he not only wants to see humans on Mars in seven years, he also has a workable plan to make it a reality.

After flexing its technological muscles with the 1969 moon landing, it seemed only logical that NASA would next aim for Mars. Once our lifeless moon was scoured and analysed from every angle, the possibility of sending astronauts to the potentially life-filled surface of the red planet seemed within grasp. With its apparently dry riverbeds and ice-capped poles, Mars has remained a tantalizing target for space programs and the governments that fund them. What happened? Why aren't we there yet?

As far as Zubrin is concerned, we should be able to get there soon. He expressed the nature of the problem using a simple analogy:

"In principle, it can take any amount of rope to connect two posts separated by 10 metres. The issue is whether you want to connect the posts or sell rope."

In other words, a bare-bones mission designed to keep costs low while still sending people to Mars is feasible but unappealing to the numerous corporations contracted by NASA to design and manufacture the necessary equipment.

Politicians also complicate the issue. Bush has declared that before America goes to Mars, there must first be a launch pad on the moon. A not-so-subtle land grab, the lunar base also carries a huge price tag of U.S. $450 billion. But there's another problem with Bush's plan: it just doesn't make sense.

"Flying to the moon before going to Mars is like flying to Saskatoon on your way to Chicago," said Zubrin.

Zubrin's plan is much more elegant and direct. Rather than building Deathstar-sized space ships or lunar Cape Canaverals, his proposed five-year mission plan would involve launching unmanned ships to prepare for a manned vehicle. The beauty of the idea is that it can be accomplished using current technology and allows for four different backup plans should something go wrong, which is all too often the case in space exploration.

Contrary to common perception, the biggest hurdle that we face in the race to Mars is not the distance. With today's spacecraft, the voyage to the planet would last only 200 days. Instead, the challenge has to do with weight: specifically, how to get our astronauts off the launch pad with enough supplies to make it there and back.

Zubrin's plan sidesteps those constraints. Rather than launching one huge ship, Mars Direct is broken down into several smaller launches. First off the ground would be an unmanned vessel containing an Earth-return vehicle and a nuclear-powered surface vehicle designed to run atmosphere-processing machinery. Martian atmosphere is 95 per cent carbon dioxide, a chemical that can catalyze a series of chemical reactions to produce methane, the fuel that would get astronauts home. This ability to make propellant on Mars would allow the Earth-return vehicle to be launched from Earth with empty gas tanks. This key step, which has already been successfully tested at full scale, is critical to the potential success of the mission.

Says Zubrin, "You have to ask yourself: why is the Mars mission so heavy in the first place? 75 per cent of what they are shipping to Mars is the propellant to come home. That's what makes the [Mars Direct] mission sing: 95 per cent of your return propellant comes from Mars."

The window of time suitable for launching a mission to Mars opens up once every two years. This means that by second ship's launch time, NASA would already know if there would be enough propellant to bring the astronauts home safely. This second part of the mission would launch four brave souls towards the red planet, a voyage lasting six months. After landing on Mars, the crew would spend 18 months conducting research and thoroughly exploring the planet. The astronauts would then use the fully fuelled return vehicle to travel back to Earth. As a backup, a second Earth-return vehicle would be launched during the astronauts' time on Mars, in case the original did not work. If this Earth-return vehicle is not needed, it could be used by future missions.

Another safeguard built into the mission design is a methane-powered rover, complete with habitat module. With a range of 1,000 kilometres, the rover would allow the team to reach the additional Earth-return vehicle if it happened to miss its designated landing spot.

These safeguards—critical for a mission so far from home—are a big step forward from the original Apollo missions. The abort protocol for those missions was simple: "If anything goes wrong, you quit and go home," said Zubrin.

Venturing farther into the reaches of space presents a unique set of challenges. The most hazardous parameter to consider is not one that would immediately spring to mind for most people: radiation. Solar flares are a large source of radiation and can deliver fatal doses in a matter of hours. Frustratingly, they occur about once a year on an irregular basis. The Mars Direct plan has a convenient way of dealing with this problem. By storing their food and water around a small room in the centre of the living quarters, the astronauts can hide out during solar flares, with the solid matter blocking deadly radiation. "Our pantry becomes our storm shelter," says Zubrin. With advanced warning from Earth-based monitoring systems, the astronauts would be given plenty of time to reach their safe haven. Another type of radiation, the mysterious "cosmic radiation," is less serious in nature. The exposure levels that the astronauts are expected to endure would increase their likelihood of getting cancer by only one per cent.

If the price tag for the Mars Direct mission seems astronomical—a cool $20 billion to $30 billion—it seems less so when compared to the inflation-adjusted $135 billion cost of the Apollo program. Considering NASA's 2007 operating budget is over $16 billion, Mars Direct seems affordable, even if sizeable cost overruns were to occur.

With improving technology and a quickly-filling planet, the case for sending people to Mars grows stronger. More than just a scientific curiosity, Mars could potentially prove profitable in the long run. With rich mineral deposits, including large amounts of deuterium (a valuable nuclear fuel), mining and resource exploitation will be an important aspect of humanity's future endeavours on the red planet. Even more pressing is the imminent overcrowding of Earth and the eventual food shortfall. A terraformed Mars capable of growing crops could support and provide space for the human race.

All of this hinges on actually reaching Mars, of course. If Zubrin had funding for the project today, he is convinced that we could set foot on the planet by 2014. It may well be wishful thinking, but the point that Zubrin wanted to get across was clear.

"If used correctly, the same resources that make Mars interesting can make it attainable."

For more information about future Astronomy and Space Exploration Society events, visit asx.sa.utoronto.ca

// MARS: PLANETARY PROFILE

Origin of name: Mars, the Roman god of war. Also commonly known as the "Red Planet."

Surface gravity: 0.376g

Axial tilt: 25.19°

Volume: 1.6318×10^{11} km^3 (0.151 Earth volumes)

Mass: 6.4185×10^{23} kg (0.107 Earth masses)

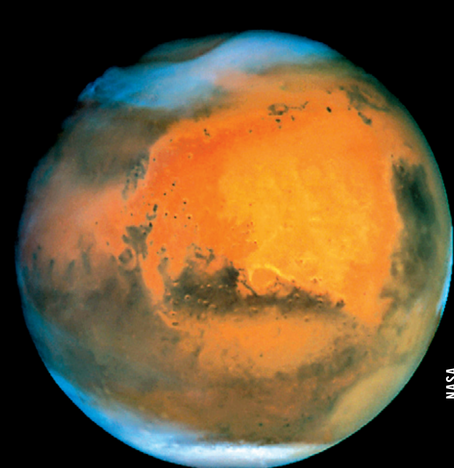
Surface temperature: Ranges from –87 °C to –5 °C

Atmospheric composition (approximate values): 95.7% CO_2, 2.7% Nitrogen, 1.6% Argon, 0.2% O_2 and small amounts of other compounds

Satellites: Two moons, called Phobos and Deimos. They may be captured asteroids, as they are irregularly shaped.

Visibility: Can be seen from the Earth with the naked eye. Its brightness is only surpassed by Venus, the moon and the sun.

Colour: Mars is orange-red on its surface due to the presence of iron oxide (rust)



NASA

Features of note: Has the highest known volcano and mountain in the solar system. Named Olympus Mons, it is 26 kilometres high (over three times the high of Mt. Everest). As well, the planet has ice on its north and south poles and many interesting geological features (some that appear to be dry river beds) that suggest that there may have once been liquid water on Mars.