**2011-2012 GBPDL Novice Packet**

**•Mars Colonization Affirmative**

**•Mars Colonization Negative**

**Resolved: The United States federal government should substantially increase its exploration and/or development of space beyond the Earth’s mesosphere.**

**Mars Colonization Affirmative**

# Mars Colonization Affirmative

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# Explanation

Humans have long been fascinated with the other planets in the Solar System. Hundreds of years ago, we believed that the Earth was the center of the universe. Now we know that all of the planets in our solar system orbit around the sun, not the Earth. Despite the immense amount that we have learned since this time through science, there remains the same interest and fascination with outer space.

This case argues that the United States should attempt to establish a permanent human presence on Mars, like a colony. The case believes that this is a good idea because of the many problems that plague people on Earth. There are nuclear weapons, deadly diseases, and a growing population, all of which have the potential to cause great harm to humans. Following the logic that you shouldn’t put all of your eggs in one basket, the case argues that if we had people on a different planet that we would have an insurance policy in case a disaster happened on Earth.

Finally, this case argues that the technology to reach and set up a place to live on Mars is possible with our current technology. Mars is a very attractive option to attempt to colonize because it is a similar size and has a comparable climate to Earth.

# Glossary

**Key Words**:

**Colonize** – sending settlers to a new area with the aim of gaining control of it.

**Status quo** – The world as it is presently

**De-orbited**- taken out of orbit, allowing an object to crash into Earth

**Wane** – When something, like interest in a subject, decreases

**Frontier** – the outer limit of territory that humanity has colonized. Antarctica is a frontier because no humans live there. So is the moon.

**Extinction** – When no more of a species remain. For example, dinosaurs are extinct

**Epidemics** – a widespread and deadly disease. AIDS is an epidemic.

**confined** – restricted or cramped

regions

**self-sustaining** – something that can function on its own.

**Catastrophe** – an event causing great damage and suffering

**Demise** – Something’s demise is its death.

**Species** – a class of living thing. Humans are a species, just like ants or oak trees

**Extinct** – when a species no longer exists

**Implement** – to put into action

**Intriguing** – interesting

**Reserves** – Something stored for later, perhaps in the event of a tragedy

**Inhabitants** – the organisms that live in a certain area

**Vulnerable** – something that is easily open to harm is vulnerable

**springboard** – a point to begin from, like a launch pad.

**Asteroid** – a rocky body, smaller than a planet, that is flying through space with the potential to hit other planets

Key Phrases:

**Axial tilt –** the amount that a planet “wobbles” back and forth along the imaginary line that it spins around. You may have learned that on the Earth are caused by its axial tilt.

**Inelegant Jargon** – Jargon is special words used by people in a specific area (like debaters and “disad” or “1AC”) that are hard for people to understand. Inelegant jargon are phrases that don’t flow easily.

**Diminishing returns –** The idea that it in any area, it is easier to get the basics down than to master everything. For example, the first time you read a book you will learn a lot because you have never read it before. However, the second time you read it you will learn fewer new things because there is less left that you didn’t already know and only the tricky details remain

**Survival prospects** – the likelihood that humans would survive

**Formulate a strategy** – to come up with a plan of action

**Habitable location for homo sapiens** – a place that humans could live in

**Ecological collapse –** when an environment becomes unlivable for many of its inhabitants. For example, if a fresh water lake became contaminated with salt water, many of the plants and animals would not be able to survive, and the lake would suffer an ecological collapse

**Microbial life** – Bacteria, germs, and other organisms that only can be seen through microscopes

**Scientific facility** – a place where scientific experiments are conducted. Think of a lab.

**Political and social implications –** the effects that something would have on the way people work in government and how they interact with each other in society more generally

**El Dorado** – A mythical city of gold that colonizers of the Americas sought. When El Dorado is used today, it refers to an ideal place with great riches that either does not exist or would be very difficult to attain.

**Acronyms**:

**ISS** - International Space Station

**NASA** – National Aeronautics and Space Administration

# 1AC [1/6]

**Contention 1: Inherency**

**The end of the space shuttle program is a symbol of the end of American interest in space exploration. There are currently no plans to colonize Mars, or any other planet.**

**The Economist, 6/30/2011, “The End of the Space Age,” http://www.economist.com/node/18897425**

The reason for that second objective is also the reason for thinking 2011 might, in the history books of the future, be seen as the year when the space cadets’ dream finally died. It marks the end of America’s space-shuttle programme, whose last mission is planned to launch on July 8th (see [article](http://www.economist.com/node/18895018), [article](http://www.economist.com/node/18895010)). The shuttle was supposed to be a reusable truck that would make the business of putting people into orbit quotidian. Instead, it has been nothing but trouble. Twice, it has killed its crew. If it had been seen as the experimental vehicle it actually is, that would not have been a particular cause for concern; test pilots are killed all the time. But the pretence was maintained that the shuttle was a workaday craft. The technical term used by NASA, “Space Transportation System”, says it all. But the shuttle is now over. The ISS is due to be de-orbited, in the inelegant jargon of the field, in 2020. Once that happens, the game will be up. There is no appetite to return to the moon, let alone push on to Mars, the El Dorado of space exploration. The technology could be there, but the passion has gone—at least in the traditional spacefaring powers, America and Russia.

The space cadets’ other hope, China, might pick up the baton. Certainly it claims it wishes, like President John Kennedy 50 years ago, to send people to the surface of the moon and return them safely to Earth. But the date for doing so seems elastic. There is none of Kennedy’s “by the end of the decade” bravura about the announcements from Beijing. Moreover, even if China succeeds in matching America’s distant triumph, it still faces the question, “what next?” The chances are that the Chinese government, like Richard Nixon’s in 1972, will say “job done” and pull the plug on the whole shebang. With luck, robotic exploration of the solar system will continue. But even there, the risk is of diminishing returns. Every planet has now been visited, and every planet with a solid surface bar Mercury has been landed on. Asteroids, moons and comets have all been added to the stamp album. Unless life turns up on Mars, or somewhere even more unexpected, public interest in the whole thing is likely to wane. And it is the public that pays for it all. The future, then, looks bounded by that new outer limit of planet Earth, the geostationary orbit. Within it, the buzz of activity will continue to grow and fill the vacuum. This part of space will be tamed by humanity, as the species has tamed so many wildernesses in the past. Outside it, though, the vacuum will remain empty. There may be occasional forays, just as men sometimes leave their huddled research bases in Antarctica to scuttle briefly across the ice cap before returning, for warmth, food and company, to base. But humanity’s dreams of a future beyond that final frontier have, largely, faded.

# 1AC [2/6]

**Contention 2: Harms.**

Humans have a limited amount of time left on Earth. Global warming, deadly diseases, and nuclear weapons are just a few of many catastrophes that will eventually endanger all life on Earth.

Michael Huang, writer for The Space Review, 4/11/2005, **“The top three reasons for humans in space,”** [**http://www.thespacereview.com/article/352/1**](http://www.thespacereview.com/article/352/1)

Humankind made it through the 20th century relatively well, but there were close calls: the Cuban Missile Crisis almost began a total war between nuclear-armed superpowers. The 21st century has presented its own distinct challenges. Nuclear and biological weapon technologies are spreading to many nations and groups. Progress in science and technology, while advancing humankind, will also lead to the development of more destructive weapons and possibly other unintended consequences. In addition to these manmade threats, natural threats such as epidemics and impacts from space will continue to be with us. The most valuable part of the universe is life: not only because life is important, but because life appears to be extremely rare. The old saying, “Don’t put all your eggs in one basket”, advises that valuable things should be kept in separate places, in case something bad happens at one of the places. This advice is more familiar to investors in the guise of “diversify your portfolio” and “spread your risk”: one should invest in many different areas in case one area declines disastrously. The same principle applies to the big picture. The most valuable part of the universe is life: not only because life is important, but because life appears to be extremely rare. Life and humankind are presently confined to the Earth (although we have built habitats in Earth orbit and ventured as far as the moon). If we were throughout the solar system, at multiple locations, a disaster at one location would not end everything. If we had the technologies to live in the extreme environments beyond Earth, we would be able to live through the extreme environments of disaster areas and other regions of hardship.

# 1AC [3/6]

**In fact, the likelihood of human extinction due to one of many disasters is likely at least 10% over the next several centuries.**

**Bruce E. Tonn, Department of Political Science, U. Of Tennessee, 09/2009, Department of Political Science, U of Tennessee, “Obligations to Future Generations and Acceptable Risks of Human Extinction,” Futures, 41:7, p. 427-435**

[**http://www.sciencedirect.com/science/article/pii/S0016328709000020**](http://www.sciencedirect.com/science/article/pii/S0016328709000020)

The litany of catastrophe-scale problems facing humanity is long and well known [1]. The set of catastrophic-scale events includes nuclear war, global climate change, massive volcanic eruptions, and collisions with near-earth objects [2]. Humanity is also plagued by myriad lesser risks that, when chained together, could equal or possibly even surpass risks posed by catastrophic events. Imagine the consequences of chaining to together the worst outcomes of terrorism, energy shortages, flu pandemics, HIV/AIDS, air and water pollution, water shortages, soil erosion, species extinction, and forest fire. Indeed, history has witnessed the collapse of many civilizations due to chains of less than catastrophic events, usually anchored by the overutilization of natural resources [3]. Last but not least is the set of potential exotic catastrophic events, which includes out-of-control (grey goo) nanotechnologies [4], the emergence of threatening super computer intelligences [5], bombardment by gamma rays emanating from explosions of super novae [6] and [7] and the creation of earth-destroying tears in the fabric of space–time within new high-energy physics devices [8,9]. Because of the perceived weight of these threats, many knowledgeable people believe that the situation facing humanity is extremely dire [10], so dire that human extinction not only seems quite possible but also very probable. For example, Rees [8] puts the chances of human civilization surviving another 100 years to be just 50–50. Bostrom [9] argues that the imminent chances of human extinction cannot be less than 25%. Leslie [11] estimates a 30% probability of human extinction during next five centuries. The Stern Review conducted for the United Kingdom Treasury assumes probability of human extinction during next century is 10% [[12]](http://www.sciencedirect.com/science/article/pii/S0016328709000020" \l "bbib12)

Plan: The United States federal government should direct the National Aeronautics and Space Administration to develop and implement a strategy to send humans to Mars, in order to establish a permanent human presence in space.

# 1AC [4/6]

**Contention 3: Solvency.**

**Colonizing another planet, specifically Mars, will provide a “life insurance policy” against these disasters on Earth, ensuring that human kind will survive even after one of these catastrophic events.**

**J. Richard Gott, Professor of Astrophysics at Princeton University, 6/17/2009, “A Goal For The Human Spaceflight Program,” http://www.nasa.gov/pdf/368985main\_GottSpaceflightGoal.pdf**

The goal of the human spaceflight program should be to increase the survival prospects of the human race by colonizing space. Self-sustaining colonies in space, which could later plant still other colonies, would provide us with a life insurance policy against any catastrophes which might occur on Earth.

Fossils of extinct species offer ample testimony that such catastrophes do occur. Our species is 200,000 years old; the Neanderthals went extinct after 300,000 years. Of our genus (Homo) and the entire Hominidae family, we are the only species left. Most species leave no descendant species. Improving our survival prospects is something we should be willing to spend large sums of money on— governments make large expenditures on defense for the survival of their citizens.

The Greeks put all their books in the great Alexandrian library. I’m sure they guarded it very well. But eventually it burnt down taking all the books with it. It’s fortunate that some copies of Sophocles’ plays were stored elsewhere, for these are the only ones that we have now (7 out of 120 plays). We should be planting colonies off the Earth now as a life insurance policy against whatever unexpected catastrophes may await us on the Earth. Of course, we should still be doing everything possible to protect our environment and safeguard our prospects on the Earth. But chaos theory tells us that we may well be unable to predict the specific cause of our demise as a species. By definition, whatever causes us to go extinct will be something the likes of which we have not experienced so far. We simply may not be smart enough to know how best to spend our money on Earth to insure the greatest chance of survival here. Spending money planting colonies in space simply gives us more chances--like storing some of Sophocles’ plays away from the Alexandrian library.

If we made colonization our goal, we might formulate a strategy designed to increase the likelihood of achieving it. Having such a goal makes us ask the right questions. Where is the easiest place in space to plant a colony—the place to start? Overall, Mars offers the most habitable location for Homo sapiens in the solar system outside of Earth, as Bruce Murray has noted. Mars has water, reasonable gravity (1/3rd that of the Earth), an atmosphere, and all the chemicals necessary for life. Living underground (like some of our cave dwelling ancestors) would lower radiation risks to acceptable levels. The Moon has no atmosphere, less protection against solar flares and galactic cosmic rays, harsher temperature ranges, lower gravity (1/6th that of the Earth), and no appreciable water. Asteroids are similar. The icy moons of Jupiter and Saturn offer water but are much colder and more distant. Mercury and Venus are too hot, and Jupiter, Saturn, Uranus, and Neptune are inhospitable gas giants. Free floating colonies in space, as proposed by Gerard O’Neill, would need material brought up from planetary or asteroid surfaces. If we want to plant a first permanent colony in space, Mars would seem the logical place to start.

# 1AC [5/6]

**Colonizing Mars is possible – the planet has many characteristics similar to Earth.**

**Fraser Cain, Publisher for Universe Today, 6/8/2008, “Mars Colonizing”,** [**http://www.universetoday.com/14883/mars-colonizing/**](http://www.universetoday.com/14883/mars-colonizing/)

Mars makes an intriguing target for human colonizing. Let’s see what some of the Mars colonizing advantages are: It has a very similar length of day. A Martian day is 24 hours and 39 minutes, so plants and animals might find that familiar. It has an axial tilt very similar to Earth. This gives it familiar seasons to our home planet. It has vast reserves of water in the form of ice. This water would be essential for human travelers to Mars, and could also be used to make rocket fuel and hydrogen for fuel. Robert Zubrin, in his book, “The Case for Mars”, explains how future human colonists might be able to live off the land when traveling to Mars, and eventually colonizing it. Instead of bringing all their supplies from Earth – like the inhabitants of the International Space Station – future colonists would be able to make their own air by splitting water on Mars into oxygen and hydrogen. This Martian water would also be used for drinking, and even rocket fuel. Preliminary experiments have shown that Mars soil could be baked into bricks to create protective structures. Earth plants could even be grown in Martian soil, assuming they get enough sunlight and carbon dioxide. Over time, there may be many mineral deposits that could be discovered on Mars and sent back to Earth for sale. In the far future, there might be a viable economy between Martian colonists and the home planet. Launching precious metals, like platinum, off the surface of Mars would be relatively inexpensive thanks to its lower gravity. And in the far future, Mars colonizing might include terraforming Mars, raising the temperature of the planet to the point that its water melts and vast reserves of gas escape and thicken the atmosphere. One day, there could be real Martians, and they would be us. Here’s a great article written by Nancy Atkinson about the possibility of a one-way, one-person trip to Mars. What about using microbes to help colonize mars. The Mars Society is working to try and colonize Mars. And Red Colony is a great resource of articles about colonizing Mars. Finally, if you’d like to learn more about Mars in general, we have done several podcast episodes about the Red Planet at Astronomy Cast. Episode 52: Mars, and Episode 91: The Search for Water on Mars.

# 1AC [6/6]

**Finally, colonizing mars provides a stepping-stone for looking for life on other planets and for colonizing deeper into the Solar System.**

Drik Schulze-Makuch, Professor at the **School of Earth and Environmental Sciences, Washington State University** and Paul Davies, **Co-Director of the Cosmology Initiative, Arizona State University, October 2010,** “**To Boldly Go: A One-Way Human Mission to Mars**”[**http://journalofcosmology.com/Mars108.html**](http://journalofcosmology.com/Mars108.html)

There are several reasons that motivate the establishment of a permanent Mars colony. We are a vulnerable species living in a part of the galaxy where cosmic events such as major asteroid and comet impacts and supernova explosions pose a significant threat to life on Earth, especially to human life. There are also more immediate threats to our culture, if not our survival as a species. These include global pandemics, nuclear or biological warfare, runaway global warming, sudden ecological collapse and supervolcanoes (Rees 2004). Thus, the colonization of other worlds is a must if the human species is to survive for the long term. The first potential colonization targets would be asteroids, the Moon and Mars. The Moon is the closest object and does provide some shelter (e.g., lava tube caves), but in all other respects falls short compared to the variety of resources available on Mars. The latter is true for asteroids as well. Mars is by far the most promising for sustained colonization and development, because it is similar in many respects to Earth and, crucially, possesses a moderate surface gravity, an atmosphere, abundant water and carbon dioxide, together with a range of essential minerals. Mars is our second closest planetary neighbor (after Venus) and a trip to Mars at the most favorable launch option takes about six months with current chemical rocket technology. In addition to offering humanity a "lifeboat" in the event of a mega-catastrophe, a Mars colony is attractive for other reasons. Astrobiologists agree that there is a fair probability that Mars hosts, or once hosted, microbial life, perhaps deep beneath the surface (Lederberg and Sagan 1962; Levin 2010; Levin and Straat 1977, 1981; McKay and Stoker 1989; McKay et al. 1996; Baker et al. 2005; Schulze-Makuch et al. 2005, 2008, Darling and Schulze-Makuch 2010; Wierzchos et al. 2010; Mahaney and Dohm 2010). A scientific facility on Mars might therefore be a unique opportunity to study an alien life form and a second evolutionary record, and to develop novel biotechnology there from. At the very least, an intensive study of ancient and modern Mars will cast important light on the origin of life on Earth. Mars also conceals a wealth of geological and astronomical data that is almost impossible to access from Earth using robotic probes. A permanent human presence on Mars would open the way to comparative planetology on a scale unimagined by any former generation. In the fullness of time, a Mars base would offer a springboard for human/robotic exploration of the outer solar system and the asteroid belt. Finally, establishing a permanent multicultural and multinational human presence on another world would have major beneficial political and social implications for Earth, and serve as a strong unifying and uplifting theme for all humanity.

# Overview Effect Advantage

**Committing to space colonization enacts an overview effect, inaugurating the spirit of human wholeness and connectedness—this solves for human fragmentation and violent divisiveness.**

**Isaac Asimov, President of the American Humanist Association, Biochemist, and famous author, 2003 “Our Future in the Cosmos – Space,” http://www.wronkiewicz.net/asimov.html**

I have a feeling that if we really expanded into space with all our might and made it a global project, this would be the equivalent of the winning of the West. It’s not just a matter of idealism or preaching brotherhood. If we can build power stations in space that will supply all the energy the world needs, then the rest of the world will want that energy too. The only way that each country will be able to get that energy will be to make sure these stations are maintained. It won’t be easy to build and maintain them; it will be quite expensive and time-consuming. But if the whole world wants energy and if the price is world cooperation, then I think people are going to do it. We already cooperate on things that the whole world needs. International organizations monitor the world’s weather and pollution and deal with things like the oceans and with Antarctica. Perhaps if we see that it is to our advantage to cooperate, then only the real maniacs will avoid cooperating and they will be left out in the cold when the undoubted benefits come in. I think that, although we as nations will retain our suspicions and mutual hatreds, we will find it to our advantage to cooperate in developing space. In doing so, we will be able to adopt a globalist view of our situation. The internal strife between Earthlings, the little quarrels over this or that patch of the Earth, and the magnified memories of past injustices will diminish before the much greater task of developing a new, much larger world**.** I think that the development of space is the great positive project that will force cooperation, a new outlook that may bring peace to the Earth**,** and a kind of federalized world government. In such a government, each region will be concerned with those matters that concern itself alone, but the entire world would act as a unit on matters that affect the entire world. Only in such a way will we be able to survive and to avoid the kind of wars that will either gradually destroy our civilization or develop into a war that will suddenly destroy it. There are so many benefits to be derived from space exploration and exploitation; why not take what seems to me the only chance of escaping what is otherwise the sure destruction of all that humanity has struggled to achieve for 50,000 years? That is one of the reasons, by the way, that I have come from New York to Hampton despite the fact that I have a hatred of traveling and I faced 8 hours on the train with a great deal of fear and trembling. It was not only The College of William and Mary that invited me, but NASA as well, and it is difficult for me to resist NASA, knowing full well that it symbolizes what I believe in too.

# Inherency Extensions

**[\_\_\_\_]**

**[\_\_\_\_]Without a commitment to colonization, human spaceflight will end.**

**Jeff** **Foust,** **editor and publisher for the Space Review, 6/6/2011**, <http://www.thespacereview.com/article/1860/1>

Jeff Greason [president of XCOR Aerospace and a member of 2009’s Augustine Committee], though, is more pessimistic about the future of at least NASA’s human spaceflight program without a firm strategy in place for space settlement. Without that strategy, he said, “we’re going to build a big rocket, and then we’re going to hope a space program shows up to fly it. Any in my opinion, that strategy—the strategy of default—is going to result in the end of the NASA human spaceflight program” when members of Congress question the wisdom of spending several billion dollars a year on that effort and its lack of progress in an era of constricting budgets. “If we haven’t done better in the next ten years than we have in the last ten years, we’re going to lose that fight, and NASA’s human spaceflight activity will end.”

**[\_\_\_\_]**

**[\_\_\_\_] Governments are not investing in human colonization in the status quo.**

**Joe Falconer, Australian editor of TheNextWeb news service, 6/26/2011, “What Would Colonization of the Final Frontier Look Like?”** [**http://thenextweb.com/industry/2011/06/26/what-would-colonization-of-the-final-frontier-look-like/**](http://thenextweb.com/industry/2011/06/26/what-would-colonization-of-the-final-frontier-look-like/)

Space colonization is something that people have dreamed about since the moon landing, and is in fact considered a priority for the future of mankind by leading scientists. Unfortunately, we’ve all but ignored space colonization and the development of its technologies in recent decades, though there have been a myriad of developments that weren’t intended to advance the cause that will do just that. Aerospace advances, submarines that humans can survive in for months at a time autonomously and experiments like the Biodome have all led to uncovering pieces of the puzzle. It’s not a huge surprise that governments and corporations aren’t investing heavily in space colonization itself. We still need to make many, many more of these ancillary but important advances before we’d make any significant progress in the area. And there’s that other issue – that governments and corporations don’t see a need to ramp up the timeline on this. But Stephen Hawking, one of the few physicists whose name regular people actually know, thinks differently. He’s worried that until we disperse, we’re in imminent danger of a catastrophic event destroying human civilization – heck, human life – for good. “One we spread out into space and establish colonies, our future should be safe,” Hawking [once said](http://news.bbc.co.uk/2/hi/uk_news/6158855.stm) to a BBC reporter. There’s much to consider, and the question of where we should colonize isn’t even chief among them yet. Let’s skip the boring stuff for the moment, though, and start there. Where would we colonize?

# Extinction Inevitable – Human Weapons

**[\_\_\_\_]**

**[\_\_\_\_] Nuclear war is inevitable as resources run out.**

**Andrew R. Jones, Assistant Professor of Sociology at California State University, Fresno, 2009, “The Next Mass Extinction: Human Evolution or Human Eradication”, Journal of Cosmology, 2009, Vol 2, pages 316-333.** [**http://journalofcosmology.com/Extinction108.html**](http://journalofcosmology.com/Extinction108.html)

An additional threat manifests in the form of global warfare. As resources become increasingly scarce, and human populations attempt to migrate away from areas desertified or inundated due to climate change, the use of military force to secure liveable space will come into play (Klare, 2001; McKee, 2009). The likelihood of this scenario is predicated on whether international efforts at cooperation in addressing our collective situation succeed or fail (Klare, 2009; Levy & Sidel, 2009). Failure could result in the probable use of nuclear weapons, and chemical and biological agents to eliminate “problem” populations (Homer-Dixon, 2001). Be it the Khmer rouge of Cambodia, Hitler and the Nazis, the Armenian genocide, the purposeful eradication of the "Native Americans" and so on, history is replete with stark evidence of humanity's willingness to exterminate their fellow humans. With nuclear proliferation and the increasing risk that "rogue states" or international terrorists will acquire and unleash weapons of mass destruction, it would be naive to believe that humans will not attempt to exterminate millions of their fellow humans again in the future. Dwindling resources, competition for clean water, gas, oil, and other commodities, may guarantee it.

**[\_\_\_\_] If nature’s threats don’t end life first, human behavior will lead to their own extinction.**

**Anders Sandberg, Jason Matheny, and Milan Cirkovic, James Martin Research Fellow, Future of Humanity Institute, Oxford University; Special Consultant, Center for Biosecurity, U of Pittsburgh Medical Center;, Senior Research Associate, Astronomical Observatory, Belgrade and Asst. Prof of Physics, 9/9/2008, Bulletin of the Atomic Scientists Online**

The risks from anthropogenic hazards appear at present larger than those from natural ones. Although great progress has been made in reducing the number of nuclear weapons in the world, humanity is still threatened by the possibility of a global thermonuclear war and a resulting nuclear winter. We may face even greater risks from emerging technologies. Advances in synthetic biology might make it possible to engineer pathogens capable of extinction-level pandemics. The knowledge, equipment, and materials needed to engineer pathogens are more accessible than those needed to build nuclear weapons. And unlike other weapons, pathogens are self-replicating, allowing a small arsenal to become exponentially destructive. Pathogens have been implicated in the extinctions of many wild species. Although most pandemics "fade out" by reducing the density of susceptible populations, pathogens with wide host ranges in multiple species can reach even isolated individuals. The intentional or unintentional release of engineered pathogens with high transmissibility, latency, and lethality might be capable of causing human extinction. While such an event seems unlikely today, the likelihood may increase as biotechnologies continue to improve at a rate rivaling Moore's Law.

# Extinction Inevitable – Asteroids

**[\_\_\_\_]**

[\_\_\_\_] In fact, the planet is overdue for a major impact.

A. Ghayur , Lecturer at the University Institute of Information Technology, Pakistan, 2007, “Developing a Three Period Strategy to Face a Global Threat: A Preliminary Analysis”<http://www.aero.org/conferences/planetarydefense/2007papers/P5-1--Ghayur--Paper.pdf>

1694 was the year when a man envisioned a bone chilling scenario after witnessing a Near Earth Object (NEO); “What if it would return and hit the Earth?” The man is now a world renowned scientist, Dr. Edmond Halley, and the object now one of the most famous comets, the Halley’s Comet has returned numerous times without any incident. Human civilization has come a long way since the Dark Ages of mid twentieth century, however, it is only now that the mankind is realizing the veracity of the apocalyptic scenario – a heavenly body colliding with earth – the Hellish nightmare which troubled Dr. Halley. Although the chances of Halley’s Comet plummeting into earth are nearly nonexistent, the chances nevertheless of another NEO colliding head on with earth are very much there. The battle-scared face of moon and the numerous impact craters on earth are a living testament to it. But all this evidence proved insufficient to turn any heads until 1994 when Shoemaker-Levy Nine crashed into Jupiter. The earth-sized storms created on Jupiter surface sent alarms through the echelons of bureaucracy and politics and suddenly a nonexistent apocalyptic nightmare had become a very much possible scenario. 1 Today, we are sitting in the midst of ever increasing human population on this planet Earth, which in turn is sitting amidst ever increasing number of identified NEOs. We are already overdue for our next big hit*; last one occurring 65 million years ago at Chixilub.* Any impact of that scale would result in deaths and displacement of billions, if not more. Do we have a global network and an institution to respond timely and effectively?

## [\_\_\_\_] Extinction from asteroids is inevitable without space colonization.

James Oberg**, Space Writer and former Space Flight Engineer. 1999, “Space Power Theory”**

We have the great gift of yet another period when our nation is not threatened; and our world is free from opposing coalitions with great global capabilities. We can use this period to take our nation and our fellow men into the greatest adventure that our species has ever embarked upon. The United States can lead, protect, and help the rest of mankind to move into space. It is particularly fitting that a country comprised of people from all over the globe assumes that role. This is a manifest destiny worthy of dreamers and poets, warriors and conquerors. In his last book, Pale Blue Dot, Carl Sagan presents an emotional argument that our species must venture into the vast realm of space to establish a spacefaring civilization. While acknowledging the very high costs that are involved in manned spaceflight, Sagan states that our very survival as a species depends on colonizing outer space. Astronomers have already identified dozens of asteroids that might someday smash into Earth. Undoubtedly, many more remain undetected. In Sagan’s opinion, the only way to avert inevitable catastrophe is for mankind to establish a permanent human presence in space. He compares humans to the planets that roam the night sky, as he says that humans will too wander through space. We will wander space because we possess a compulsion to explore, and space provides a truly infinite prospect of new directions to explore. Sagan’s vision is part science and part emotion. He hoped that the exploration of space would unify humankind. We propose that mankind follow the United States and our allies into this new sea, set with jeweled stars. If we lead, we can be both strong and caring. If we step back, it may be to the detriment of more than our country.

# Extinction Inevitable – Overpopulation

**[\_\_\_\_]**

**[\_\_\_\_] Overpopulation will eventually render Earth inhabitable.**

**Nawal Mahmood, writer for the tech journal, 6/28/2010,** [**http://thetechjournal.com/science/eminent-scientist-claims-humans-will-be-extinct-in-100-years.xhtml#ixzz1Qt1nhm6n**](http://thetechjournal.com/science/eminent-scientist-claims-humans-will-be-extinct-in-100-years.xhtml#ixzz1Qt1nhm6n)

Eminent biologist Professor Frank Fenner, who helped to eradicate smallpox, recently made the dire prediction that humans will probably be extinct within the next 100 years due to overpopulation, environmental destruction and climate change. Fenner, who is emeritus professor of microbiology at the Australian National University (ANU) in Canberra, said homo sapiens will not be able to survive the population explosion and “unbridled consumption,” and will become extinct, perhaps within a century, along with many other species. United Nations official figures from last year estimate the human population is 6.8 billion, and is predicted to pass seven billion next year. Fenner told *The Australian* he tries not to express his pessimism because people are trying to do something, but keep putting it off. He said he believes the situation is irreversible, and it is too late because the effects we have had on Earth since industrialization (a period now known to scientists unofficially as the Anthropocene) rivals any effects of ice ages or comet impacts.

**[\_\_\_\_] Overpopulation will cause extinction. The population has tripled in the last century.**

**Melinda Ham, Writer for the Sydney Morning Herald, 3/21/2011, “The world keeps on churning; overpopulation – our changing environment Part I”**

Mankind is losing the numbers game, writes Melinda Ham. The population of the world's low-income or developing countries is growing at a faster rate than in the higher-income or "developed" countries. In many cases worldwide, this growth is unsustainable, causing overpopulation and putting immense pressure on economic resources and essential services, resulting in poverty and environmental problems. WHY SO MANY PEOPLE ON THE PLANET? During the 19th and early 20th centuries, the development of modern medicine and the control of infectious diseases decreased death rates around the developed world. After the Second World War, this population growth spread to the developing world, resulting in a global population explosion and urban expansion. The number of people on the planet has tripled in only a century, according to the World Bank report Beyond Economic Growth, published in 2004. This has caused "overpopulation", especially in developing countries, where insufficient economic resources means clean water, food, hospitals, schools and jobs can be scarce. This also causes increased pollution and deforestation. HOW BIG WILL THE POPULATION GET? Many push-and-pull factors affect how much world population will increase. By early next year, the United Nations' Population Fund (UNFPA) estimates the world will have reached 7 billion people and go beyond 9 billion by 2050. Most of this growth will still be in the 49 least-developed countries, even though the number of babies women are having is decreasing markedly. Simultaneously, the population growth also depends on the impact of the HIV/AIDS epidemic. If, for some reason, women in less-developed countries stop using contraception, the world population would increase by nearly twice as much as projected, the World Bank says.

# Answers To: War in Space

**[\_\_\_\_]**

## [\_\_\_\_] Space colonization will eliminate ethnic tensions.

The Columbus Dispatch**, 5/23/**2001

There may come a time when humans will consider space colonization. Initiatives such as the space station and a manned Mars landing could be steppingstones toward pitching a tent on another world. In one unexpected consequence, an international push into space could be the great uniter. The heavens, so immense and enigmatic, could make ethnic and religious groups look beyond their problems with each other. Everyone has a stake in this trip.

**[\_\_\_\_]**

## [\_\_\_\_] Space colonization will end nationalism.

**Frank** White, **space lecturer and writer**, 1990, **The SETI Factor**

Many scholars and scientists see benefits in opening up the “space frontier.” It provides an opportunity to divert nationalistic energies away from war and toward peaceful cooperation ventures; it also offers an expanded range in which to work out new forms of societal and political interaction. In the Overview Effect, I pointed out that space exploration also provides an opportunity for human awareness to evolve and transform itself because it provides us with a new perspective on the earth, the universe, and ourselves. The defining feature of the space development subculture is a refusal to consider the future of humanity as confined to the surface of one planet. While members of the space development community may be concerned about the future of Earth, it is not because they plan to stay here. They see themselves as the leaders in creating a “spacefaring civilization,” and making humanity into a “multi-planet species.”

# Overview Effect Extensions

**[\_\_\_\_]**

**Experiencing the “Overview Effect” solves war as we shift to a more peaceful mindset.**

**Frank White, space writer and lecturer, 1998, “The overview effect: space exploration and human evolution” page 48**

The space frontier has become a symbol of humanity working out its destiny: war or peace, cooperation or competition, love or hate. The Overview Effect says it all: we are one; we are all in this together; war and strife solve nothing.Returning to Earth, the astronaut has many choices regarding transmission of the message, and each per-son uses the experience in terms of his or her own interests and place in society. However, because of the cultural role that they have played, people who have been in space often have creditability un-matched by others**.** Many of our cultures are replete with the stories of angels, messengers, sky-gods who come from above with a better view of what is happening below. Even for those who are not reli-gious, this symbolism of people who go into the regions of God (or the gods) and return must be powerful. And previously pointed out by Loren Acton, the influence of astro-nauts, cosmonauts, and other space travelers back to Earth may be the most important aspect of recent missions. The Space Shuttle Program,regardless of the other benefits it may or may not bring to soci-ety,is consolidating the impact of the effect and the supporting its dissemination to the people on Earth. The ultimate impact could be substantial, Nelson suggested, **if** the superpower leaders would have to ar-range a summit meeting in space in the next century. “It would have a positive effect on their making decisions on war and peace.” Ultimately, the Space Shuttle points to a future when living on the frontier with a new perspective will be normal. As Bonnie Dunbar put it, “With success flights, I have become more at home in Space….. I miss looking down n the Earth and out into the universe.” Her views are echoed by Al Sacco, a recent space flier: “For me, being in orbit was very comforting. In some ways, I was more comfortable in space than on Earth, and I hated to leave that environment.”

# Overview Effect Extensions

**[\_\_\_\_]**

**[\_\_\_\_] Colonizing space will cause the next renaissance and promote universal prosperity and clarity.**

Patrick Collins and Adriano Autino, **Professor of Economics at Azabu University (Japan); President of the Space Renaissance International,** 2008 **“What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace”**

Healthy societies can revitalise themselves. An interesting explanation of the potential of space travel and its offshoots to revitalise human civilisation is expressed in the idea that "The Earth is not sick: she's pregnant" [35]. Although this idea may seem strange at first sight, it is a surprisingly useful analogy for understanding humans' current predicament. According to the "Pregnant Earth" analogy, the darkening prospect before humanity is due to humans' terrestrial civilisation being "pregnant"—and indeed dangerously overdue—with an extra-terrestrial offspring. Once humans' space civilisation is safely born, the current stresses on the mother civilisation will be cured, and the new life may eventually even surpass it's parent. This idea not only illuminates many aspects of humans' present problems described above, it also provides detailed directions for how to solve these problems, and explains convincingly how successfully aiding this birth will lead to a far better condition than before the pregnancy. A young couple may be happy in each other's company, but their joy is increased by the birth of children and life with them, from which many new possibilities arise. Likewise, the birth of humans' coming extra-terrestrial civilisation will lead to a wide range of activities outside our planet's precious ecosystem. This evolution will solve not just our material problems, by making the vast resources of near-Earth space accessible, but it will also help to cure the emptiness of so-called "modern" commercial culture -- including the "dumbing down" by monopolistic media, the falling educational standards, passification by television, obesity, ever-growing consumption of alcohol, decline in public morality, pornography, narcotics, falling social capital, rising divorce rates, and youths' lack of challenge and lack of "dreams". It will do this by raising humans' sights to the stars, and showing that the door to them is unlocked, and has been for decades—we have only to make a small effort to push it open forever. In addition, re-opening a true geographical frontier, with all its challenges, will in itself be of inestimable value for the cultural growth of modern civilisation. The widespread sense that we live in a closed world which is getting more and more crowded will be replaced by an open-ended, optimistic vision of an unlimited future. Access to the cornucopia of space resources that await humans' exploitation can clearly make a unique contribution to this. To the extent that leaders of major industries are motivated by ambition in business competition, they will welcome this opportunity to extend their activities to new fields in the far wider arena of space. However, to the extent that they are motivated by the attempt to achieve monopolistic control and profits, they may try to hinder development in space, even at the cost of preventing its wide benefits, since this could be more profitable to them. Implementing the "Pregnant Earth" agenda can prevent this cultural regression and start a true world-wide Renaissance, an unprecedented ﬂowering of civilisation of which human culture has been in need ever since the inspiration of the Italian Renaissance was followed by a decline into progressive materialism and war-mongering [35].

# Solvency Extensions

**[\_\_\_\_]**

**[\_\_\_\_]Space Development requires more funding and new visions.**

**Michael Griffin, Administrator of NASA, seven degrees in the fields of Physics, Electrical Engineering, Aerospace Engineering, 2003: “The Future of Human Space Flight,”** [**http://www.spaceref.com/news/viewsr.html?pid=10683)[KEZIOS**](http://www.spaceref.com/news/viewsr.html?pid=10683)%5bKEZIOS)

The required time to achieve the intermediate milestones is irrevocably tied to funding constraints. If no new funding can be provided, we will spend the next several years - probably a decade - working our way out of the Space Shuttle and International Space Station dilemmas, even proceeding as expeditiously as possible. It will be difficult, likely impossible, to begin development of (for example) heavy lift launch vehicles and space nuclear power systems while restricting NASA to today's budget levels and simultaneously respecting current obligations to ISS. Yet, these technologies and others are crucial to any permanent step beyond LEO. There is a lot of ground to be made up, but with a $5 B annual funding increase for NASA, I believe one could expect to see the first lunar base within a decade. What is needed is a different view of spaceflight in the affairs of men and nations than we have so far seen. Space programs in the United States have so far have been just that - programs. They are justified individually, each on its own merits, and have defined goals, funding, start dates and, it is hoped, completion dates. Space activities so far have been largely episodic, when in fact they need to become, again, a way of life. NASA and the space community generally, whether civil or DoD, receive frequent criticism for the high cost of what we do, the cumbersome pace at which it often seems to proceed, and the not infrequent failures which occur. This may not be entirely unfair; it is my own belief that the nation is entitled to expect a higher standard of performance on space projects than has often been the case in recent years. But we in the space community - the engineers who must execute a multiyear vision one budget year at a time - are, I think, entitled to expect a higher and more consistent standard of commitment by the nation, through its policymakers, to that vision.

[\_\_\_\_] Our only chance of survival is to move into space.

**Niall Firth, writer for The Daily Mail, 8/10/2010, “Human race 'must colonise space or face extinction', warns Stephen Hawking”** [**http://www.dailymail.co.uk/sciencetech/article-1301482/Human-race-colonise-space-face-extinction-warns-Stephen-Hawking.html**](http://www.dailymail.co.uk/sciencetech/article-1301482/Human-race-colonise-space-face-extinction-warns-Stephen-Hawking.html)

‘If we are the only intelligent dead’beings in the galaxy we should make sure we survive and continue.’ But he warned that mankind was entering an increasingly dangerous period. ‘Our population and use of the finite resources of planet Earth are growing exponentially along with our technical ability to change the environment for good and ill,’ said the author of the bestseller, A Brief History of Time. ‘But our genetic code carries selfish and aggressive instincts that were a survival advantage in the past. It will be difficult enough to avoid disaster in the next 100 years let alone the next thousand or a million. 'Our only chance of long-term survival is not to remain on planet Earth but to spread into space. ‘We have made remarkable progress in the last 100 years but if we want to continue beyond the next 100 years our future is in space.’

# Answers To: Can’t Establish a Colony Fast Enough

**[\_\_\_\_]**

**[\_\_\_\_] Space Colonization is possible due to new propulsion technologies.**

**Clara Moskowitz, staff writer for Space.com, 2/1/2010, “NASA’s Far-Out New Plans,” http://www.space.com/7852-nasa-plans.html,**

One of the possible consequences of new commercial space vehicles and new propulsion mechanisms is the chance that human civilians could travel to space in large numbers for the first time. That means that space vacations and moon hotels may not be a mere pipe dream anymore. "I am excited to think that the development of commercial capabilities to send humans into low earth orbit will likely result in so many more earthlings being able to experience the transformative power of spaceflight," Apollo 11 astronaut Buzz Aldrin said in a statement. In his comments, Bolden echoed this sentiment. "Imagine enabling hundreds, even thousands of people to visit or live in low-Earth orbit, while NASA firmly focuses its gaze on the cosmic horizon beyond Earth," he said.

**[\_\_\_\_]**

**[\_\_\_\_] A direct trip to mars would be quick.**

**Robert Zubrin, Aerospace engineer and founder of the Mars Society, 6/24/1996, “The case for Mars,”**

Mars Direct says what it means. The plan discards unnecessary, expensive, and time-consuming detours: no need for assembly of spaceships in low Earth orbit; no need to refuel in space; no need for spaceships hangars at an enlarged Space Station, and no requirement for dawn-out development of lunar bases as a prelude to Mars exploration. Avoiding these detours brings the first landing on Mars perhaps twenty years earlier than would otherwise happen, and avoids the ballooning administrative cost that tend to afflict extended government programs.

# Answer To: Health Risks in Space

**[\_\_\_\_]**

## [\_\_\_\_] Nuclear power creates artificial gravity- avoids adverse effects.

**Space.com, 5/21/2000, http://www.space.com/scienceastronomy/solarsystem/nuclearmars\_000521.html**

One of the great added strengths of the Bimodal Nuclear Thermal Rocket is that it can be used to generate not only thrust, but all the power that a crew needs during interplanetary travel. Once the crew-transfer vehicle escapes from Earth orbit and reaches speed on its trip to Mars, the engines are brought down to an idle. Their heat is routed through a generator to produce power for crew survival, high data-rate communications, and even a refrigerator to keep the liquid hydrogen fuel from boiling off into space. Because liquid hydrogen boils at minus 423 degrees Fahrenheit (minus 217 degrees Celsius), the loss of hydrogen propellant is a serious problem which forces most mission designers to carry a great deal of extra propellant to make up for the loss. With nuclear reactors, though, there is plenty of energy to run a refrigeration system to keep the hydrogen cold. This greatly reduces the total mass of the vehicle. Nuclear reactors even provide enough power to create artificial gravity, a feature that should protect the astronaut crew from the physiological ravages of living in low-gravity conditions for extended periods.

**[\_\_\_\_]**

**[\_\_\_\_[ Radiation doesn’t pose significant risks to Mars cosmonauts, shelter sufficient.**

**Robert Zubrin, Aerospace engineer and founder of the Mars Society, Journal of Cosmology, October-November 2010, Vol 12, 3549-3557. “Human Mars Exploration: The Time Is Now”** [**http://journalofcosmology.com/Mars111.html**](http://journalofcosmology.com/Mars111.html)

It is alleged by some that the radiation doses involved in a Mars mission present insuperable risks, or are not well understood. This is untrue. Solar flare radiation, consisting of protons with energies of about 1 MeV, can be shielded by 12 cm of water or provisions, and there will be enough of such materials on board the ship to build an adequate pantry storm shelter for use in such an event. The residual cosmic ray dose, about 50 Rem for the 2.5 year mission, represents a statistical cancer risk of about 1%, roughly the same as that which would be induced by an average smoking habit over the same period.

# Answers To: Colonization Technologically Impossible

**[\_\_\_\_]**

**[\_\_\_\_] Leading experts in the field conclude that funding a human mission to Mars can establish a human colony using current technology.**

**Jeremy A. Kaplan, Executive Editor of PC Magazine, 12/30/2010 “NASA Scientist Publishes 'Colonizing the Red Planet,' a How-To Guide”, http://www.pcmag.com/author-bio/jeremy-a.-kaplan**

A manned mission to Mars would be the greatest adventure in the history of the human race**.** And one man knows how to make it a reality. In fact, he just wrote the book on it -- literally. Joel Levine, senior research scientist with NASA's Langley Research Center and co-chair of NASA's Human Exploration of Mars Science Analysis Group, just published "The Human Mission to Mars: Colonizing the Red Planet." The book reads like a who's who of Mars mission science, featuring senators, astronauts, astrophysicists, geologists and moreon getting to Mars, studying its atmosphere and climate, the psychological and medical effects on the crew and other details. There's even a section detailing the science of sex on Mars, should NASA attempt to create a permanent colony there. "For the last three years, I've been co-chairing a panel of about 30 U.S. and Canadian scientists, coming up with a blueprint, purely from a scientific perspective, of humanity's role on Mars," Levine told FoxNews.com. He was asked to put together a special edition of the Journal of Cosmology exploring the topic, which was just published as the new book. "The United States of America is the only country that can do this successfully right now," he said. And to remain the technological leader of the world, he argued, we need to do this. And it's quite possible**,** the book notes; after all, a trip to Mars isn't even a lengthy one.

# Answers To: Colonization Technologically Impossible

**[\_\_\_\_]**

**[\_\_\_\_] We can reach mars quickly with current technology.**

**Robert Zubrin, Aerospace engineer and founder of the Mars Society, 5/14/2011, “How We Can Fly to Mars in This Decade—And on the Cheap”, Wall Street Journal**

Nothing in this plan is beyond our current technology, and the costs would not be excessive. Falcon-9 Heavy launches are priced at about $100 million each, and Dragons are cheaper. With this approach, we could send expeditions to Mars at half the cost to launch a Space Shuttle flight. There is no question that this plan involves considerable risk, and a variety of missions, technology developments and testing programs in advance might reduce that risk. But if we try to do even a significant fraction before committing to the mission, we will never get to Mars. Is it responsible to forgo any expenditure that might reduce the risk to the crew? I believe so. The purpose of the space program is to explore space, and its expenditures come at the cost of other national priorities. If we want to reduce risk to human life, there are vastly more effective ways of doing so than by spending $10 billion per year for the next two or three decades on a human spaceflight program mired in low Earth orbit. We could spend the money on childhood vaccinations, fire escape inspections, highway repairs, better body armor for the troops—take your pick. For NASA managers to demand that the mission be delayed for decades while hundreds of billions are spent to marginally reduce the risk to a handful of volunteers, when the same funds spent on other priorities could save the lives of tens of thousands, is narcissistic in the extreme. The Falcon 9 Heavy is scheduled for its first flight in 2013. All of the other hardware elements in this plan could be made ready for flight within the next few years. NASA's astronauts have gone nowhere new since 1972, but these four decades of wasteful stagnation need not continue. If President Obama were to act decisively and embrace this plan, we could have our first team of human explorers on the Red Planet by 2016.

# Answers To: Privatization DA / CP

**[\_\_\_\_]**

**[\_\_\_\_] Governments must pioneer on a mission to mars in order to allow the private sector to follow behind it.**

**Charles Q. Choi, journalist for Astrobiology Magazine, 2/10/2011, “Red Planet for Sale? How Corporate Sponsors Could Send Humans to Mars,” Space.com**

It could be argued that NASA and other government space agencies should spearhead a human mission to Mars instead of corporations because of cost and safety. Astronauts have never set foot on Mars, and like the Apollo missions that sent men to the moon, the mission to Mars would need teams of engineers and other scientists working together over many years, with cost concerns more about staying under a projected budget than earning big profits. Governments also pioneered space travel due to the risky and untested aspects of venturing into such territory. Only after pushing boundaries to make voyages into space safer, more routine and less expensive, could business go where they once feared to tread. "I think it likely most people would find it difficult to conceive there wouldn't be any government involvement in such a mission," said space-law expert Timothy Nelson at New York-based law firm Skadden. "The possession of a rocket alone would probably trip you up on the military regulations that govern the ownership of missile technology in the United States. Not to sound too cynical, but space rockets were built as a byproduct of the arms race." There is no ban on putting ads on the sides of spacecraft or for licensing TV broadcast rights on such missions in the existing law regarding outer space, Nelson added. "The question becomes, economically, whether you can generate enough license fee revenue to pay for what you're trying to do," he said.

# Article: Why Spaceflight Has Ended

**The Economist: *The End of the Space Age: Inner space is useful. Outer space is history*. June 20th, 2011.**

HOW big is the Earth? Any encyclopedia will give you an answer: its equatorial diameter is 12,756km, or, for those who prefer to think that way, 7,926 miles. Ah, but then there is the atmosphere. Should that count? Perhaps the planet’s true diameter is actually nearer 13,000km, including all its air. But even that may no longer be an adequate measure. For the Earth now reaches farther still. The vacuum surrounding it buzzes with artificial satellites, forming a sort of technosphere beyond the atmosphere. Most of these satellites circle only a few hundred kilometres above the planet’s solid surface. Many, though, form a ring like Saturn’s at a distance of 36,000km, the place at which an object takes 24 hours to orbit the Earth and thus hovers continuously over the same point of the planet.

Viewed this way, the Earth is quite a lot larger than the traditional textbook answer. And viewed this way, the Space Age has been a roaring success. Telecommunications, weather forecasting, agriculture, forestry and even the search for minerals have all been revolutionised. So has warfare. No power can any longer mobilise its armed forces in secret. The exact location of every building on the planet can be known. And satellite-based global-positioning systems will guide a smart bomb to that location on demand.

Yet none of this was the Space Age as envisaged by the enthusiastic “space cadets” who got the whole thing going. Though engineers like Wernher von Braun, who built the rockets for both Germany’s second-world-war V2 project and America’s cold-war Apollo project, sold their souls to the military establishment in order to pursue their dreams of space travel by the only means then available, most of them had their eyes on a higher prize. “First Men to a Geostationary Orbit” does not have quite the same ring as “First Men to the Moon”, a book von Braun wrote in 1958. The vision being sold in the 1950s and 1960s, when the early space rockets were flying, was of adventure and exploration. The facts of the American space project and its Soviet counterpart elided seamlessly into the fantasy of “Star Trek” and “2001: A Space Odyssey”. Other planets may or may not have been inhabited by aliens, but they, and even other stars, were there for the taking. That the taking would begin in the lifetimes of people then alive was widely assumed to be true.

No longer. It is quite conceivable that 36,000km will prove the limit of human ambition. It is equally conceivable that the fantasy-made-reality of human space flight will return to fantasy. It is likely that the Space Age is over.

**Bye-bye, sci-fi**

Today’s space cadets will, no doubt, oppose that claim vigorously. They will, in particular, point to the private ventures of people like Elon Musk in America and Sir Richard Branson in Britain, who hope to make human space flight commercially viable. Indeed, the enterprise of such people might do just that. But the market seems small and vulnerable. One part, space tourism, is a luxury service that is, in any case, unlikely to go beyond low-Earth orbit at best (the cost of getting even as far as the moon would reduce the number of potential clients to a handful). The other source of revenue is ferrying astronauts to the benighted International Space Station (ISS), surely the biggest waste of money, at $100 billion and counting, that has ever been built in the name of science.

The reason for that second objective is also the reason for thinking 2011 might, in the history books of t

the future, be seen as the year when the space cadets’ dream finally died. It marks the end of America’s space-shuttle programme, whose last mission is planned to launch on July 8th (see [article](http://www.economist.com/node/18895018), [article](http://www.economist.com/node/18895010)). The shuttle was supposed to be a reusable truck that would make the business of putting people into orbit quotidian. Instead, it has been nothing but trouble. Twice, it has killed its crew. If it had been seen as the experimental vehicle it actually is, that would not have been a particular cause for concern; test pilots are killed all the time. But the pretence was maintained that the shuttle was a workaday craft. The technical term used by NASA, “Space Transportation System”, says it all.

But the shuttle is now over. The ISS is due to be de-orbited, in the inelegant jargon of the field, in 2020. Once that happens, the game will be up. There is no appetite to return to the moon, let alone push on to Mars, El Dorado of space exploration. The technology could be there, but the passion has gone—at least in the traditional spacefaring powers, America and Russia.

The space cadets’ other hope, China, might pick up the baton. Certainly it claims it wishes, like President John Kennedy 50 years ago, to send people to the surface of the moon and return them safely to Earth. But the date for doing so seems elastic. There is none of Kennedy’s “by the end of the decade” bravura about the announcements from Beijing. Moreover, even if China succeeds in matching America’s distant triumph, it still faces the question, “what next?” The chances are that the Chinese government, like Richard Nixon’s in 1972, will say “job done” and pull the plug on the whole shebang.

**No bucks, no Buck Rogers**

With luck, robotic exploration of the solar system will continue. But even there, the risk is of diminishing returns. Every planet has now been visited, and every planet with a solid surface bar Mercury has been landed on. Asteroids, moons and comets have all been added to the stamp album. Unless life turns up on Mars, or somewhere even more unexpected, public interest in the whole thing is likely to wane. And it is the public that pays for it all.

The future, then, looks bounded by that new outer limit of planet Earth, the geostationary orbit. Within it, the buzz of activity will continue to grow and fill the vacuum. This part of space will be tamed by humanity, as the species has tamed so many wildernesses in the past. Outside it, though, the vacuum will remain empty. There may be occasional forays, just as men sometimes leave their huddled research bases in Antarctica to scuttle briefly across the ice cap before returning, for warmth, food and company, to base. But humanity’s dreams of a future beyond that final frontier have, largely, faded.

# Article: Why We Must Return to Space

**J. Richard Gott: *A Goal For the Human Spaceflight Program*. June 17th, 2009.**

The goal of the human spaceflight program should be to increase the survival prospects of the human race by colonizing space. Self-sustaining colonies in space, which could later plant still other colonies, would provide us with a life insurance policy against any catastrophes which might occur on Earth.

Fossils of extinct species offer ample testimony that such catastrophes do occur. Our species is 200,000 years old; the Neanderthals went extinct after 300,000 years. Of our genus (*Homo*) and the entire *Hominidae* family, we are the only species left. Most species leave no descendant species. Improving our survival prospects is something we should be willing to spend large sums of money on - governments make large expenditures on defense for the survival of their citizens.

The Greeks put all their books in the great Alexandrian library. I'm sure they guarded it very well. But eventually it burnt down taking all the books with it. It's fortunate that some copies of Sophocles' plays were stored elsewhere, for these are the only ones that we have now (7 out of 120 plays). We should be planting colonies off the Earth now as a life insurance policy against whatever unexpected catastrophes may await us on the Earth. Of course, we should still be doing everything possible to protect our environment and safeguard our prospects on the Earth. But chaos theory tells us that we may well be unable to predict the specific cause of our demise as a species. By definition, whatever causes us to go extinct will be something the likes of which we have not experienced so far. We simply may not be smart enough to know how best to spend our money on Earth to insure the greatest chance of survival here. Spending money planting colonies in space simply gives us more chances--like storing some of Sophocles' plays away from the Alexandrian library.

If we made colonization our goal, we might formulate a strategy designed to increase the likelihood of achieving it. Having such a goal makes us ask the right questions. Where is the easiest place in space to plant a colony - the place to start? Overall, Mars offers the most habitable location for *Homo sapiens* in the solar system outside of Earth, as Bruce Murray has noted. Mars has water, reasonable gravity (1/3rd that of the Earth), an atmosphere, and all the chemicals necessary for life. Living underground (like some of our cave dwelling ancestors) would lower radiation risks to acceptable levels. The Moon has no atmosphere, less protection against solar flares and galactic cosmic rays, harsher temperature ranges, lower gravity (1/6th that of the Earth), and no appreciable water. Asteroids are similar. The icy moons of Jupiter and Saturn offer water but are much colder and more distant. Mercury and Venus are too hot, and Jupiter, Saturn, Uranus, and Neptune are inhospitable gas giants. Free floating colonies in space, as proposed by Gerard O’Neill, would need material brought up from planetary or asteroid surfaces. If we want to plant a first permanent colony in space, Mars would seem the logical place to start.

If colonization is our goal, rather than bringing astronauts back from Mars, we should leave them there to multiply using indigenous materials. Once we have astronauts safely sitting on the surface of Mars, it makes more sense to send them additional supplies rather than to trade them for an equal number of astronauts sitting on Earth. After all, trips from one planet to another pose an additional risk, and it is on Mars that the astronauts help our survival prospects. We just need a few astronauts who would rather be founders of a Martian civilization than return to ticker tape parades on Earth. We can find such intrepid men and women.

**The real space race is whether we colonize off the planet before the funds for the human**

**spaceflight program end.** Now that the Cold War is over, the driving force that got us to the Moon has ended and the human spaceflight program is in danger of extinction. Expensive technological projects are often abandoned after awhile. The Egyptians built bigger and bigger pyramids for about 50 years and then built smaller and less well made ones before finally quitting entirely. Admiral Cheng Ho sailed a great Chinese fleet all the way to Africa and brought back giraffes to the Chinese court. But then the Chinese government decided to cancel the program. Once lost, opportunities may not come again. The human spaceflight program is only 48 years old. The Copernican Principle tells us that our location is not likely to be special. If our location within the history of human space travel is not special, there is a 50% chance that we are in the last half now and that its future duration is less than 48 years (cf. Gott, 2007). If the human spaceflight program has a much longer future duration than this, then we would be lucky to be living in the first tiny bit of it. Bayesian statistics warn us against accepting hypotheses that imply our observations are lucky. It would be prudent to take the above Copernican estimate seriously since it assumes that we are not particularly lucky or unlucky in our location in time, and a wise policy should aim to protect us even against some bad luck. With such a short past track record of funding, it would be a mistake to count on much longer and better funding in the future. Instead, assuming funding levels in the next 48 years like those we have had in the past 48 years, we should ask ourselves what project we could undertake in the next 48 years that would be of most benefit to our species. Planting a self- supporting colony on Mars would make us a two-planet species. It would change the course of world history. You couldn’t even call it world history any more. It might as much as double our long term survival prospects by giving our species two chances instead of one. Colonies are a great bargain. You just send a few astronauts and they multiply there using indigenous materials. It’s the Martian colonists that would do all the work. They would increase their numbers by having children and grandchildren on Mars while increasing their habitable facilities and biosphere using indigenous materials--with no further help needed from us. If couples had four children, on average, the colony, on its own, might multiply its initial population by a factor of as much as a million in 600 years.

And colonies can plant other colonies. The first words spoken on the Moon were in English, not because England sent astronauts to the Moon but because it planted a colony in North America that did. People on Mars might one day plant colonies elsewhere themselves. If people on Earth were extinguished by some catastrophe, Martian colonists might at some later date send an expedition to repopulate it.

Since the funding window for colonization may be short, we should concentrate on establishing the first self-supporting colony in space as soon as possible. That it be self-supporting is important since this would allow it to continue even if funding for space launches from Earth were discontinued.

If establishing a self-supporting colony is our goal, we could skip going back to the Moon, and concentrate on colonizing Mars. According to calculations by Gerard O’Neill, about 50 tons per person are required for a self-supporting colony in space (including biosphere). One of the three colonization waves that populated North and South America with Native Americans began when perhaps a dozen or so people traveled across a land bridge from Asia about 12,000 years ago. The Aboriginal population of Australia may have started with as few as 30 people who voyaged there by raft some 60,000 years ago. (Genetic diversity of our Mars colony could be increased by bringing frozen sperm and egg cells along.) If we just put up into low Earth orbit as much tonnage in the next 48 years as we have in the last 48 years (in Saturn V and Shuttle launches alone) we could deliver 2,304 tons to the surface of Mars. We would need a heavy lift vehicle like the *Ares V*. Four new *Ares V* rockets could be assembled at a time in the vertical assembly building at Cape Canaveral and be ready for launch in sequence during the launch window which opens up once every 26 months. Even if it took 11 years to develop the *Ares V* rocket, we could still deliver 1,808 tons to the surface of Mars in the next 48 years. With no greater commitment in the next 48 years than we have made in the last 48 years we could plant a colony on Mars. The goal

would then be to make the colony self-supporting as soon as possible.

If we fail to establish a self-supporting colony on Mars while we have the chance, it would be a tragedy. The dimensions of that tragedy might not become apparent to us until such time, perhaps many thousands of years from now, when we would find ourselves trapped on Earth with no viable space program, a low population, and our extinction as a species looming near. Moreover, we might end up spending as much money in real terms on the human spaceflight program in the future as we have in the past and *still* never get to Mars. If that happens, it would be a double tragedy. But if we just continue as we are now, without a clear or urgent purpose, this may well be our future.

We should worry that we will not succeed at colonizing off the Earth. Why? Because we are having this conversation on Earth right now. If the human species stays limited to Earth, you and I are entirely typical. You should worry that we might fail to colonize.

The United States has a particular stake in this. It put Neil Armstrong on the Moon. But the importance of that event is yet to be determined. As Kenneth Gatland said in *The Illustrated Encyclopedia of Space Technology*, in 1989, "It is still too early to assess the full significance of the Apollo Moon landings. Did they represent a blind alley of technological advance never to be repeated, or were they the beginning of a bold new era in which mankind eventually will colonize the solar system." If we stay on Earth, then Neil Armstrong’s flight is just another event in the history of exploration, like Edmund Hillary’s ascent of Mount Everest or Roald Amundsen’s visit to the South Pole. But if Neil Armstrong’s flight is just the first step in our becoming a multiplanet species, then he is an important historical figure like Christopher Columbus - someone who was part of changing the course of human history. Indeed, as Representative Robert Torricelli of New Jersey, speaking in favor of the continuation of the manned spaceflight program, once said, if we quit, then “Neil Armstrong’s giant leap for mankind will turn out to have been a small step after all.”

I do not say establishing a colony on Mars would be easy. Small colonies often fail. In North America, the Jamestown colony failed before the Plymouth colony eventually succeeded. Persistence is valuable. Colonizing Mars is a dangerous enterprise for the astronauts who go, but it is what we should be doing. Astronauts are risking their lives every time they take off; we should give them something to do that is worth risking their lives for.

Because the human spaceflight program is not very old we should be colonizing off the Earth as soon as possible, while we still can. In 1961 President Kennedy said: “We choose to go to the Moon in this decade and do the other things not because they are easy but because they are hard” Many people remember that line. But then he added another less well remembered coda: “Because that challenge is one we are willing to accept and unwilling to postpone.” Space colonization is a challenge we should be willing to accept and unwilling to postpone.

With a great recession upon us it is easy to imagine human settlement of Mars being postponed or taken off the table entirely. On the other hand, President Obama now has an opportunity to set forth a new and inspirational objective for the human spaceflight program, one that could change the course of human history.

# Article: Why a Mars Colony Would Be Possible

Drik Schulze-Makuch: ***To Boldly Go: A One-Way Human Mission to Mars***. **October 2010**

The exploration of Mars has been a priority for the space programs of several nations for decades, yet the prospect of a manned expedition continually recedes in the face of daunting and well-recognized challenges. The long travel time to Mars in zero gravity and high radiation conditions would impose a serious health burden on the astronauts. The costs of developing the launch vehicle and assembling the large amount of equipment needed for the astronauts to survive the journey and their long sojourn on the Martian surface, together with a need to send all the fuel and supplies for a return journey make a manned Mars expedition at least an order of magnitude more expensive than the Apollo program.

In our view, however, many of these human and financial problems would be ameliorated by a one-way mission. It is important to realize that this is not a "suicide mission." The astronauts would go to Mars with the intention of staying for the rest of their lives, as trailblazers of a permanent human Mars colony. They would be resupplied periodically from Earth, and eventually develop some "home grown" industry such as food production and mineral/chemical processing (Zubrin and Baker 1992; Zubrin and Wagner 1997). Their role would be to establish a "base camp" to which more colonists would eventually be sent, and to carry out important scientific and technological projects meanwhile. Of course, the life expectancy of the astronauts would be substantially reduced, but that would also be the case for a return mission. The riskiest part of space exploration is take-off and landing, followed by the exposure to space conditions. Both risk factors would be halved in a one-way mission, and traded for the rigors of life in a cramped and hostile environment away from sophisticated medical equipment. On the financial front, abandoning the need to send the fuel and supplies for the return journey would cut costs dramatically, arguably by about 80 percent. Furthermore, once a Mars base has been established, it would be politically much easier to find the funding for sustaining it over the long term than to mount a hugely expensive return mission.

There are several reasons that motivate the establishment of a permanent Mars colony. We are a vulnerable species living in a part of the galaxy where cosmic events such as major asteroid and comet impacts and supernova explosions pose a significant threat to life on Earth, especially to human life. There are also more immediate threats to our culture, if not our survival as a species. These include global pandemics, nuclear or biological warfare, runaway global warming, sudden ecological collapse and supervolcanoes (Rees 2004). Thus, the colonization of other worlds is a must if the human species is to survive for the long term. The first potential colonization targets would be asteroids, the Moon and Mars. The Moon is the closest object and does provide some shelter (e.g., lava tube caves), but in all other respects falls short compared to the variety of resources available on Mars. The latter is true for asteroids as well. Mars is by far the most promising for sustained colonization and development, because it is similar in many respects to Earth and, crucially, possesses a moderate surface gravity, an atmosphere, abundant water and carbon dioxide, together with a range of essential minerals. Mars is our second closest planetary neighbor (after Venus) and a trip to Mars at the most favorable launch option takes about six months with current chemical rocket technology.

In addition to offering humanity a "lifeboat" in the event of a mega-catastrophe, a Mars colony is attractive for other reasons. Astrobiologists agree that there is a fair probability that Mars hosts, or once hosted, microbial life, perhaps deep beneath the surface (Lederberg and Sagan 1962; Levin 2010; Levin and Straat 1977, 1981; McKay and Stoker 1989; McKay et al. 1996; Baker et al. 2005; Schulze-Makuch

et al. 2005, 2008, Darling and Schulze-Makuch 2010; Wierzchos et al. 2010; Mahaney and Dohm 2010). A scientific facility on Mars might therefore be a unique opportunity to study an alien life form and a second evolutionary record, and to develop novel biotechnology therefrom. At the very least, an intensive study of ancient and modern Mars will cast important light on the origin of life on Earth. Mars also conceals a wealth of geological and astronomical data that is almost impossible to access from Earth using robotic probes. A permanent human presence on Mars would open the way to comparative planetology on a scale unimagined by any former generation. In the fullness of time, a Mars base would offer a springboard for human/robotic exploration of the outer solar system and the asteroid belt. Finally, establishing a permanent multicultural and multinational human presence on another world would have major beneficial political and social implications for Earth, and serve as a strong unifying and uplifting theme for all humanity.

**2. The Concept of a One-Way Mission to Mars**

A human mission to Mars is undoubtedly technologically feasible, but unlikely to lift off in the very near future, because of the enormous financial and political commitments associated with it. As remarked, however, much of the costs and payload of the mission are associated with bringing the astronauts back to Earth. Furthermore, the returning astronauts would have to go through an intense rehabilitation program after being exposed for at least one year to zero gravity and an extended period to reduced gravity on the surface of Mars. Eliminating the need for returning early colonists would cut the costs several fold and at the same time ensure a continuous commitment to the exploration of Mars and space in general.

The first colonists to Mars wouldn’t go in "cold." Robotic probes sent on ahead would establish necessities such as an energy source (such as a small nuclear reactor augmented by solar panels), enough food for two years, the basics for creating home-grown agriculture, one or more rover vehicles and a tool-kit for carrying out essential engineering and maintenance work. In addition, the scientific equipment needed for the colonists to do important research work should be part of the preceding unmanned mission. All this equipment could easily be put into place using current technology before the astronauts set out. The first human contingent would rely heavily on resources that can be produced from Mars such as water, nutrients, and shelter (such as in form of lava tube caves). They also would be continuously resupplied from Earth with necessities that could not be produced from the resources available on Mars. This semi-autonomous phase might last for decades, perhaps even centuries before the size and sophistication of the Mars colony enabled it to be self-sustaining.

The first human contingent would consist of a crew of four, ideally (and if the budget permits) distributed between two two-man space craft to allow for some mission redundancy such as in the Viking mission or for the Mars Exploration Rovers. Also, if any technical malfunction occurs on one space craft, the other craft could come to the rescue. Further, any critical part of equipment after landing would be available in duplicate in case of an emergency.

A one-way human mission to Mars would not be a one-time commitment as was the case with the Apollo program. More than 40 years after the last Apollo mission, no human has set foot on a planetary body beyond Earth. Such a hiatus cannot be afforded if humanity is to commit to a grander vision of space exploration (Davies and Schulze-Makuch 2008; Schulze-Makuch and Irwin 2008). No base on the Moon is needed to launch a one-way human mission to Mars. Given the broad variety of resources

available on Mars, the long-term survival of the first colonists is much more feasible than it would be on the Moon.

While the pragmatic advantages of this approach are clear, we anticipate that some ethical considerations may be raised against it. Some in the space agencies or public might feel that the astronauts are being abandoned on Mars, or sacrificed for the sake of the project. However, the situation these first Martian settlers are in, who would of course be volunteers, would really be little different from the first white settlers of the North American continent, who left Europe with little expectation of return. Explorers such as Columbus, Frobisher, Scott and Amundsen, while not embarking on their voyages with the intention of staying at their destination, nevertheless took huge personal risks to explore new lands, in the knowledge that there was a significant likelihood that they would perish in the attempt. A volunteer signing up for a one-way mission to Mars would do so in the full understanding that he or she would not return to Earth. Nevertheless, informal surveys conducted after lectures and conference presentations on our proposal, have repeatedly shown that many people are willing to volunteer for a one-way mission, both for reasons of scientific curiosity and in a spirit of adventure and human destiny. Others may raise objections based on planetary protection considerations, depending on whether indigenous life exists on Mars or not. However, any Martian biota is almost certainly restricted to microbes that would be adapted to the natural environment of that planet, and would therefore almost certainly not pose a safety concern for the colonists due to their presumably different biochemical make-up (e.g., Houtkooper and Schulze-Makuch 2007). Nevertheless, caution has to be urged since we do not know the biochemistry of the putative Martian biota at this time. Thus, it might be prudent to launch a life detection mission or even a sample return mission prior to a one-way human mission to Mars. On the other hand, if Martian organisms really do pose a hazard to human health, it may be preferable to limit the exposure to the crew of a one-way mission rather than place at risk the entire human population from a botched sample return mission (Rummel et al. 2002).

A much more likely problem is the reverse: that the human habitation would pose a threat to any indigenous Martian micro-organisms, even if all possible precautions would be employed to protect it. Sadly, the battle to protect putative Martian biota from terrestrial organisms has already been compromised by the fact that several unsterilized, or inadequately sterilized, spacecraft have already been sent to Mars. In addition, terrestrial impact ejecta may have conveyed viable Earth microbes to Mars repeatedly over geological time scales (Melosh and Tonks 1993; Davies 1996, 2008; Kirschvink and Weiss 2001). Nor is it clear that terrestrial microbes would be better adapted to life on Mars that they would spread uncontrollably in a way that would completely displace the indigenous organisms. Furthermore, the colonists would likely only affect a small portion of the planet and "nature parks" could be designated with special precautions enforced in respect to human interference. Again, such issues could be addressed by a prior life detection or sample return mission to inform us about any risks to Martian biota and the type of precautions that could be taken to protect it. And while we agree that all reasonable precautions should be taken, we do not think their presence should be an over-riding reason to forever resist sending humans to Mars. Indeed, our presence there would allow us to study indigenous life in detail, further our knowledge about essential characteristics of life, and design methods to actually enhance the prospects of Martian biota (McKay 1982; McKay and Marinova 2001).

**3. First Steps in the Human Colonization of Mars**

The success of the project we are proposing would hinge on the quality of preparation. We envisage

three stages: careful site selection using existing and future probes to gather relevant data, the establishment of an unmanned base with minimum resources necessary for human habitation, and the dispatch of the first astronauts. We shall not dwell here on the astronautics of the mission, as these have been thoroughly discussed elsewhere (e.g., Zubrin and Wagner 1997).

**3.1 Site selection** The final determination of a suitable settlement location would require advance scouting missions that could use geophysical exploration tools like ground penetrating radar to locate subsurface voids from aerial or buoyant platforms. Numerous igneous flow features, including lava tubes (large cave structures formed by rivulets of molten lava) have already been identified on Mars (Boston 2003; Figure 1). Lava tube caves on Mars appear to be much larger than on Earth probably due to the lower gravity on Mars (0.38g compared to 1g on Earth). They are natural caves, and some of them are located at a low elevation in close proximity to the former northern ocean, which means that they could harbor ice deposits inside similar to many ice-containing caves on Earth. Ice caves would go a long way to solving the needs of a settlement for water and oxygen. Mars has a thin but substantial atmosphere mostly consisting of carbon dioxide (95%), but it is approximately 1/100th the density of Earth’s atmosphere, has no ozone shield and no magnetospheric shielding; thus some natural or artificial shielding to protect from ionizing and ultraviolet radiation will be required. Ice caves would also provide shelter from this radiation. After a candidate cave is located, its interior would need to be robotically explored before selecting it for the colony’s first home.

**3.2. Establishing an unmanned base** After a suitable location is identified, preferentially associated with some natural shelter (e.g., lava tube caves as discussed above) and other nearby resources (water, minerals, nutrients), a base should be established using unmanned probes and robots, including small rover vehicles, to prepare for the arrival of the first human contingent. The base would also be equipped to allow for a more thorough investigation of specific localities of interest. The base would not have to be very sophisticated, but could simply consist of a communication relay and a power generator, perhaps together with a remotely operated telescope (Schulze-Makuch and Irwin 2008). The lander craft should be designed to double as a permanent station, in modular form, to allow later expansion following further one-way missions.

**3.3. The first colonists** Crew selection for the initial manned mission would have to take into account several factors. Initially, colonists may be preferred who are beyond their reproductive age, because their life expectancy is likely to be 20 years or less, and secondly, the first settlers will endure some radiation damage to their reproductive organs, both during the trip to Mars and on the Martian surface. One feasible approach for the initial one-way mission would be to send two space probes with two astronauts each. Ideally, one should be a trained physician, and all should have advanced scientific and technical know-how, and show a strong commitment to scientific research and exploration.

Once the humans arrived at the base, their task would be not unlike that of the early settlers in North America – only the underlying technology and utilized tools would be much more sophisticated. Plants could be grown outside of the caves in an enriched soil underneath a robotically constructed dome, thus providing the inhabitants of the outpost with food and an additional supply of oxygen. Microbes could be used to break down and recycle wastes, thus the human base would constitute its own independent biosphere with some additional resources provided by the Martian environment. Certainly, the first colonists would be exposed to multiple challenges, from physical rigor to psychological strains due to isolation and uncertainties. However, the astronauts will have undergone psychological profiling and

training before embarking on the mission, and would remain in constant contact with Earth via normal channels such as email, radio and video links. In the era of modern communications they would in fact feel more connected to home than the early Antarctic explorers (who had no systematic psychological training either). Over time, the human contingent on Mars would slowly increase with follow-up missions. Several cave-centered biospheres would be created, each being in constant communication with other cave-centered biospheres to share experiences on which approaches are working best. At some later time, probably several decades after the first human mission, the colony’s population might have expanded to about 150 individuals, which would constitute a viable gene pool to allow the possibility of a successful long-term reproduction program. New arrivees and possibly the use of genetic engineering would further enhance genetic variety and contribute to the health and longevity of the colonists.

While it would undoubtedly take a tremendous effort over many years to establish multiple settlements on Mars, we see no fundamental reason why this plan is not technologically implementable. Some of the heavy lifting hardware has been developed or is in an advanced stage from the recently cancelled Moon program. Work on the permanent unmanned base could be initiated right away, while the human mission and colonization details could be worked out later. We estimate that a reasonable time line for establishing a permanent unmanned base with robots would be 20 years, with the first human contingent arriving shortly thereafter. The main impediment is the narrow vision and the culture of political caution that now pervades the space programs of most nations.

**4. Conclusions**

Self-preservation considerations in a dangerous universe and the human exploratory spirit compel us to explore space and colonize other planets. Mars is the planet in our solar system, which is reasonably close and provides an abundance of resources and shelter for such a colonization effort. Nevertheless, the first step for the colonization of Mars will be the most difficult. Here, we propose that the most pragmatic approach to achieve this goal is by establishing a small permanent robotic base followed by a series of one-way missions to Mars. The advantages of a one-way human mission are many-fold including a dramatic reduction of costs, the long-term commitment by the space agency, the public, and the crew, and that no rehabilitation program is needed for crew members when remaining on the low-gravity surface of Mars. The challenges are still monumental, though, foremost because political and financial long-term commitments have to be secured.

**Mars Colonization Negative**

# Mars Colonization Negative

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# Glossary

**Accept the inevitability of Earth’s destruction** – To recognize that the Earth will be destroyed and that there is no way to prevent it

**Comparative planetology –** the study of the differences and similarities between planets, including how they evolved

**Galactic ray –** rays that originate in the galaxy, consisting of positively charged protons. They are a form of radiation and can cause harm.

**Wake –** the aftermath or consequences of something

**Prophesy –** messages communicated by a divine source. God communicated prophesies to Moses, for example.

**Prudent –** the timely and responsible course of action

**Species** - a class of living thing. Humans are a species, just like ants or oak trees

**Sustainable –** able to be maintained at a certain rate or level

**Colonialism –** when a country makes it a goal to gain full control over a new territory by sending settlers there.

**Hostilities -** fighting or acts of warfare

**Full spectrum dominance –** attempting to be superior in every form of warfare, whether it is air combat, naval combat, etc.

**Overpopulation –** When an ecosystem cannot support the population that is living in it. Some people think that the Earth is overpopulated with humans, that it cannot continue to support the 6 billion that currently live there.

**Assumption –** an implicit statement that is accepted as true without proof

**Unremittingly –** unrelentingly, uninterrupted and constantly continuing

**Trans-oceanic –** across an ocean

**Neolithic** – A period of ancient human history from approximately 9500 to 6500 BC.

**Quasi religious –** bordering on a religion

**Catastrophe –** A disastrous event causing much disruption or harm to many

**Militarization –** the act of assembling and readying resources for war

**Physiological –** the affects of something on the body

**Psychosocial –** the relationship between aspects of society and their affects on individual behavior

**Interpersonal –** communication between people

**Stressor –** something that causes stress

**Infeasibility –** something that is impossible or not feasible.

# Answers To: Inherency

**[\_\_\_\_]**

**[\_\_\_\_]**

**[\_\_\_\_] Private companies are filling in for the government and will colonize Mars in the status quo.**

**Discovery News, 4/23/2011, “SPACEX AIMS TO PUT MAN ON MARS IN 10-20 YEARS,” http://news.discovery.com/space/spacex-elon-musk-mars-astronauts-20-years-110423.html**

Private US company SpaceX hopes to put an astronaut on Mars within 10 to 20 years, the head of the firm said."We'll probably put a first man in space in about three years," Elon Musk told the Wall Street Journal Saturday. "We're going all the way to Mars, I think... best case 10 years, worst case 15 to 20 years." SpaceX is one of the two leading private space companies in the United States and has won $75 million from the US space agency NASA to help its pursuit of developing a spacecraft to replace the space shuttle.The California-based company last year completed its first successful test of an unmanned space capsule into orbit and back. "Our goal is to facilitate the transfer of people and cargo to other planets, and then it will be up to people if they want to go," said Musk, who also runs the Tesla company which develops electric cars. The US space shuttle program is winding down later this year with final flights of Endeavour set for next week and Atlantis in June, ending an era of American spaceflight that began with the first space shuttle mission in 1981. When the shuttle program ends, the United States hopes private industry will be able to fill the gap by creating the next generation of spacecraft to transport astronauts into space.

# Answers To: Colonization Advantage

**[\_\_\_\_]**

**[\_\_\_\_]**

**[\_\_\_\_] Focusing on going to space means we ignore the problems on Earth. We need to keep focusing on our own planet until technology becomes advanced enough for us to leave.**

Lynda Williams, Professor of Physics at San Francisco State University, 2010, “Irrational Dreams of Space Colonization,” *The Peace Review*; Spring 2010; [**http://www.scientainment.com/lwilliams\_peacereview.pdf**](http://www.scientainment.com/lwilliams_peacereview.pdf)

We have much to determine on planet Earth before we launch willy-nilly into another race into space and a potential environmental disaster and arms race in outer space. If we direct our intellectual and technological resources toward space exploration without consideration of the environmental and political consequences, what is left behind in the wake? The hype surrounding space exploration leaves a dangerous vacuum in the collective consciousness of solving the problems on Earth. If we accept the inevitability of Earth’s destruction and its biosphere, we are left looking toward the heavens for our solutions and resolution. Young scientists, rather than working on serious environmental challenges on Earth, dream of Moon or Martian bases to save humanity, fueling the prophesy of our planetary destruction, rather than working on solutions to solve the problems on Earth. Every space faring entity, be they governmental or corporate, will face the same challenges. Star Trek emboldened us all to dream of space, the final frontier. The reality is that our planet Earth is a perfect spaceship. We travel around our star the sun once every year, and the sun pull us with her gravitational force around the galaxy once every 250 million years through star systems, star clusters and all the possible exosolar planets that may host life or be habitable for us to colonize. The sun will be around for billions of years and we have ample time to explore the stars. It would be wise and prudent for us as a species to focus our intellectual and technological knowledge now into preserving our spaceship for the long voyage through the stars, so that once we have figured out how to make life on Earth work in an environmentally and politically sustainable way, we can then venture off the planet into the final frontier of our dreams.

# Answers To: Colonization Advantage

**[\_\_\_\_]**

**[\_\_\_\_] Extinction claims are way overblown.**

**Gregg Easterbrook, senior editor of the New Republic, 07/2003, “We’re All Gonna Die!”**

If we're talking about doomsday - the end of human civilization - many scenarios simply don't measure up. A single nuclear bomb ignited by terrorists, for example, would be awful beyond words, but life would go on. People and machines might converge in ways that you and I would find ghastly, but from the standpoint of the future, they would probably represent an adaptation. Environmental collapse might make parts of the globe unpleasant, but considering that the biosphere has survived ice ages, it wouldn't be the final curtain. Depression, which has become 10 times more prevalent in Western nations in the postwar era, might grow so widespread that vast numbers of people would refuse to get out of bed, a possibility that Petranek suggested in a doomsday talk at the Technology Entertainment Design conference in 2002. But Marcel Proust, as miserable as he was, wrote Remembrance of Things Past while lying in bed. Of course, some worries are truly worrisome. Nuclear war might extinguish humanity, or at least bring an end to industrial civilization. The fact that tensions among the US, Russia, and China are low right now is no guarantee they'll remain so. Beyond the superpowers, India and Pakistan have demonstrated nuclear capability; North Korea either has or soon will have it; Japan may go nuclear if North Korea does; Iran and other countries could join the club before long. Radiation-spewing bombs raining from the sky would, no doubt, be cataclysmic. If you're in the mood to keep yourself up at night, nuclear war remains a good subject to ponder. But reversal of the planet's magnetic field? At a time of global unease, worst-case scenarios have a certain appeal, not unlike reality TV. And it's only natural to focus on danger; if nature hadn't programmed human beings to be wary, the species might not have gotten this far. But a little perspective is in order. Let's review the various doomsday theories, from least threatening to most. If the end is inevitable, at least there won't be any surprises.

# Answers To: Colonization Advantage

**[\_\_\_\_]**

**[\_\_\_\_] History proves that attempts at colonization lead to wars and other conflicts over new territory. Colonization of space would not be any different.**

Peter Dickens, Professor of Sociology at the University of Brighton, UK, 2010, The Monthly Review Volume 62, Issue 6  “The Humanization of the Cosmos—To What End?” <http://monthlyreview.org/2010/11/01/the-humanization-of-the-cosmos-to-what-end> JS).

But even manufactured risks may be minimal in scope, compared with another risk stemming from cosmic colonization. This is outright war. Armed conflict has long been a common feature of past colonialisms; between colonizing nations as well as between the colonizers and aboriginal peoples. Satellites are already a means by which territories and investments on Earth are monitored and protected by governments operating on behalf of their economic interests. But the prospect of galactic colonialisms raises the distinct possibility of hostilities in space. Galactic wars may therefore be the product of galactic colonialism. Such a scenario was prefigured by the *Star Trek* science fiction television series in which the main role of “The Federation” is the protection of capitalist mining colonies. It is a discomforting fact that both China and the United States are now actively developing their own versions of “full spectrum dominance.” China demonstrated its capabilities in January 2007 by shooting down one of its own defunct satellites. In February 2008, the U.S. Navy demonstrated a similar capability, destroying a faulty U.S. satellite with a sea-based missile. An arms race in outer space has already started.

**[\_\_\_\_]**

**[\_\_\_\_] Humans are safe from extinction precisely because there are so many of them. The species that go extinct are the ones that have sparse and fluctuating populations.**

**Darren Curnoe, Senior Lecturer at the University of New South Whales 6/7/2011, “Climate Change, doomsday and the Inevitable Extinction of Humankind”**

Seen in its broadest context, the history of life on Earth soberly demonstrates that the vast majority of organisms that ever lived, perhaps 99% of them, no longer do. It also shows that mammal species normally last 1-2 million years before extinction inevitably bumps them off. Yet, unlike most mammals, including our dozens of extinct hominin cousins, we have escaped the vulnerabilities of a small and massively fluctuating population. The simple, but profound act, of growing our own food delivered us the food security that ensured most of our children survived and our population grew. In effect, farming gave our species level assurance that the biological isn’t always inevitable. The odds have shifted to such a degree that we may now be, with or without climate change, extinction-proof.

# Answers To: Colonization Advantage

**[\_\_\_\_]**

**[\_\_\_\_] Development of space technology will cause wars to be fought in space.**

Kevin Pollpeter, **China Project Manager for Defense Group Incorporated’s Center for Intelligence Research and Analysis, 6/29/2006, “THE CHINESE VISION OF SPACE MILITARY OPERATIONS”, www.defensegroupinc.com/cira/pdf/doctrinebook\_ch9.pdfSimilar**

The development of space technology will inevitably lead to the militarization of space and space militarization will lead to confrontation in space. As the struggle over air and space control is becoming the new focal point of war, space will become the main battlefield of future wars. According to Chinese writings, recent high-technology local wars are evidence that whoever gains air and space control will seize the initiative. Consequently, air and space control will play an increasingly important role in modern war and dominating space will be the one and only principle of winning future wars. Therefore, air and space control will be the new focal point of struggle in future wars.

**[\_\_\_\_]**

**[\_\_\_\_] We have no obligation to save our species down the line – we should be focusing on our own problems right now.**

**Charles Stross, Journalist and Science Fiction Writer, 6/16/2007, 2007 “The High Frontier-Redux,” http://www.antipope.org/charlie/blog-static/2007/06/the-high-frontier-redux.html)**

I'm going to take it as read that the idea of space colonization isn't unfamiliar; domed cities on Mars, orbiting cylindrical space habitats a la [J. D. Bernal](http://en.wikipedia.org/wiki/J._D._Bernal) or [Gerard K. O'Neill](http://en.wikipedia.org/wiki/O%27Neill_cylinder), that sort of thing. Generation ships that take hundreds of years to ferry colonists out to other star systems where — as we are now discovering — there are profusions of planets to explore. And I don't want to spend much time talking about the unspoken ideological underpinnings of the urge to space colonization, other than to point out that they're there, that the case for space colonization isn't usually presented as an economic enterprise so much as a quasi-religious one. "We can't afford to keep all our eggs in one basket" isn't so much a justification as an appeal to sentimentality, for in the hypothetical case of a planet-trashing catastrophe, we (who currently inhabit the surface of the Earth) are dead anyway. The future extinction of the human species cannot affect you if you are already dead: strictly speaking, it should be of no personal concern.

# Answers To: Humans Will Cause Extinction

**[\_\_\_\_] Earth could easily survive a nuclear war.**

**J. R. Nyquist, staff writer in geopolitics and IR,, 5/20/1999, “Is Nuclear War Survivable?” http://www.wnd.com/index.php?pageId=6341**

I patiently reply to these correspondents that nuclear war would not be the end of the world. I then point to studies showing that "nuclear winter" has no scientific basis, that fallout from a nuclear war would not kill all life on earth. Surprisingly, few of my correspondents are convinced. They prefer apocalyptic myths created by pop scientists, movie producers and journalists. If Dr. Carl Sagan once said "nuclear winter" would follow a nuclear war, then it must be true. If radiation wipes out mankind in a movie, then that's what we can expect in real life.

But Carl Sagan was wrong about nuclear winter. And the movie "On the Beach" misled American filmgoers about the effects of fallout. It is time, once and for all, to lay these myths to rest. Nuclear war would not bring about the end of the world, though it would be horribly destructive. The truth is, many prominent physicists have condemned the nuclear winter hypothesis. Nobel laureate Freeman Dyson once said of nuclear winter research, "It's an absolutely atrocious piece of science, but I quite despair of setting the public record straight."

Professor Michael McElroy, a Harvard physics professor, also criticized the nuclear winter hypothesis. McElroy said that nuclear winter researchers "stacked the deck" in their study, which was titled "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions" (Science, December 1983). Nuclear winter is the theory that the mass use of nuclear weapons would create enough smoke and dust to blot out the sun, causing a catastrophic drop in global temperatures. According to Carl Sagan, in this situation the earth would freeze. No crops could be grown. Humanity would die of cold and starvation. In truth, natural disasters have frequently produced smoke and dust far greater than those expected from a nuclear war. In 1883 Krakatoa exploded with a blast equivalent to 10,000 one-megaton bombs, a detonation greater than the combined nuclear arsenals of planet earth. The Krakatoa explosion had negligible weather effects. Even more disastrous, going back many thousands of years, a meteor struck Quebec with the force of 17.5 million one-megaton bombs, creating a crater 63 kilometers in diameter. But the world did not freeze. Life on earth was not extinguished.

**[\_\_\_\_] Biological superweapons would not cause extinction.**

**Gregg Easterbrook, senior editor of the New Republic, 07/2003, “We’re All Gonna Die!”**

3. Germ warfare! Like chemical agents, biological weapons have never lived up to their billing in popular culture. Consider the 1995 medical thriller Outbreak, in which a highly contagious virus takes out entire towns. The reality is quite different. Weaponized smallpox escaped from a Soviet laboratory in Aralsk, Kazakhstan, in 1971; three people died, no epidemic followed. In 1979, weapons-grade anthrax got out of a Soviet facility in Sverdlovsk (now called Ekaterinburg); 68 died, no epidemic. The loss of life was tragic, but no greater than could have been caused by a single conventional bomb. In 1989, workers at a US government facility near Washington were accidentally exposed to Ebola virus. They walked around the community and hung out with family and friends for several days before the mistake was discovered. No one died. The fact is, evolution has spent millions of years conditioning mammals to resist germs. Consider the Black Plague. It was the worst known pathogen in history, loose in a Middle Ages society of poor public health, awful sanitation, and no antibiotics. Yet it didn't kill off humanity. Most people who were caught in the epidemic survived. Any superbug introduced into today's Western world would encounter top-notch public health, excellent sanitation, and an array of medicines specifically engineered to kill bioagents.

# Answers To: Overpopulation Will Cause Extinction

**[\_\_\_\_]**

### **[\_\_\_\_] Earth is sustainable – we haven’t even come close to exhausting our resources yet.**

**Donald G McNeil, science and technology journalist for the New York Times, 6/15/2008 “Malthus Redux: Is Doomsday Upon Us, Again?”http://www.nytimes.com/2008/06/15/world/americas/15iht-15mcneil.13714561.html,**

The whole world has never come close to outpacing its ability to produce food. Right now, there is enough grain grown on earth to feed 10 billion vegetarians, said Joel Cohen, professor of populations at Rockefeller University and the author of "How Many People Can the Earth Support?" But much of it is being fed to cattle, the SUV's of the protein world, which are in turn guzzled by the world's wealthy. Theoretically, there is enough acreage already planted to keep the planet fed forever, because 10 billion humans is roughly where the United Nations predicts that the world population will plateau in 2060. But success depends on portion control; in the late 1980s, Brown University's World Hunger Program calculated that the world then could sustain 5.5 billion vegetarians, 3.7 billion South Americans or 2.8 billion North Americans, who ate more animal protein than South Americans. Even if fertility rates rose again, many agronomists think the world could easily support 20 billion to 30 billion people. Anyone who has ever flown across the United States can see how that's possible: there's a lot of empty land down there. The world's entire population, with 1,000 square feet of living space each, could fit into Texas. Pile people atop each other like Manhattanites, and they get even more elbow room. Water? When it hits $150 a barrel, it will be worth building pipes from the melting polar icecaps, or desalinating the sea as the Saudis do. The same potential is even more obvious flying around the globe. The slums of Mumbai are vast; but so are the empty arable spaces of Rajasthan. Africa, a huge continent with a mere 770 million people on it, looks practically empty from above. South of the Sahara, the land is rich; south of the Zambezi, the climate is temperate. But it is farmed mostly by people using hoes.

**[\_\_\_\_] Overpopulation will soon cease to be an issue, birth rates are falling.**

**Fred Pearce, environment consultant of New Scientist magazine, 2010 “The Coming Population Crash: And Our Planet's Surprising Future" beacon Press Books: Boston, Massachusetts**

But don't despair. There is something you may not have guessed something that may save us all. The population "bomb" is being defused. Only gradually, because the children of the greatest population explosion in history are still mostly of childbearing age, but it is happening. They may be having seven children in Mali, and six in Afghanistan, but half of the world's women are now having two children or fewer-not just in rich countries, but in Iran and parts of lndia, Burma and Brazil, Vietnam and South Africa. Mothers today have fewer than half as many offspring as their own mothers. This is happening mostly out of choice and not compulsion. Women have always wanted freedom, not domestic drudgery and the childbirth treadmill. And now that most of their babies survive to adulthood, they are grabbing it.

# Answers To: Asteroids Will Cause Extinction

**[\_\_\_\_]**

## [\_\_\_\_] Asteroids won’t cause extinction – none will hit earth and we’d be able to deflect it if they did.

**Robert Roy** Britt**, Live Science, 8/7/**2008**, “Will an Asteroid Hit Earth?” http://www.livescience.com/mysteries/070116\_asteroid\_hit.html**

But no, a continent-destroying asteroid is not likely to hit during your lifetime. Most of 1,100 or so that could do the job have been found. And none are on their way. Okay, there is one mid-sized rock—called Apophis—that has a small chance of striking Earth in 2036 and wreaking some regional havoc. But astronomers are watching it and, if future observations reveal it really could hit us, scientists are confident they can devise a mission to deflect it. And if all else fails, some futurists suggests, humanity could simply set up shop elsewhere.

**[\_\_\_\_] No human has ever died from an asteroid strike. Their impact is too improbable.**

**James Bennett, Professor of Economics at George Mason University, 2010, “*The Doomsday Lobby: Hype and Panic from Sputniks, Martians, and Marauding Meteors*,” p. 157-8**

The matter, or manipulation, of odds in regards to a collision between a space rock and Earth would do Jimmy the Greek proud. As Michael B. Gerrard writes in Risk Analysis in an article assessing the relative allocation of public funds to hazardous waste site cleanup and protection against killer comets and asteroids, “Asteroids and comets are… the ultimate example of a low-probability/high-consequence event: no one in recorded human history is confirmed to have ever died from one.” Gerrard writes that “several billion people” will die as the result of an impact “at some time in the coming half million years,” although that half-million year time-frame is considerably shorter than the generally accepted extinction-event period.66 The expected deaths from a collision with an asteroid of, say, one kilometer or more in diameter are so huge that by jacking up the tiny possibility of such an event even a little bit the annual death rate of this never-before experienced disaster exceeds deaths in plane crashes, earthquakes, and other actual real live dangers. Death rates from outlandish or unusual causes are fairly steady across the years. About 120 Americans die in airplane crashes annually, and about 90 more die of lightning strikes. Perhaps five might die in garage-door opener accidents. The total number of deaths in any given year by asteroid or meteor impact is zero — holding constant since the dawn of recorded time.

# Answers To: Overview Effect Advantage

**[\_\_\_\_]**

**[\_\_\_\_] The overview effect is not supported by any scientifically rigorous evidence.**

**William Sims** Bainbridge**, tenured Professor in the Department of Sociology at the University of Washington,** 2006 **(*Goals In Space: American Values and the Future of Technology***,

Several of the Idealistic goals assert that space travel gives a new perspective to the astronauts who look back at Earth from afar and to those Earth-bound enthusiasts who participate vicariously in voyages beyond our world. From the viewpoint of space, we see ourselves, our nations, and our planet in a new light. In a recent book, Frank White (1987) reports that astronauts commonly experience “the overview effect,” a radical shift in consciousness achieved by seeing the Earth as a unity and from outside the traditional limits of human experience. He documents this thesis with material from a number of interviews, but unfortunately his data collection and theoretical analysis were not conducted in a manner that social scientists would consider systematic. Furthermore, although White considers “consciousness” to be the essential ingredient of any culture, he does not draw upon any of the standard literatureon this conceptually slippery topic. Yet, his hypothesis that from the new world-view offered by space exploration will come a series of new civilizations is a stimulating expression of the basic faith of the Idealistic class.

**[\_\_\_\_]**

**[\_\_\_\_] Virtual reality and other technologies on Earth have the same effect as the Overview effect.**

**Jun Okushi and Dudley-Flores, NASA-trained space architect, codeveloper of the International Space Station; policy analyst and space policy expert, 2007“Space and Perceptions of Space in Spacecraft: An Astrosociological Perspective.”**

Author Frank White has mentioned on the radio that he would like to allow more human beings to experience the “Overview Effect” by creating realistic simulations of space travel that go beyond the visual to include the other senses and perhaps create the feeling of isolation as sensed by space travelers. And, if the ordinary individualin Canada, in Italy, in Mozambique, in the Seychelles, in Tajikistan, in Mongolia, in Papua-New Guinea, and in California or any other locale, in his or her space-like isolation, can look out the window to apprehend the Earth, there will likely swell within his or her heart new feelings and new realizations.Such is a paradigm shift, born of humanity abroad in the Cosmos, even if bound to the Earth**.** This shift can be expected to more tightly integrate humans, their machines, and the experiences of all those on Mother Earth. By engaging the challenges of abyssal distances, the humans of the whole Earth can develop a sense of kinship, that “we are in this together,” a perception never fully developed to date by the global population in its history. And, hopefully, one that will be coming soon.

# Answers To: Overview Effect Advantage

**[\_\_\_\_]**

**[\_\_\_\_] Flying in a plane has the same effect as the overview effect.**

**Frank White, space writer and lecturer, 1998, The Overview Effect: Space Exploration and Human Evolution, Second Edition. USA:AIAA,**

There are ways to experience the Overview Effect without going into outer space**.** Anyone who flies in an airplane and looks out the window has the opportunity to experience a mild version of it. My own effort to confirm the reality of the Overview Effect had its origins in a cross-country flight in the late 1970s. As the plane flew north of Washington, D.C., I found myself looking down at the Capitol and Washington Monument. From 30,000 feet, they looked like little toys sparkling in the sunshine. From that altitude, all ofWashington looked small and insignificant. However, I knew that people down there were making life and death decisions on my behalf and taking themselves very seriously as they did so. From high in the jet stream, it seemed absurd that they could have an impact on my life. It was like ants making laws for humans. On the other hand, I knew that it was all a matter of perspective. When the plane landed, everyone on it would act just like the people over whom we flew. This line of thought led to a simple but important realization: mental processes and views of life cannot be separated from physical location.Our "world view" as a conceptual framework depends quite literally on our view of the world from a physical place in the universe. Later, as the plane flew over the deserts and mountains of the western states, the flood of insights continued. I could look down on the network of roads below and actually "see the future." I knew that the car on Route 110 would soon meet up with that other car on Route 37, although the two drivers were not yet aware of it. If they were about to have an accident, I'd see it, but they wouldn't. From the airplane, the message that scientists, philosophers, spiritual teachers, and systems theorists have been trying to tell us for centuries was obvious: everything is interconnected and interrelated, each part a subsystem of a larger whole system. Finally, after I spent several hours looking out at the Earth's surface, all the insights linked into a single gestalt. I expressed it as the following: People living in space settlements will always have an overview! They will be able to see how everything is related, that what appears to be "the world" to people on Earth is merely a small planet in space, and what appears to be "the present" is merely a limited viewpoint to one looking from a higher level. People who live in space will take for granted philosophical insights that have taken those on Earth thousands of years to formulate, They will start at a place we have labored to attain over several millennia.

# Answers To: Solvency

**[\_\_\_\_] We would be better off creating a safe haven on Earth than trying to colonize Mars. We are much closer to creating an underground facility on Earth that would be able to survive a nuclear war or other catastrophic event than we are to colonizing another planet. The sooner we have a haven, the better, because it will allow us to ensure survival in the case of one of the disasters the affirmative mentions.**

**[\_\_\_\_] Another planet would be a poor life insurance policy. We could not get people to Mars fast enough if extinction were to occur on Earth.**

**Donald Rapp, Professor of Engineering at the University of California, Berkeley, 2008,**

**“Human Missions to Mars: Enabling Technologies for Exploring the Red Planet,” P. 11**

In regard to the broader, visionary viewpoint expressed in DRM-1, the drive toward a sustained human presence beyond Earth appears to be premature by a few hundred years. Certainly, the presence of a handful of humans on Mars will not relieve the Earth of any of its pressures due to overpopulation, pollution, or resource depletion. Comparative planetology is a worthwhile goal but it is not clear that a human presence is needed to accomplish this. Surely, there are plenty of opportunities for international cooperation without sending humans into Mars? The conclusion that the investment required to send humans to Mars is “modest” is derived by comparing with larger societal expenditures. But when compared with traditional expenditures for space, it is huge. On the other hand, there may be merit in the claims that the new technologies or the new uses of existing technologies will not only benefit humans exploring Mars but will also enhance the lives of people on Earth, and the boldness and grandeur of Mars exploration “will motivate our youth, will drive technical education goals, and will excite the people and nations of the world.” Here it all boils down to the benefit/cost ratio, which seems likely to be low.

# Answers To: Solvency

**[\_\_\_\_]**

**[\_\_\_\_] There are immense health risks to traveling in outer space include muscle degeneration and cosmic radiation.**

**Besty Querna, writer for National Geographic, 05/18/2001, “Health Risks Pose Hurdle for Travel to Mars”** [**http://news.nationalgeographic.com/news/pf/26132202.html**](http://news.nationalgeographic.com/news/pf/26132202.html)

Humans may soon be on their way to Mars. But human safety is paramount in space missions. Depending on its orbit, Mars can be 500 times farther from Earth than the moon. Traveling such a long distance poses health problems never faced before. Being weightless for the entire mission would cause degeneration of muscles, bones, and the heart. And without a vigorous exercise program, an astronaut would likely experience heart problems because his or her heart would become too weak to pump blood upon returning to Earth and its gravitation. Another issue that must be addressed is the huge amount of radiation exposure that occurs outside the atmosphere. Gary Marin, director for advanced programs at the U.S. National Aeronautics and Space Administration (NASA), said, "Being away from Earth for three years would mean that every cell of your body would be transversed by a galactic ray, and we just don't know what that would do to people." Chemically propelled engines, which are currently used for space flights, would not be able to carry enough fuel for the spacecraft to turn around and return to Earth if a problem such as trauma or serious illness occurred on board.

[\_\_\_\_] We do not have the technology to travel to another planet in the status quo. Many would die in the attempt

Donald F. Robertson, Aperospace industry journalist, 3/6/2006, “Space Exploration,” Space News, http://www.space.com/spacenews/archive06/RobertsonOpEd\_030606.html

Two largely unquestioned assumptions long ago took root within the space community. As we prepare to voyage back to Earth's Moon and on to Mars, it is time to question them both. The first assumption is that exploring the Moon, Mars, or any part of the solar system, can be accomplishedin a generation or two and with limited loss of life. The second is that we can use robots to successfully understand another world. Both assumptions are almost certainly wrong, yet many important elements of our civil space program are based on one or both of them being correct. To paraphrase Douglas Adams, even within the space community most people don't have a clue how "mind-bogglingly big space really is." Most of the major worlds in the solar system have surface areas at least as large as terrestrial continents -- a few are much larger -- and every oneof them is unremittingly hostile to human life**.** Learning to travel confidently through former President John F. Kennedy's "this new ocean" will be difficult, expensive, time-consuming and dangerous. Mr. Kennedy's rhetoric was more accurate than he probably knew. The only remotely comparable task humanity has faced was learning to travel across our world's oceans. We take trans-oceanic travel for granted, but getting from Neolithic boats to modern freighters cost humanity well over 10,000 years of hard work and uncounted lives. Even today, hundreds of people die in shipping accidents every year. We and our woefully inadequate chemical rockets are like Stone Age tribesfolk preparing to cast off in canoes, reaching for barely visible islands over a freezing, storm-tossed, North Atlantic.

# Answers To: Solvency

**[\_\_\_\_]**

[\_\_\_\_] The extended time in space will give the crew cabin fever – they won’t be able to handle the pressure.

Kira Bacal, Assistant Professor of Medicine at Ohio University, 1/2/2009, **“Sex in space taken seriously,” http://philosophyofscienceportal.blogspot.com/2009/01/sex-in-space-taken-seriously.html) hss**

The psychosocial implications of in-flight sex and reproduction are at least as problematic as the related physiological challenges. For the foreseeable future, space crews will be relatively small in number. If pairing off occurs within the crew, it can have serious ramifications on the crew's working relationships, and therefore, on mission success and crew operations.[4,11,14,15] Former astronaut Norman Thaggard commented, "[Issues associated with romantic relationships are] just one more problem that can potentially cause the whole thing to come apart."[4]

As we have seen in recent years, even professional astronauts on active flight status can develop serious mental health issues related to interpersonal relationships,[2,16] and the extreme, prolonged stressors of the long-duration spaceflight environment will only make such situations worse.[4] Previous long-duration missions have demonstrated that minor nuisances can lead to huge conflicts, and the addition of sexual tension will create even more challenges for the crew.[17] The limited social networks can lead to problems, such as privacy issues, the odd man out, and triangles.[15] Break-ups, which must be considered an inevitable corollary to romantic pairings, can further contribute to widespread inter-personal conflicts.[11,17] Behavioral health has long been recognized as a major challenge to long-duration spaceflight.[17-20] An International Space Station astronaut Dan Bursch commented, "Most of the challenges are more mental and psychological." In this, he echoed the earlier sentiments of cosmonaut Valerie Ryumin, "All one needs to effect a murder is lock two men into a cabin, 18 ft by 20 ft, and keep them there for two months.[17]" How much more challenging will it be to maintain crew performance and healthy interpersonal relationships when the group becomes coeducational, semi-permanent, and sexually involved?

# Answers To: Solvency

**[\_\_\_\_]**

**[\_\_\_\_] We don’t have the technology for humans to return from Mars. We would be sending them on a suicide mission.**

Lynda Williams. Professor of Physics at San Francisco State University, 2010, “Irrational Dreams of Space Colonization,” *The Peace Review*; Spring 2010; [**http://www.scientainment.com/lwilliams\_peacereview.pdf**](http://www.scientainment.com/lwilliams_peacereview.pdf)

Moon base is envisioned as serving as a launch pad for Martian expeditions, so the infeasibility of a lunar base may prohibit trips to Mars, unless they are launched directly from Earth. Mars is, in its closest approach, 36 million miles from Earth and would require a nine-month journey with astronauts exposed to deadly solar cosmic rays. Providing sufficient shielding would require a spacecraft that weighs so much it becomes prohibitive to carry enough fuel for a roundtrip. Either the astronauts get exposed to lethal doses on a roundtrip, or they make a safe one-way journey and never return. Either way, no one can survive a trip to Mars and whether or not people are willing to make that sacrifice for the sake of scientific exploration, human missions to Mars do not guarantee the survival of the species, but rather, only the death of any member who attempts the journey.

# Article: Why We Should Not Seek to Colonize Mars

**Lynda Williams: *Irrational Dreams of Space Colonization*. Spring, 2010.**

Since Sputnik was launched over 50 years ago and the first human walked on the moon 12 years later, we have associated the exploration and colonization of space, specifically the Moon and Mars, as a necessary pursuit to guarantee our survival as a species, and to satisfy an evolutionary drive to explore and inhabit worlds beyond our own. Space enthusiasts claim that it is our manifest destiny, an expression of the human spirit, to explore and colonize the solar system. World-renowned scientists such as Stephen Hawking have made calls to colonize the Moon and Mars in order to preserve the species due to the inevitability of certain future doom on Earth by environmental destruction, plague or warfare. Commercial space developers promise private trips to space and beyond, infusing dreams of space wanderlust and enthusiasm for space travel in citizens who could never even afford such expensive and lofty excursions. Corporate space interests promise the certainty of achieving these goals along with new technological advances and resource riches from space exploration that will rival those gained from the Apollo moon missions. This article will examine the validity of these threats and promises, and their environmental and ethical consequences to life on Earth.

**The Destruction of Earth Threat**

According to scientific theory, the destruction of Earth is a certainty. About five billion years from now, when our sun exhausts its nuclear fuel, it will expand in size and envelope the inner planets, including the Earth, and burn them into oblivion. So yes, we are doomed, but we have 5 billion years, plus or minus a few hund red million, to plan our extraterrestrial escape. The need to colonize the Moon or Mars to guarantee our survival based on this fact is not pressing. There are also real risks due to collisions with asteroids and comets, though none are of immediate threat and do not necessitate extraterrestrial colonization. There are many Earth-based technological strategies that can be developed in time to mediate such astronomical threats such as gravitational tugboats that drag the objects out of range. The solar system could also potentially be exposed to galactic sources of high-energy gamma ray bursts that could fry all life on Earth, but any Moon or Mars base would face a similar fate. Thus, Moon or Mars human based colonies would not protect us from any of these astronomical threats in the near future.

**The Destruction of Earth’s Biosphere**

Life on Earth is more urgently threatened by the destruction of the biosphere and its life sustaining habitat due environmental catastrophes such as climate change, ocean acidification, disruption of the food chain, bio-warfare, nuclear war, nuclear winter, and myriads of other man-made doomsday prophesies. If we accept these threats as inevitabilities on par with real astronomical dangers and divert our natural, intellectual, political and technological resources from solving these problems into escaping them, will we playing into a self- fulfilling prophesy of our own planetary doom? Seeking space based solutions to our Earthly problems may indeed exacerbate the planetary threats weface. This is the core of the ethical dilemma posed by space colonization: should we put our recourses and bets on developing human colonies on other worlds to survive natural and man-made catastrophes or should we focus all of our energies on solving the problems that create these threats on Earth?

**Human Life on The Moon and Mars**

What do the prospects of colonies or bases on the Moon and Mars offer? Both the Moon and Mars host

extreme environments that are uninhabitable to humans without very sophisticated technological life supporting systems beyond any that are feasible now or will be available in the near future. Both bodies are subjected to deadly levels of solar radiation and are void of atmospheres that could sustain oxygen-based life forms such as humans. Terra- forming either body is not feasible with current technologies or within any reasonable time frames so any colony or base would be restricted to living in space capsules or trailer park like structures which could not support a sufficient number of humans to perpetuate and sustain the species in any long term manner.

Although evidence of water has been discovered on both bodies, it exists in a form that is trapped in minerals, which would require huge amounts of energy to access. Water can be converted into fuel either as hydrogen or oxygen, which would eliminate the need to transport vast amounts of fuel from Earth. However, according to Britain's leading spaceflight expert, Professor Colin Pillinger, "You would need to heat up a lot of lunar soil to 200C to get yourself a glass of water." The promise of helium as an energy source on the moon to is mostly hype. Helium-3 could be used in the production of nuclear fusion energy, a process we have yet to prove viable or efficient on Earth. Mining helium would require digging dozens of meters into the lunar surface and processing hundreds of thousands of tons of soil to produce 1 ton of helium-3. (25 tons of helium-3 is required to power the US for 1 year.) Fusion also requires the very rare element tritium, which does not exist naturally on the Moon, Mars or on Earth in abundances needed to facilitate nuclear fusion energy production. There are no current means for generating the energy on the Moon to extract the helium-3 to produce the promised endless source of energy from helium-3 on the Moon. Similar energy problems exist for using solar power on the Moon, which has the additional problem of being sunlit two weeks a month and dark for the other two weeks.

A Moon base is envisioned as serving as a launch pad for Martian expeditions, so the infeasibility of a lunar base may prohibit trips to Mars, unless they are launched directly from Earth. Mars is, in its closest approach, 36 million miles from Earth and would require a nine- month journey with astronauts exposed to deadly solar cosmic rays. Providing sufficient shielding would require a spacecraft that weighs so much it becomes prohibitive to carry enough fuel for a roundtrip. Either the astronauts get exposed to lethal doses on a roundtrip, or they make a safe one-way journey and never return. Either way, no one can survive a trip to Mars and whether or not people are willing to make that sacrifice for the sake of scientific exploration, human missions to Mars do not guarantee the survival of the species, but rather, only the death of any member who attempts the journey.

**Space Law and Space Ethics**

The technological hurdles prohibiting practical space colonization of the Moon and Mars in the near future are stratospherically high. The environmental and political consequences of pursuing these lofty dreams are even higher. There are no international laws governing the Moon or the protection of the space environment. The Moon Treaty, created in 1979 by the United Nations, declares that the Moon shall be developed to benefit all nations and that no military bases could be placed on the moon or on any celestial body, and bans altering the environment of celestial bodies. To date, no space faring nation has ratified this treaty, meaning, the moon, and all celestial bodies, including Mars and asteroids are up for the taking. If a nation did place a military base on the moon, they could potentially control all launches from Earth. The Moon is the ultimate military high ground. How should we, as a species, control the exploration, exploitation and control of the Moon and other celestial bodies if we can not even agree on a legal regime to protect and share its resources?

Since the space race began 50 years ago with the launch of Sputnik, the space environment around Earth

has become overcrowded with satellites and space debris, so much so, that circumterrestrial space has become a dangerous place with an increasing risk of collision and destruction. Thousands of pieces of space junk created from launches orbit the Earth in the same orbit as satellites, putting them at risk of collision. Every time a rocket is launched, debris from the rocket stages are put into orbital space. In 2009 there was a disastrous collision between an Iridium satellite and a piece of space junk that destroyed the satellite. In 2007 China blew up one of its defunct satellites to demonstrate its antiballistic missile capabilities, increasing the debris field by 15%. There are no international laws prohibiting anti-satellite actions. Every year, since the mid 1980s, a treaty has been introduced into the UN for a Prevention of an Arms Race in Outer Space (PAROS), with all parties including Russia and China voting for it except for the US. How can we hope to pursue a peaceful and environmentally sound route of space exploration without international laws in place that protect space and Earth environments and guarantee that the space race to the moon and beyond does not foster a war over space resources? Indeed, if the space debris problem continues to grow unfettered or if there is war in space, space will become too trashed for launches to take place without risk of destruction.

The private development of space is growing at a flurried rate. Competitions such as the X-Prize for companies to reach orbit and the Google Prize to land a robot on the Moon has launched space wanderlust in citizens throughout the country who dream of traveling to space. The reality is that there are few protections for the environment and the passengers of these flights of fancy. The FAA, which regulates space launches, is under a Congressional mandate to foster the industry. It is difficult if not impossible to have objective regulation of an industry when it enjoys government incentives to profit.

We have much to determine on planet Earth before we launch willy nilly into another race into space and a potential environmental disaster and arms race in outer space.

**Spaceship Earth**

If we direct our intellectual and technological resources toward space exploration without consideration of the environmental and political consequences, what is left behind in the wake? The hype surrounding space exploration leaves a dangerous vacuum in the collective consciousness of solving the problems on Earth. If we accept the inevitability of Earth’s destruction and its biosphere, we are left looking toward the heavens for our solutions and resolution. Young scientists, rather than working on serious environmental challenges on Earth, dream of Moon or Martian bases to save humanity, fueling the prophesy of our planetary destruction, rather than working on solutions to solve the problems on Earth.

Every space faring entity, be they governmental or corporate, face the same challenges. Star Trek emboldened us all to dream of space, the final frontier. The reality is that our planet Earth is a perfect spaceship. We travel around our star the sun once every year, and the sun pull us with her gravitational force around the galaxy once every 250 million years through star systems, star clusters and all the possible exosolar planets that may host life or be habitable for us to colonize. The sun will be around for billions of years and we have ample time to explore the stars. It woukd be wise and prudent for us as a species to focus our intellectual and technological knowledge now into preserving our spaceship for the long voyage through the stars, so that once we have figured out how to make life on Earth work in an environmentally and politically sustainable way, we can then venture off the planet into the final frontier of our dreams.

# Article: Space Travel Has Many Health Risks

**National Geographic Magazine: *Health Risks Pose Hurdle for Mission to Mars.* May, 18th, 2001.**

Humans may soon be on their way to Mars. But human safety is paramount in space missions.

Depending on its orbit, Mars can be 500 times farther from Earth than the moon. Traveling such a long distance poses health problems never faced before.

Being weightless for the entire mission would cause degeneration of muscles, bones, and the heart. And without a vigorous exercise program, an astronaut would likely experience heart problems because his or her heart would become too weak to pump blood upon returning to Earth and its gravitation.

Another issue that must be addressed is the huge amount of radiation exposure that occurs outside the atmosphere. Gary Marin, director for advanced programs at the U.S. National Aeronautics and Space Administration (NASA), said, "Being away from Earth for three years would mean that every cell of your body would be transversed by a galactic ray, and we just don't know what that would do to people."

Chemically propelled engines, which are currently used for space flights, would not be able to carry enough fuel for the spacecraft to turn around and return to Earth if a problem such as trauma or serious illness occurred on board.

NASA is now looking into ways to deal with some of the physical risks. But psychological problems are harder to solve with technology.

Astronauts would be confined in the spacecraft for most of the mission. As Richard Berendzen, a scientist at American University, observed, "Five or six of your closest friends in a room the size of your living room for three years, that's a tough thing to do."

Scientists have discovered evidence that water may have existed on Mars, and may still be present under the surface. The availability of water is crucial to a mission to Mars because it might help provide the basic elements people need to remain on the planet for an extended period.

"That water is very important to us," said Berendzen speaking on *National Geographic Today.* "Not only to drill down and drink, but to pump up, break the H2O apart, use the oxygen to breath and the hydrogen for fuel."

The possibility that there is water on Mars suggests that even more intriguing findings may lie ahead. The presence of water is an indication of energy sources, and very likely organic matter.

Berendzen said that if evidence of past forms of life were found, "It would probably be the most stunning discovery in the history of humankind."

While going to Mars would clearly offer a minefield of discoveries, carrying out such a mission at this time has too high a risk for the people who would make such a journey. As research continues, however, the dream of a trip to Mars will inevitably become a reality.