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\*\*\*1AC\*\*\*

1AC---Plan

The United States federal government should direct the National Aeronautics and Space Administration to develop and implement a strategy to return astronauts to the Moon, in order to establish a permanent human presence in space as soon as is feasible.

1AC---Colonization Advantage

Contention \_\_ is Colonization

Try or Die for Space---Extinction is Inevitable:

A. Super volcanoes

**Britt 5** (Robert Roy Britt, Livescience Senior Writer, “Super volcanoes will chill the world someday”, http://www.msnbc.msn.com/id/7129908/, 3/8/2005)SV

The eruption of a super volcano "sooner or later" will chill the planet and threaten human civilization, British scientists warned Tuesday. And now the bad news: There's not much anyone can do about it. Several volcanoes around the world are capable of gigantic eruptions unlike anything witnessed in recorded history, based on geologic evidence of past events, the scientists said. Such eruptions would dwarf those of Mount St. Helens, Krakatoa, Pinatubo and anything else going back dozens of millennia. "Super eruptions are up to hundreds of times larger than these," said Stephen Self of Britain's Open University. "An area the size of North America can be devastated, and pronounced deterioration of global climate would be expected for a few years following the eruption," Self said. "They could result in the devastation of world agriculture, severe disruption of food supplies, and mass starvation. These effects could be sufficiently severe to threaten the fabric of civilization." Self and his colleagues at the Geological Society of London presented their report to the British government's Natural Hazard Working Group. "Although very rare, these events are inevitable, and at some point in the future humans will be faced with dealing with and surviving a super eruption," Stephen Sparks of the University of Bristol told LiveScience in advance of Tuesday's announcement. Supporting evidence The warning is not new. Geologists in the United States detailed a similar scenario in 2001, when they found evidence suggesting volcanic activity in Yellowstone National Park will eventually lead to a colossal eruption. Half the United States will be covered in ash up to 3 feet (1 meter) deep, according to a study published in the journal Earth and Planetary Science Letters. Explosions of this magnitude "happen about every 600,000 years at Yellowstone," says Chuck Wicks of the U.S. Geological Survey, who has studied the possibilities in separate work. "And it's been about 620,000 years since the last super explosive eruption there." Past volcanic catastrophes at Yellowstone and elsewhere remain evident as giant collapsed basins called calderas. A super eruption is a scaled up version of a typical volcanic outburst, Sparks explained. Each is caused by a rising and growing chamber of hot molten rock known as magma. "In super eruptions the magma chamber is huge," Sparks said. The eruption is rapid, occurring in a matter of days. "When the magma erupts the overlying rocks collapse into the chamber, which has reduced its pressure due to the eruption. The collapse forms the huge crater." The eruption pumps dust and chemicals into the atmosphere for years, screening the Sun and cooling the planet. Earth is plunged into a perpetual winter, some models predict, causing many plant and animal species to disappear forever. "The whole of a continent might be covered by ash, which might take many years — possibly decades — to erode away and for vegetation to recover," Sparks said. Yellowstone may be winding down geologically, experts say. But they believe it harbors at least one final punch. Globally, there are still plenty of possibilities for super volcano eruptions, even as Earth quiets down over the long haul of its 4.5-billion-year existence. "The earth is of course losing energy, but at a very slow rate, and the effects are only really noticeable over billions rather than millions of years," Sparks said. Human impact The odds of a globally destructive volcano explosion in any given century are extremely low, and no scientist can say when the next one will occur. But the chances are five to 10 times greater than a globally destructive asteroid impact, according to the new British report. The next super eruption, whenever it occurs, might not be the first one humans have dealt with. About 74,000 years ago, in what is now Sumatra, a volcano called Toba blew with a force estimated at 10,000 times that of Mount St. Helens. Ash darkened the sky all around the planet. Temperatures plummeted by up to 21 degrees at higher latitudes, according to research by Michael Rampino, a biologist and geologist at New York University. Rampino has estimated three-quarters of the plant species in the Northern Hemisphere perished. Stanley Ambrose, an anthropologist at the University of Illinois, suggested in 1998 that Rampino's work might explain a curious bottleneck in human evolution: The blueprints of life for all humans — DNA — are remarkably similar, given that our species branched off from the rest of the primate family tree a few million years ago. Ambrose has said early humans were perhaps pushed to the edge of extinction after the Toba eruption — around the same time folks got serious about art and tool making. Perhaps only a few thousand survived. Humans today would all be descended from these few, and in terms of the genetic code, not a whole lot would change in 74,000 years. Sitting ducks Based on the latest evidence, eruptions the size of the giant Yellowstone and Toba events occur at least every 100,000 years, Sparks said, "and it could be as high as every 50,000 years. There are smaller but nevertheless huge eruptions which would have continental to global consequences every 5,000 years or so." Unlike other threats to humanity — asteroids, nuclear attacks and global warming, to name a few — there's little to be done about a super volcano. "While it may in future be possible to deflect asteroids or somehow avoid their impact, even science fiction cannot produce a credible mechanism for averting a super eruption," the new report states. "No strategies can be envisaged for reducing the power of major volcanic eruptions." The Geological Society of London has issued similar warnings going back to 2000. The scientists this week called for more funding to investigate further the history of super eruptions and their likely effects on the planet and on modern society. "Sooner or later a super eruption will happen on Earth, and this issue also demands serious attention," the report concludes.

B. Overpopulation

Mcdougall et al 7 (Rosamund Mcdougall, Co-Chair of the Optimum Population Trust and Joint Policy Director, “Too many people: Earth’s population problem”, Optimum Population Trust, http://www.optimumpopulation.org/opt.earth.html, 6/7/2007)SV

The Earth faces a future of rising populations and growing strains on the planet. Whatever else the future holds, significant population increase is inevitable and the current UN forecast of 9.2 billion by 2050 – itself a 40 per cent increase on the 6.7 billion in 2007 – may turn out to be an underestimate. The environmental damage resulting from population increase is already widespread and serious, ranging from climate change to shortages of basic resources such as food and water. By 2050, humanity is likely to require the biological capacity of two Earths. Without action, longages of humans – the prime cause of all shortages of resources – may cause parts of the planet to become uninhabitable, with governments pushed towards coercive population control measures as a regrettable but lesser evil than conflict and suffering.

C. Asteroid Strikes

Lt. Col. Kunich - Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base – 1997 (John C., “Planetary Defense: The Legality of Global Survival,” The Air Force Law Review, Volume 41 [41 A.F.L. rev. 119). [Online] LexisNexis) jfs

It is true that destructive impacts of gigantic asteroids and comets are extremely rare and infrequent when compared with most other dangers humans face, with the [\*126] intervals between even the smallest of such events amounting to many human generations... No one alive today, therefore, has ever witnessed such an event, and indeed there are no credible historical records of human casualties from impacts in the past millennium. Consequently, it is easy to dismiss the hazard as negligible or to ridicule those who suggest that it be treated seriously. n32 On the other hand, as has been explained, when such impacts do occur, they are capable of producing destruction and casualties on a scale that far exceeds any other natural disasters; the results of impact by an object the size of a small mountain exceed the imagined holocaust of a full-scale nuclear war... Even the worst storms or floods or earthquakes inflict only local damage, while a large enough impact could have global consequences and place all of society at risk... Impacts are, at once, the least likely but the most dreadful of known natural catastrophes. n33 What is the most prudent course of action when one is confronted with an extremely rare yet enormously destructive risk? Some may be tempted to do nothing, in essence gambling on the odds. But because the consequences of guessing wrong may be so severe as to mean the end of virtually all life on planet Earth, the wiser course of action would be to take reasonable steps to confront the problem. Ultimately, rare though these space strikes are, there is no doubt that they will happen again, sooner or later. To do nothing is to abdicate our duty to defend the United States, and indeed the entire world, and place our very survival in the uncertain hands of the false god of probabilities. Thus, the mission of planetary defense might be considered by the United States at some point in time, perhaps with a role played by the military, including the United States Air Force.

Colonization is key-it’s time to leave Earth or face extinction

**Fox News 10** (Fox News, “Abandon Earth or Face Extinction, Stephen Hawking Warns – Again”, http://www.foxnews.com/scitech/2010/08/09/abandon-earth-face-extinction-warns-stephen-hawking/, 6/9/10) SV

It's time to abandon Earth, warned the world's most famous theoretical physicist. In an interview with website Big Think, Stephen Hawking warned that the long-term future of the planet is in outer space. "It will be difficult enough to avoid disaster on planet Earth in the next hundred years, let alone the next thousand, or million. The human race shouldn't have all its eggs in one basket, or on one planet," he said. "I see great dangers for the human race," Hawking said. "There have been a number of times in the past when its survival has been a question of touch and go. The Cuban missile crisis in 1963 was one of these. The frequency of such occasions is likely to increase in the future." "But I'm an optimist. If we can avoid disaster for the next two centuries, our species should be safe, as we spread into space," he said.

Defer to our impact calculus - In framing the debate, you should embrace your professional responsibility to act as if the disaster will happen.

Chapman, Durda & Schweickart 06 (Southwest Research Institute), (SRI) and (B612 Foundation) (Clark R., Daniel D. and Russell L., “Mitigation: Interfaces between NASA, Risk Managers, and the Public,” White Paper submitted to NASA Workshop on Near-Earth Object Detection, Characterization, and Threat Mitigation, 26 June 2006 (Vail, CO). [PDF Online @] http://www.aero.org/conferences/planetarydefense/resources.html) Accessed 06.07.11 jfs

Since NASA astronomers and officials are first in the line of defense against a potential impact disaster, they must act throughout in ways that would seem proper from the perspective of survivors of the catastrophe if it were actually to happen. While NASA must caution the public not to worry about very small impact probabilities, its professional responsibility is to otherwise behave counterintuitively as if a possible impact is going to happen...until it becomes known that it will not happen. As hurricane Katrina was approaching Florida, the chances that it would directly strike New Orleans were low. But officials are now smarting from criticism that they did not act as they should have during the days when the threat was growing until Katrina actually struck. This maxim of acting as if the disaster will happen goes without saying for professional risk managers, but it is a lesson that New Orleans officials needed to know beforehand and that NASA needs to learn now.

Trillions of lives are lost for every second we delay.

**Bostrom 04** Nick, philosophy professor at Yale & Oxford,” http://www.nickbostrom.com/astronomical/waste.htm

"As I write these words, suns are illuminating and heating empty rooms, unused energy is being flushed down black holes, and our great common endowment of negentropy is being irreversibly degraded into entropy on a cosmic scale. These are resources that an advanced civilization could have used to create value-structures, such as sentient beings living worthwhile lives. The rate of this loss boggles the mind. One recent paper speculates, using loose theoretical considerations based on the rate of increase of entropy, that the loss of potential human lives in our own galactic supercluster is at least ~10^46 per century of delayed colonization.[1] This estimate assumes that all the lost entropy could have been used for productive purposes, although no currently known technological mechanisms are even remotely capable of doing that. Since the estimate is meant to be a lower bound, this radically unconservative assumption is undesirable. We can, however, get a lower bound more straightforwardly by simply counting the number or stars in our galactic supercluster and multiplying this number with the amount of computing power that the resources of each star could be used to generate using technologies for whose feasibility a strong case has already been made. We can then divide this total with the estimated amount of computing power needed to simulate one human life. As a rough approximation, let us say the Virgo Supercluster contains 10^13 stars. One estimate of the computing power extractable from a star and with an associated planet-sized computational structure, using advanced molecular nanotechnology[2], is 10^42 operations per second.[3] A typical estimate of the human brain's processing power is roughly 10^17 operations per second or less.[4] Not much more seems to be needed to simulate the relevant parts of the environment in sufficient detail to enable the simulated minds to have experiences indistinguishable from typical current human experiences.[5] Given these estimates, it follows that the potential for approximately 10^38 human lives is lost every century that colonization of our local supercluster is delayed; or equivalently, about 10^31 potential human lives per second. While this estimate is conservative in that it assumes only computational mechanisms whose implementation has been at least outlined in the literature, it is useful to have an even more conservative estimate that does not assume a non-biological instantiation of the potential persons. Suppose that about 10^10 biological humans could be sustained around an average star. Then the Virgo Supercluster could contain 10^23 biological humans. This corresponds to a loss of potential equal to [is] about 10^14 potential human lives per second of delayed colonization. What matters for present purposes is not the exact numbers but the fact that they are huge. Even with the most conservative estimate, assuming a biological implementation of all persons, the potential for one hundred trillion potential human beings is lost for every second of postponement of colonization of our supercluster.[6]"

Colonization’s the only way to ensure human survival---we won’t be able to predict what causes extinction which means all counter-measures will fail

Gott 9 – J. Richard Gott, Professor of Astrophysics at Princeton University, July 17, 2009, “A GOAL FOR THE HUMAN SPACEFLIGHT PROGRAM,” online: 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.

It’s now or never---political will to fund the space program is eroding quickly and won’t be restored later

Gott 9 – J. Richard Gott, Professor of Astrophysics at Princeton University, July 17, 2009, “A GOAL FOR THE HUMAN SPACEFLIGHT PROGRAM,” online: http://www.nasa.gov/pdf/368985main\_GottSpaceflightGoal.pdf

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 selfsupporting 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.

Delaying the beginning of colonization means we won’t be successful later---we’ll be trapped on earth even after spending the same amount of resources on attempted colonization

Gott 9 – J. Richard Gott, Professor of Astrophysics at Princeton University, July 17, 2009, “A GOAL FOR THE HUMAN SPACEFLIGHT PROGRAM,” online: http://www.nasa.gov/pdf/368985main\_GottSpaceflightGoal.pdf

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.

1AC---Space Leadership Advantage

Contention \_\_ is US Hegemony

Obama’s space policy abandons human exploration, crushing overall U.S. leadership---fully funding NASA’s colonization efforts is key to regain space dominance

Schmitt 10 - Harrison H. Schmitt, geologist, Apollo 17 astronaut, Former Chair NASA Advisory Council, February 2010, “FORMER SENATOR SCHMITT FINDS NEW SPACE POLICY CEDES MOON TO CHINA, SPACE STATION TO RUSSIA, AND LIBERTY TO THE AGES,” online: http://wolf.house.gov/uploads/schmitt\_20100226094141.pdf

The Administration finally has announced its formal retreat on American Space Policy after a year of morale destroying clouds of uncertainty. The lengthy delay, the abandonment of human exploration, and the wimpy, un-American thrust of the proposed budget indicates that the Administration does not understand, or want to acknowledge, the essential role space plays in the future of the United States and liberty. This continuation of other apologies and retreats in the global arena would cede the Moon to China, the American Space Station to Russia, and assign liberty to the ages.

The repeated hypocrisy of this President continues to astound. His campaign promises endorsed what he now proposes to cancel. His July celebration of the 40th Anniversary of the first Moon landing now turns out to be just a photo op with the Apollo 11 crew. With one wave of a budget wand, the Congress, the NASA family, and the American people are asked to throw their sacrifices and achievements in space on the ash heap of history.

Expenditures of taxpayer provided funds on space related activities find constitutional justification in Article I, Section 83 Clause 8, that gives Congress broad power to "promote the Progress of Science and the useful Arts." In addition, the Article I power and obligation to "provide for the Common Defence" relates directly to the geopolitical importance of space exploration at this frontier of human endeavor. A space program not only builds wealth, economic vitality, and educational momentum through technology and discovery, but it also sets the modem geopolitical tone for the United States to engage friends and adversaries in the world.

For example, in the 1980s, the dangerous leadership of the former Soviet Union believed America would be successful in creating a missile defense system because we succeeded in landing on the Moon and they had not. Dominance in space was one of the major factors leading to the end of the Cold War.

With a new Cold War looming before us, involving the global ambitions and geopolitical challenge of the national socialist regime in China, President George W. Bush put America back on a course to maintain space dominance. What became the Constellation Program comprised his January 14,2004 vision of returning Americans and their partners to deep space by putting astronauts back on the Moon, going on to Mars, and ultimately venturing beyond. Unfortunately, like all Administrations since Eisenhower and Kennedy, the Bush Administration lost perspective about space. Inadequate budget proposals and lack of Congressional leadership and funding during Constellation's formative years undercut Administrator Michael Griffin's effort to implement the Program after 2004. Delays due to this under-funding have rippled through national space capabilities until we must retire the Space Shuttle without replacement access to space. Now, we must pay at least $50 million per seat for the Russians to ferry Americans and others to the International Space Station. How the mighty have fallen.

The status quo ensures a U.S. loss in the space race:

A. Russia, India, Japan, and Germany

**Williams 7** (Mark Williams, Actor, Writer, and Presenter at BBC, “Mining the Moon: Lab experiments suggest that future fusion reactors could use helium-3 gathered from the moon”, http://www.technologyreview.com/Energy/19296/, 8/23/2007) SV

At the 21st century's start, few would have predicted that by 2007, a second race for the moon would be under way. Yet the signs are that this is now the case. Furthermore, in today's moon race, unlike the one that took place between the United States and the U.S.S.R. in the 1960s, a full roster of 21st-century global powers, including China and India, are competing. Even more surprising is that one reason for much of the interest appears to be plans to mine helium-3--purportedly an ideal fuel for fusion reactors but almost unavailable on Earth--from the moon's surface. NASA's Vision for Space Exploration has U.S. astronauts scheduled to be back on the moon in 2020 and permanently staffing a base there by 2024. While the U.S. space agency has neither announced nor denied any desire to mine helium-3, it has nevertheless placed advocates of mining He3 in influential positions. For its part, Russia claims that the aim of any lunar program of its own--for what it's worth, the rocket corporation Energia recently started blustering, Soviet-style, that it will build a permanent moon base by 2015-2020--will be extracting He3. The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011. Nor does India intend to be left out. (See "India's Space Ambitions Soar.") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, Chandrayaan-1, will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending Chandrayaan-2, a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He3 and bringing it back to fuel fusion-based nuclear reactors on Earth.

B. China

**Kazan 10** (Casey Kazan, Daily Galaxy Editor, “China Launches Second Moon Mission: Is Helium 3 an Ultimate Goal”, http://www.dailygalaxy.com/my\_weblog/2010/10/china-launches-second-moon-mission-is-mining-helium-3-an-ultimate-goal.html, 10/3/2010) SV

In 2007, shortly after Russia claimed a vast portion of the Arctic sea floor, accelerating an international race for the natural resources as global warming opens polar access, China announced plans to map "every inch" of the surface of the Moon and exploit the vast quantities of Helium-3 thought to lie buried in lunar rocks as part of its ambitious space-exploration program. Ouyang Ziyuan, head of the first phase of lunar exploration, was quoted on government-sanctioned news site ChinaNews.com describing plans to collect three dimensional images of the Moon for future mining of Helium 3: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of Helium-3 can reach one to five million tons." "Helium-3 is considered as a long-term, stable, safe, clean and cheap material for human beings to get nuclear energy through controllable nuclear fusion experiments," Ziyuan added. "If we human beings can finally use such energy material to generate electricity, then China might need 10 tons of helium-3 every year and in the world, about 100 tons of helium-3 will be needed every year." Helium 3 fusion energy - classic Buck Rogers propulsion system- may be the key to future space exploration and settlement, requiring less radioactive shielding, lightening the load. Scientists estimate there are about one million tons of helium 3 on the moon, enough to power the world for thousands of years. The equivalent of a single space shuttle load or roughly 25 tons could supply the entire United States' energy needs for a year. Thermonuclear reactors capable of processing Helium-3 would have to be built, along with major transport system to get various equipment to the Moon to process huge amounts of lunar soil and get the minerals back to Earth. **With China's announcement, a new Moon-focused Space Race seems locked in place**. China made its first steps in space just a few years ago, and is in the process of establishing a lunar base by 2024. Russia, the first to put a probe on the moon, plans to deploy a lunar base in 2015. A new, reusable spacecraft, called Kliper, has been earmarked for lunar flights, with the International Space Station being an essential galactic pit stop.

Colonization Programs are key to win the space race, if not-NASA Collapses and China & Russia beat us---Collapses Heg

**Hawking 11** (William R Hawking Ph.D,Senior Fellow in National Security Studies at the U.S. Business and Industry Council Education Foundation, “Forfeiting US Leadership in Space”, http://www.familysecuritymatters.org/publications/id.8906/pub\_detail.asp, 3/7/2011) SV

The National Aeronautics and Space Administration (NASA) has put out its 2011 Strategic Plan. Its first goal is to "extend and sustain human activities across the solar system." As the lead civilization of the current era, it is America's duty to advance human achievement. Yet, there is very little in the NASA plan or budget to fulfill this noble goal. The NASA plan relies first and foremost on "expanding efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration." But without the shuttle or a replacement space vehicle, the U.S. will be dependent on the Russians for access to the ISS. Yes, the Russians, who lost both the Space Race and the Cold War in the last century, are now poised to control the ISS. The Russians, it should be remembered, were invited into the ISS because the U.S., even though it was the richest nation on the planet and the world's most advanced scientific state, was looking for other countries to put up money for the ISS to lighten its own "burden." It would be hard to find a better example of the old adage "penny wise, but pound foolish." NASA notes the danger. Its strategic plan has as a goal "reducing the risk of relying exclusively on foreign crew transport capabilities." But the road to that goal will be a long one. The report talks about creating “architectures" that will then lead to a "roadmap for affordable and sustainable human space exploration." So after 30 years of relying on shuttles that were designed in the 1970s, NASA is back to square one. NASA knows, "The core elements to a successful implementation are a space launch system and a multipurpose crew vehicle to serve as our national capability to conduct advanced missions beyond low Earth orbit. Developing this combined system will enable us to reach cislunar space, near-Earth asteroids, Mars, and other celestial bodies." Tragically, no one higher up in Washington, either at the White House or in Congress, has cared enough about the nation's future in space to do anything about funding such a project. As long as there are still satellites that can beam down episodes of "American Idol" to a nation of couch potatoes, who cares about achieving anything more? NASA is one of the few government programs than actually deserves to be called an investment. Its 2012 request of $18 billion is only 0.4 percent of a $3.7 trillion Federal budget. The bailout money given to the AIG insurance company would have funded NASA for a decade. Yet, the technology the space program has generated for society has rewarded taxpayers many times over. And developing new generations of scientific breakthroughs will continue to be a major strategic goal of the program. NASA's role extends beyond the agency's own work. It has served as a stimulus for education and industry. It's 2011 report states, "One of NASA's top strategic goals is to Inspire students to be our future scientists, engineers, explorers, and educators through interactions with NASA’s people, missions, research, and facilities." At a time when the performance of American students in math and science has fallen behind that of most of the world, there needs to be a new push to stimulate the public imagination and to provide rewarding careers for a new generation of innovative thinkers. But with NASA doing less in space, from where is the inspiration to come? Designing more video games? The NASA report raises concerns about how to keep even its current high-skilled workforce employed, noting. "The retirement of the Space Shuttle in 2011 is ushering in a tran­sition period for the Nation’s human space flight workforce." New programs, such as "development of a heavy-lift rocket and crew capsule to carry explorers beyond Earth’s orbit, including a mission to an asteroid next decade" are supposed to provide some jobs, but not enough. Shifting work to "greentechnology" and the study of "global warming" will not lead to new adventures in manned space exploration Meanwhile, China is positioning itself to lead humankind' further into space. The state news agency Xinhua reported Friday, "The world's largest design, production and testing base for rockets is being built in Tianjin" as part of China's expanding space program. Twenty of the 22 plants have been completed, and some of are ready for operation. The base is designed to meet China's growing demand for space technology for the next thirty years. By integrating the industrial chain, the base will be able to produce the whole spectrum of rockets for China's lunar missions, its own space station and other ambitious projects according to Liang Xiaohong, deputy head of the China Academy of Launch Vehicle Technology. China is still behind the United States, having only sent its first multi-man orbital mission aloft in 2008, but it has big ideas. Beijing plans 20 space missions this year, and wants to land an unmanned vehicle on the Moon in 2013. China sent a spacecraft to orbit the Moon last October. The stirring vision of giant space stations, commercial shuttle flights and extensive moon bases given to the public in the classic 1968 film *2001: A Space Odyssey* has become a sad testimony to three decades of lost American opportunities. I have seen this once great American spirit of adventure reborn in China. I have been amazed (and alarmed) by displays of Chinese plans to build bases on the Moon, then move farther into the solar system. I grew up in a confident America animated by futuristic thinking, but that drive has faded. Beijing is now the home of energy and ambition. What happens in space is not divorced from what happens on Earth. Though clearly helpful to military space projects, NASA is charted as a civilian organization in line with idealist notions about the heavens being a clean slate free of power politics. There are no such illusions in China. Beijing's manned-space program is placed under the General Armament Department within the Ministry of Defense. The Long March rockets used for space launches are similar in design to China's nuclear-tipped intercontinental ballistic missiles. More important, is the spirit demonstrated in the space effort. History has not been kind to nations that stagnate in the face of a rising competitor. The desire to succeed is the most important element in any strategy. The NASA strategic plan claims, "Humanity’s interest in the heavens has been universal and enduring. Humans are driven to explore the unknown, discover new worlds, push the boundaries of our scientific and technical limits, and then push further. NASA is tasked with developing the capabilities that will support our country’s long-term human space flight and exploration efforts." But where is the higher national leadership with the vision to back these efforts? The frontier spirit that built America has waned. Both political parties are too busy looking at the mud around their feet to look up at the sky. So much for the "giant leap for mankind" so bravely stated over 40 years ago. But what can be expected in a country where Buzz Aldrin, who with Neil Armstrong were the first men to walk on the Moon, ends up on "Dancing with the Stars" performing for an audience most of whom had never heard of him. Nothing could better portray the decline of American civilization.

And, Continued US Leadership is Necessary for Every Major Impact – the Only Threat to Global Peace is a Collapse of Us Primacy

**Thayer 2006** [Bradley – Pro. of security studies at Missouri State, , “In Defense of Primacy”, *The National Interest*, November/December, p. 32-37]

A grand strategy based on American primacy means ensuring the United States stays the world's number one power‑the diplomatic, economic and military leader. Those arguing against primacy claim that the United States should retrench, ei­ther because the United States lacks the power to maintain its primacy and should withdraw from its global commitments, or because the maintenance of primacy will lead the United States into the trap of "imperial overstretch." In the previous issue of The National Interest, Christopher Layne warned of these dangers of pri­macy and called for retrenchment.1 Those arguing for a grand strategy of retrenchment are a diverse lot. They include isolationists, who want no foreign military commitments; selective engagers, who want U.S. military commitments to centers of economic might; and offshore balancers, who want a modified form of selective engagement that would have the United States abandon its landpower presence abroad in favor of relying on airpower and seapower to defend its in­terests. But retrenchment, in any of its guis­es, must be avoided. If the United States adopted such a strategy, it would be a profound strategic mistake that would lead to far greater instability and war in the world, imperil American security and deny the United States and its allies the benefits of primacy. There are two critical issues in any discussion of America's grand strategy: Can America remain the dominant state? Should it strive to do this? America can remain dominant due to its prodigious military, economic and soft power capa­bilities. The totality of that equation of power answers the first issue. The United States has overwhelming military capa­bilities and wealth in comparison to other states or likely potential alliances. Barring some disaster or tremendous folly, that will remain the case for the foreseeable future. With few exceptions, even those who advocate retrenchment acknowledge this. So the debate revolves around the desirability of maintaining American pri­macy. Proponents of retrenchment focus a great deal on the costs of U.S. action­ but they fall to realize what is good about American primacy. The price and risks of primacy are reported in newspapers every day; the benefits that stem from it are not. A GRAND strategy of ensur­ing American primacy takes as its starting point the protec­tion of the U.S. homeland and American global interests. These interests include ensuring that critical resources like oil flow around the world, that the global trade and monetary regimes flourish and that Washington's worldwide network of allies is reassured and protected. Allies are a great asset to the United States, in part because they shoulder some of its burdens. Thus, it is no surprise to see NATO in Afghanistan or the Australians in East Timor. In contrast, a strategy based on re­trenchment will not be able to achieve these fundamental objectives of the United States. Indeed, retrenchment will make the United States less secure than the present grand strategy of primacy. This is because threats will exist no mat­ter what role America chooses to play in international politics. Washington can­not call a "time out", and it cannot hide from threats. Whether they are terror­ists, rogue states or rising powers, his­tory shows that threats must be confront­ed. Simply by declaring that the United States is "going home", thus abandoning its commitments or making unconvinc­ing half‑pledges to defend its interests and allies, does not mean that others will respect American wishes to retreat. To make such a declaration implies weak­ness and emboldens aggression. In the anarchic world of the animal kingdom, predators prefer to eat the weak rather than confront the strong. The same is true of the anarchic world of interna­tional politics. If there is no diplomatic solution to the threats that confront the United States, then the conventional and strategic military power of the United States is what protects the country from such threats. And when enemies must be confront­ed, a strategy based on primacy focuses on engaging enemies overseas, away from .American soil. Indeed, a key tenet of the Bush Doctrine is to attack terrorists far from America's shores and not to wait while they use bases in other countries to plan and train for attacks against the United States itself. This requires a phys­ical, on‑the‑ground presence that cannot be achieved by offshore balancing. Indeed, as Barry Posen has noted, U.S. primacy is secured because America, at present, commands the "global com­mon"‑‑the oceans, the world's airspace and outer space‑allowing the United States to project its power far from its borders, while denying those common avenues to its enemies. As a consequence, the costs of power projection for the United States and its allies are reduced, and the robustness of the United States' conventional and strategic deterrent ca­pabilities is increased.' This is not an advantage that should be relinquished lightly. A remarkable fact about international politics today‑-in a world where Ameri­can primacy is clearly and unambiguous­ly on display--is that countries want to align themselves with the United States. Of course, this is not out of any sense of altruism, in most cases, but because doing so allows them to use the power of the United States for their own purposes, ­their own protection, or to gain greater influence. Of 192 countries, 84 are allied with America‑-their security is tied to the United States through treaties and other informal arrangements‑and they include almost all of the major economic and military powers. That is a ratio of almost 17 to one (85 to five), and a big change from the Cold War when the ratio was about 1.8 to one of states aligned with the United States versus the Soviet Union. Never before in its history has this coun­try, or any country, had so many allies. U.S. primacy‑-and the bandwagon­ing effect‑has also given us extensive in­fluence in international politics, allowing the United States to shape the behavior of states and international institutions. Such influence comes in many forms, one of which is America's ability to cre­ate coalitions of like‑minded states to free Kosovo, stabilize Afghanistan, invade Iraq or to stop proliferation through the Pro­liferation Security Initiative (PSI). Doing so allows the United States to operate with allies outside of the where it can be stymied by opponents. American‑led wars in Kosovo, Afghanistan and Iraq stand in contrast to the UN's inability to save the people of Darfur or even to conduct any military campaign to realize the goals of its charter. The quiet effec­tiveness of the PSI in dismantling Libya's WMD programs and unraveling the A. Q. Khan proliferation network are in sharp relief to the typically toothless attempts by the UN to halt proliferation. You can count with one hand coun­tries opposed to the United States. They are the "Gang of Five": China, Cuba, Iran, North Korea and Venezeula. Of course, countries like India, for example, do not agree with all policy choices made by the United States, such as toward Iran, but New Delhi is friendly to Washington. Only the "Gang of Five" may be expected to consistently resist the agenda and ac­tions of the United States. China is clearly the most important of these states because it is a rising great power. But even Beijing is intimidated by the United States and refrains from openly challenging U.S. power. China proclaims that it will, if necessary, re­sort to other mechanisms of challenging the United States, including asymmetric strategies such as targeting communica­tion and intelligence satellites upon which the United States depends. But China may not be confident those strategies would work, and so it is likely to refrain from testing the United States directly for the foreseeable future because China's power benefits, as we shall see, from the international order U.S. primacy creates. The other states are far weaker than China. For three of the "Gang of Five" cases‑‑Venezuela, Iran, Cuba‑it is an anti‑U.S. regime that is the source of the problem; the country itself is not intrin­sically anti‑American. Indeed, a change of regime in Caracas, Tehran or Havana could very well reorient relations. THROUGHOUT HISTORY, peace and stability have been great benefits of an era where there was a dominant power‑‑Rome, Britain or the United States today. Schol­ars and statesmen have long recognized the irenic effect of power on the anarchic world of international politics. Everything we think of when we con­sider the current international order‑free trade, a robust monetary regime, increas­ing respect for human rights, growing de­mocratization‑‑is directly linked to U.S. power. Retrenchment proponents seem to think that the current system can be maintained without the current amount of U.S. power behind it. In that they are dead wrong and need to be reminded of one of history's most significant lessons: Appalling things happen when international orders collapse. The Dark Ages fol­lowed Rome's collapse. Hitler succeeded the order established at Versailles. With­out U.S. power, the liberal order cre­ated by the United States will end just as assuredly. As country and western great Rai Donner sang: "You don't know what you've got (until you lose it)." Consequently, it is important to note what those good things are. In addition to ensuring the security of the United States and its allies, American primacy within the international system causes many positive outcomes for Washing­ton and the world. The first has been a more peaceful world. During the Cold War, U.S. leadership reduced friction among many states that were historical antagonists, most notably France and West Germany. Today, American primacy helps keep a number of complicated rela­tionships aligned‑-between Greece and Turkey, Israel and Egypt, South Korea and Japan, India and Pakistan, Indonesia and Australia. This is not to say it fulfills Woodrow Wilson's vision of ending all war. Wars still occur where Washington's interests are not seriously threatened, such as in Darfur, but a Pax Americana does reduce war's likelihood, particularly war's worst form: great power wars. Second, American power gives the United States the ability to spread de­mocracy and other elements of its ideol­ogy of liberalism. Doing so is a source of much good for the countries concerned as well as the United States because, as John Owen noted on these pages in the Spring 2006 issue, liberal democracies are more likely to align with the United States and be sympathetic to the American worldview.3 So, spreading democracy helps maintain U.S. primacy. In addition, once states are governed democratically, the likelihood of any type of conflict is significantly reduced. This is not because democracies do not have clashing inter­ests. Indeed they do. Rather, it is because they are more open, more transparent and more likely to want to resolve things amicably in concurrence with U.S. lead­ership. And so, in general, democratic states are good for their citizens as well as for advancing the interests of the United States. Critics have faulted the Bush Admin­istration for attempting to spread democ­racy in the Middle East, labeling such an effort a modern form of tilting at windmills. It is the obligation of Bush's crit­ics to explain why democracy is good enough for Western states but not for the rest, and, one gathers from the argument, should not even be attempted. Of course, whether democracy in the Middle East will have a peaceful or sta­bilizing influence on America's interests in the short run is open to question. Per­haps democratic Arab states would be more opposed to Israel, but nonetheless, their people would be better off. The United States has brought democracy to Afghanistan, where 8.5 million Af­ghans, 40 percent of them women, voted in a critical October 2004 election, even though remnant Taliban forces threat­ened them. The first free elections were held in Iraq in January 2005. It was the military power of the United States that put Iraq on the path to democracy. Wash­ington fostered democratic governments in Europe, Latin America, Asia and the Caucasus. Now even the Middle East is increasingly democratic. They may not yet look like Western‑style democracies, but democratic progress has been made in Algeria, Morocco, Lebanon, Iraq, Ku­wait, the Palestinian Authority and Egypt. By all accounts, the march of democracy has been impressive. Third, along with the growth in the number of democratic states around the world has been the growth of the glob­al economy. With its allies, the United States has labored to create an economically liberal worldwide network character­ized by free trade and commerce, respect for international property rights, and mo­bility of capital and labor markets. The economic stability and prosperity that stems from this economic order is a glob­al public good from which all states ben­efit, particularly the poorest states in the Third World. The United States created this network not out of altruism but for the benefit and the economic well‑being of America. This economic order forces American industries to be competitive, maximizes efficiencies and growth, and benefits defense as well because the size of the economy makes the defense burden manageable. Economic spin‑offs foster the development of military technology, helping to ensure military prowess. Perhaps the greatest testament to the benefits of the economic network comes from Deepak Lal, a former Indian foreign service diplomat and researcher at the World Bank, who started his ca­reer confident in the socialist ideology of post‑independence India. Abandoning the positions of his youth, Lal now recog­nizes that the only way to bring relief to desperately poor countries of the Third World is through the adoption of free market economic policies and globaliza­tion, which are facilitated through Amer­ican primacy.4 As a witness to the failed alternative economic systems, Lal is one of the strongest academic proponents of American primacy due to the economic prosperity it provides. Fourth and finally, the United States, in seeking primacy, has been willing to use its power not only to advance its interests but to promote the welfare of people all over the globe. The United States is the earth's leading source of positive exter­nalities for the world. The U.S. military has participated in over fifty operations since the end of the Cold War‑‑and most of those missions have been humanitarian in nature. Indeed, the U.S. military is the earth's "911 force"‑it serves, de facto, as the world's police, the global paramedic and the planet's fire department. When­ever there is a natural disaster, earth­quake, flood, drought, volcanic eruption, typhoon or tsunami, the United States assists the countries in need. On the day after Christmas in 2004, a tremendous earthquake and tsunami occurred in the Indian Ocean near Sumatra, killing some 300,000 people. The United States was the first to respond with aid. Washing­ton followed up with a large contribu­tion of aid and deployed the U.S. military to South and Southeast Asia for many months to help with the aftermath of the disaster. About 20,000 U.S. soldiers, sail­ors, airmen and marines responded by providing water, food, medical aid, disease treatment and prevention as well as foren­sic assistance to help identify the bodies of those killed. Only the U.S. military could have accomplished this Herculean effort. No other force possesses the communica­tions capabilities or global logistical reach of the U.S. military. In fact, UN peace­keeping operations depend on the United States to supply UN forces. American generosity has done more to help the United States fight the War on Terror than almost any other measure. Before the tsunami, 80 percent of Indo­nesian public opinion was opposed to the United States; after it, 80 percent had a favorable opinion of America. Two years after the disaster, and in poll after poll, Indonesians still have overwhelmingly positive views of the United States. In October 2005, an enormous earthquake struck Kashmir, killing about 74,000 peo­ple and leaving three million homeless. The U.S. military responded immediate­ly, diverting helicopters fighting the War on Terror in nearby Afghanistan to bring relief as soon as possible. To help those ill need, the United States also provided fi­nancial aid to Pakistan; and, as one might expect from those witnessing the munifi­cence of the United States, it left a last­ing impression about America. For the first time since 9/11, polls of Pakistani opinion have found that more people are favorable toward the United States than unfavorable, while support for Al‑Qaeda dropped to its lowest level. Whether in Indonesia or Kashmir, the money was well‑spent because it helped people in the wake of disasters, but it also had a real impact on the War on Terror. When people in the Muslim world witness the U.S. military conducting a humanitarian mission, there is a clearly positive impact on Muslim opinion of the United States. As the War on Terror is a war of ideas and opinion as much as military action, for the United States humanitarian mis­sions are the equivalent of a blitzkrieg.

Lunar colonization’s key to overall leadership---prevents economic, technological and military collapse

Schmitt et al 9 – Harrison H. Schmitt, geologist, Apollo 17 astronaut, Former Chair NASA Advisory Council, Andy Daga, Lunar surface architecture and technology consultant, and Jeff Plescia, Applied Physics Laboratory, The Johns Hopkins University, 2009, “Geopolitical Context of Lunar Exploration and Settlement,” online: http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf

Moon, Mars, asteroids, and other space locations have attracted international attention as possible targets of interest for peaceful and geopolitical competition in space. Strategically, however, the race for space dominance will be played out on the Moon first and soon. This competition has long-term implications for the future of liberty on Earth as well as for understanding the history and evolution of the solar system.

If non-democratic regimes, such as China or Russia, dominate exploration and settlement of the Moon, liberty will be at risk. Only the United States and its democratic partners can assure the elimination of this space-related risk to liberty. If we abandon leadership in accessing the resource, science and settlement potential of our nearest neighbor to the any other nation or group of nations, particularly a non-democratic regime, the ability for the United States and its allies to protect themselves and liberty for the world will be at great risk. To others would accrue the benefits – psychological, political, economic and scientific – that the United States harvested as a consequence of Apollo's success 40 years ago. This lesson has not been lost on our intellectual, ideological and economic competitors.

The investment of money and intellectual capital in going back to the Moon, permanently, brings with it, not merely geopolitical high ground and prestige of physically being there, but constitutes a deliberate pathway to economic advancement. We need such an effort to grow our economic and technological base. The dividends paid by a return to the Moon will be seen in growth of our intellectual and technical capability and in outpacing others who do not go or in competing on equal terms with those who do. More will result from our efforts than the obvious advantage that comes from having an Saturn-class heavy lifter. A myriad of discoveries are bound to accompany lunar exploration, including astronomical and physical science, in opening the potential of extraterrestrial resource utilization, in developing new energy resources, and in many other areas. At stake are more than mere spin-offs of technology. At stake is access to transformational discovery.

Growth or stagnation forms the crossroads decision facing our country. Protection of human liberty depends on the affirmative decision to grow. For growth to occur the intellectual system of America must be stressed and problems that appear intractable must be solved. For example, history ties the expansion of democracy to a people's access to energy to drive economic. Comparable transformations await in space.

1AC---He3 Advantage

Lunar Exploration and Settlements are key to He3 mining and US Space Leadership

**Jeffrey 5/26** (Terrence P Jeffrey, Editor in Chief of CNS News, “Former Moon Astronaut and Senator: U.S. Should Settle Moon and Mars” <http://www.cnsnews.com/news/article/former-moon-astronaut-and-senator-us-sho>, 5/26/2011) SV

He now believes America’s political leadership, and particularly the Obama administration, has lost sight of the importance of the United States leading the world in space exploration. Schmitt believes that reinvigorating the U.S. manned space program would not only yield practical benefits but lift up the hope that America’s unique vision of liberty—as opposed to other political visions--will be carried with the human race to places such as the moon and Mars. When asked whether he believes that a sense of patriotism and the idea that America should be first has been drained out of the space program, Schmitt said: “Well, it certainly has been drained out of the national leadership, particularly the Obama administration. I don’t think it has drained out of the American people. Space is still very exciting to them. I think the vast majority recognize that the United States represents liberty and freedom on this planet and if it is not competitive in space, well then, liberty and freedom are in further jeopardy than they are for other reasons.” “The NSEA [National Space Exploration Administration] would be given the charter to explore deep space, which includes the moon, to settle the moon, and ultimately potentially to settle Mars, and to help the private sector utilize the resources, the energy resources in particular, that we find on the moon,” said Schmitt. “Its primary focus--almost single-minded focus--should be on building the space launch vehicles, the spacecraft, and the operational capability to work at the moon, distances of the moon, and ultimately to Mars and beyond,” he said. Schmitt says that in the long-term the moon “would be another location for the forces of freedom to, I think, grow and prosper.” In the nearer term he believes that the U.S. could retrieve Helium-3 from the moon, an isotope that is abundant on the lunar surface and that Schmitt says is an ideal fuel for nuclear fusion reactors that could create electricity without creating radioactive spent fuel. “More immediately such a [lunar] settlement would be able to supply the Earth with very important clean energy in the form of a light isotope of Helium called Helium-3,” said Schmitt. “That is a literally ideal fuel for nuclear fusion reactors.”

**Timing is crucial -- first come first serve means now is Key**

**Lasker 6** (John Lasker, Freelance Journalist-Major contributor for magazines (eg. Wired & Christian Science Monitor), “Race to the Moon for Nuclear Fuel”, <http://www.wired.com/science/space/news/2006/12/72276?currentPage=all>, 12/15/2006) SV

"After four-and-half-billion years, there should be large amounts of helium-3 on the moon," said Gerald Kulcinski, a professor who leads the Fusion Technology Institute at the University of Wisconsin at Madison. Last year NASA administrator Mike Griffin named Kulcinski to lead a number of committees reporting to NASA's influential NASA Advisory Council, its preeminent civilian leadership arm. The Council is chaired by *Apollo 17* astronaut Harrison Hagan "Jack" Schmitt, a leading proponent of mining the moon for helium 3. Schmitt, who holds the distance record for driving a NASA rover on the moon (22 miles through theTaurus-Littrow valley), is also a former U.S. senator (R-New Mexico). The Council was restructured last year with a new mission: implementing President Bush's "Vision for Space Exploration," which targets Mars as its ultimate destination. Other prominent members of the Council include ex-astronaut Neil Armstrong. Schmitt and Kulcinski are longtime friends and academic partners, and are known as helium-3 fusion's biggest promoters. At the Fusion Technology Institute, Kulcinski's team has produced small-scale helium-3 fusion reactions in the basketball-sized fusion device. The reactor produced one milliwatt of power on a continuous basis. While still theoretical, nuclear fusion is touted as a safer, more sustainable way to generate nuclear energy: Fusion plants produce much less radioactive waste, especially if powered by helium-3. But experts say commercial-sized fusion reactors are at least 50 years away. The isotope is extremely rare on Earth but abundant on the moon. Some experts estimate there a millions of tons in lunar soil -- and that a single Space-Shuttle load would power the entire United States for a year. NASA plans to have a permanent moon base by 2024, but America is not the only nation with plans for a moon base. China, India, the European Space Agency, and at least one Russian corporation, Energia, have visions of building manned lunar bases post-2020. Mining the moon for helium-3 has been discussed widely in space circles and international space conferences. Both China and Russia have stated their nations' interest in helium-3. "We will provide the most reliable report on helium-3 to mankind," Ouyang Ziyuan, the chief scientist of China's lunar program, told a Chinese newspaper. "Whoever first conquers the moon will benefit first."

Control of He3 Resources is Key to Prevent Future Resource Wars

Lasker 10 (John Lasker, Freelance Journalist-Major contributor for magazines (eg. Wired & Christian Science Monitor), "Technoir", <http://www.godlikeproductions.com/forum1/message1363174/pg1>, 4/3/2010) SV

Back in 1998, representatives from Halliburton and Shell met with officials from NASA to talk, practically in secret. At Los Alamos, NM, no less, home to some of the most radical and exotic US military research ever. They met over the prospects of drilling on Mars and the Moon. From that meeting, Halliburton – the oilfields technology and services corporation once ran by Dick Chaney – came away with the idea of building a drill specifically for our two closest celestial bodies. Why build a drill for the Red Planet and the Harvest Moon? And why “No-bid” Halliburton? Which still has a strong connection to one of its greatest beneficiary's, Dick Chaney, of course. Yes, that US Vice President, the one who tricked the world into thinking the US needed to invade Iraq for Weapons of Mass Destruction. Bruce Gagnon, the space weapons expert who runs The Global Network Against Weapons and Nuclear Power in Space, asks a rhetorical question: “Why do you think Halliburton is building a drill for Mars and the Moon?” To monopolize the untold resources Mars and the Moon might offer? The question nearly answers itself, says Gagnon. “There’s going to be a scramble for the moon by the Chinese, the Russians and the Americans. This is real. There’s going to be a conflict over it,” he says. “Who controls the moon is going to be rich by unimaginable amounts.” Perhaps those cards are in the future for mankind. But certainly mankind has history on its side as a warning. History in the form of an Iraqi insurgency. The Iraq insurgency erupted, in part, over Dick Chaney and his neo-con’s plans to privatize all of Iraq’s industries, including oil, which would be taken over by American oil giants such as Shell and Exxon. And while some may think that thousands of US troops and Iraqi civilians died in vain due to the Iraqi insurgency, perhaps their souls won't allow Chaney’s legacy and his offspring to trick us again. Hopefully on this planet and beyond. This doesn’t mean, however, there won’t be a future when man goes to war on the very surface and within the orbits of Mars and the Moon so to control the resources that can be mined and flown back to Earth. In fact, man has already predicted such a conflict will take place. In 1995, in a New York Times op-ed written by science writer Lawrence Joseph, he asks the question, “Will the Moon become the Persian Gulf of the 21st Century? And if the US does not take action in regards to the Moon, the nation could slip behind in the race for control of the global economy, and our destiny beyond.” Coincidently, late in 2009, a US Air Force recruiting commercial claiming their technology isn't “science fiction”, shows US troops tactically moving across a red and barren landscape that looks too much like Mars. Resource wars will either end when the human race becomes extinct, or rage on forever and ever as humans migrate across the universe. A migration Carl Sagan predicted will undoubtedly occur because of man’s unwaivering desire to survive, he theorized. But Sagan also conceded that our collective stupidity might do us in before we even migrate off the planet. The irony is, it might just be a resource war that ends the human race

Resource wars cause extinction

Klare 6 (Michael T. Klare Ph.D, Professor of peace and world security studies at Hampshire University, “The Coming Resource Wars” http://www.alternet.org/story/33243/the\_coming\_resource\_wars, 3/10/2006)SV

It's official: the era of resource wars is upon us. In a major London address, British Defense Secretary John Reid warned that global climate change and dwindling natural resources are combining to increase the likelihood of violent conflict over land, water and energy. Climate change, he indicated, "will make scarce resources, clean water, viable agricultural land even scarcer" -- and this will "make the emergence of violent conflict more rather than less likely." Although not unprecedented, Reid's prediction of an upsurge in resource conflict is significant both because of his senior rank and the vehemence of his remarks. "The blunt truth is that the lack of water and agricultural land is a significant contributory factor to the tragic conflict we see unfolding in Darfur," he declared. "We should see this as a warning sign." Resource conflicts of this type are most likely to arise in the developing world, Reid indicated, but the more advanced and affluent countries are not likely to be spared the damaging and destabilizing effects of global climate change. With sea levels rising, water and energy becoming increasingly scarce and prime agricultural lands turning into deserts, internecine warfare over access to vital resources will become a global phenomenon. Reid's speech, delivered at the prestigious Chatham House in London (Britain's equivalent of the Council on Foreign Relations), is but the most recent expression of a growing trend in strategic circles to view environmental and resource effects -- rather than political orientation and ideology -- as the most potent source of armed conflict in the decades to come. With the world population rising, global consumption rates soaring, energy supplies rapidly disappearing and climate change eradicating valuable farmland, the stage is being set for persistent and worldwide struggles over vital resources. Religious and political strife will not disappear in this scenario, but rather will be channeled into contests over valuable sources of water, food and energy. Prior to Reid's address, the most significant expression of this outlook was a report prepared for the U.S. Department of Defense by a California-based consulting firm in October 2003. Entitled "An Abrupt Climate Change Scenario and Its Implications for United States National Security," the report warned that global climate change is more likely to result in sudden, cataclysmic environmental events than a gradual (and therefore manageable) rise in average temperatures. Such events could include a substantial increase in global sea levels, intense storms and hurricanes and continent-wide "dust bowl" effects. This would trigger pitched battles between the survivors of these effects for access to food, water, habitable land and energy supplies. "Violence and disruption stemming from the stresses created by abrupt changes in the climate pose a different type of threat to national security than we are accustomed to today," the 2003 report noted. "Military confrontation may be triggered by a desperate need for natural resources such as energy, food and water rather than by conflicts over ideology, religion or national honor." Until now, this mode of analysis has failed to command the attention of top American and British policymakers. For the most part, they insist that ideological and religious differences -- notably, the clash between values of tolerance and democracy on one hand and extremist forms of Islam on the other -- remain the main drivers of international conflict. But Reid's speech at Chatham House suggests that a major shift in strategic thinking may be under way. Environmental perils may soon dominate the world security agenda. This shift is due in part to the growing weight of evidence pointing to a significant human role in altering the planet's basic climate systems. Recent studies showing the rapid shrinkage of the polar ice caps, the accelerated melting of North American glaciers, the increased frequency of severe hurricanes and a number of other such effects all suggest that dramatic and potentially harmful changes to the global climate have begun to occur. More importantly, they conclude that human behavior -- most importantly, the burning of fossil fuels in factories, power plants, and motor vehicles -- is the most likely cause of these changes. This assessment may not have yet penetrated the White House and other bastions of head-in-the-sand thinking, but it is clearly gaining ground among scientists and thoughtful analysts around the world. For the most part, public discussion of global climate change has tended to describe its effects as an environmental problem -- as a threat to safe water, arable soil, temperate forests, certain species and so on. And, of course, climate change is a potent threat to the environment; in fact, the greatest threat imaginable. But viewing climate change as an environmental problem fails to do justice to the magnitude of the peril it poses. As Reid's speech and the 2003 Pentagon study make clear, the greatest danger posed by global climate change is not the degradation of ecosystems per se, but rather the disintegration of entire human societies, producing wholesale starvation, mass migrations and recurring conflict over resources. "As famine, disease, and weather-related disasters strike due to abrupt climate change," the Pentagon report notes, "many countries' needs will exceed their carrying capacity" -- that is, their ability to provide the minimum requirements for human survival. This "will create a sense of desperation, which is likely to lead to offensive aggression" against countries with a greater stock of vital resources. "Imagine eastern European countries, struggling to feed their populations with a falling supply of food, water, and energy, eyeing Russia, whose population is already in decline, for access to its grain, minerals, and energy supply." Similar scenarios will be replicated all across the planet, as those without the means to survival invade or migrate to those with greater abundance -- producing endless struggles between resource "haves" and "have-nots." It is this prospect, more than anything, that worries John Reid. In particular, he expressed concern over the inadequate capacity of poor and unstable countries to cope with the effects of climate change, and the resulting risk of state collapse, civil war and mass migration. "More than 300 million people in Africa currently lack access to safe water," he observed, and "climate change will worsen this dire situation" -- provoking more wars like Darfur. And even if these social disasters will occur primarily in the developing world, the wealthier countries will also be caught up in them, whether by participatin9g in peacekeeping and humanitarian aid operations, by fending off unwanted migrants or by fighting for access to overseas supplies of food, oil, and minerals. When reading of these nightmarish scenarios, it is easy to conjure up images of desperate, starving people killing one another with knives, staves and clubs -- as was certainly often the case in the past, and could easily prove to be so again. But these scenarios also envision the use of more deadly weapons. "In this world of warring states," the 2003 Pentagon report predicted, "nuclear arms proliferation is inevitable." As oil and natural gas disappears, more and more countries will rely on nuclear power to meet their energy needs -- and this "will accelerate nuclear proliferation as countries develop enrichment and reprocessing capabilities to ensure their national security." Although speculative, these reports make one thing clear: when thinking about the calamitous effects of global climate change, we must emphasize its social and political consequences as much as its purely environmental effects. Drought, flooding and storms can kill us, and surely will -- but so will wars among the survivors of these catastrophes over what remains of food, water and shelter. As Reid's comments indicate, no society, however affluent, will escape involvement in these forms of conflict.

1AC---Inherency/Uniqueness

Current U.S. space policy abandons the goal of bringing human settlements to the Moon or Mars---will collapse the overall U.S. lead in space

PM 10 – Popular Mechanics, March 9, 2010, “What Happens If NASA's Constellation Program Dies?,” online: http://www.popularmechanics.com/science/space/nasa/4343791

The legacy of the era could become evident in a decade, when India or China succeeds in returning humanity to the moon. This achievement meant something for national prestige and scientific innovation in the 1960s and it means similar things now. NASA has long been a cradle for innovation as well as innovators. Without the appeal of a human flight program, will fewer aspiring scientists and engineers be lured into the agency and towards military and private space? Will the research end of NASA suffer from this lack of inspirational purpose? What are the geopolitical ramifications, if any, of this waning of American power?

4) What will the next big launch vehicle look like? And when will it be ready?

NASA is seeking alternative ideas for a new heavy-lifting launch vehicle, a move that increased the odds that Ares V is considered doomed by NASA. Will the agency adapt military rockets, build a new launch vehicle from scratch or adapt components from the Space Shuttle program to make a new design from established parts (and possibly save jobs from existing production lines)? When will this new craft be ready, anyway, and what will it be used for? This debate was settled with Constellation—a reassessment will be delayed by political and engineering debates.

5) Are NASA astronauts going extinct?

Heroic Explorers Wanted: Only Robots Need Apply. NASA's most exciting missions to other planets are based on robotic probes. For example, the agency is now evaluating three interplanetary missions, all of which involve sending robots to explore in our stead. The winner of the ongoing contest will receive $650 million to send a probe either to the moon, to Venus or to an asteroid, ready to launch by 2018. That's a pretty good value compared to Constellation, but colonization is the next historic step into space, and without a human space flight program, any extra-planetary colony under a U.S. flag will be populated by robots. Or a NASA astronaut will be visiting the Chinese or Indian moonbase.

1AC---Solvency

Declaring a mandate for NASA sets the overall purpose for the mission---NASA’s development process is adaptive and effective

Correll 5 – Randall R. Correll, national security consultant with Science Applications International Company, and Nicholas Peter, 2005, “Odyssey: Principles for enduring space exploration,” Space Policy, Vol. 21, p. 251-258

The most debilitating obstacle would be lack of compelling purpose. The human instinct to explore is, in itself, not sufficient to justify the public treasure that will be required. Neither is scientific gain, in itself, commensurate with the anticipated cost of publicly funded human space flight. NASA has not yet articulated how it will develop the objectives and purpose of lunar and Martian missions, laboratories, observatories and bases. Many of these decisions do not need to be made immediately and, following the metaprinciples of open-systems architectures, should not be forced prematurely. However, the process should begin among NASA, academia, industry, the public and the international community to debate the specific activities that will define the content of the program. Without visible progress in the development of compelling purpose, the exploration vision is not likely to endure, nor should it.

Moon colonies are possible-We have the tech

Tapping the Wealth of the Moon Klaus P Heiss. The Journal of Social, Political, and Economic Studies. Washington: Spring 2004. Vol. 29, Iss. 1; pg. 3, 62 pgs

The 'locational' advantages of "Space Station Moon" include that: \* It is a massive, 'airless', stable platform. \* It has an unlimited supply of solar energy hitting its surface and immediate surrounds -an energy potential of about 1.3 KW per square meter (!) at an average of 1 AU. More 'impressive' is that in but ten days more solar energy 'hits' the surface of the Moon than all the known global fossil fuel resources accumulated over eons past on Earth! Without an atmosphere the energy is there for the taking. \* It can serve as an ideal platform for emplacing nuclear reactors and missions using these power sources in a variety of novel Space missions. Use of any number of Prometheus size reactor modules will allow any level of foreseeable power supplies as an alternative to or complement to solar power plants. \* It could also serve potentially as an ideal testbed for 'clean' fusion RDT&E using the 'captured' 3He in Lunar soils 'clean' insofar as fusion processes using 3He generate as their major byproduct deuterium rather than the exceedingly volatile contaminating byproduct tritium associated with 'conventional' fusion processes.'' \* It has only a sixth of Earth's gravity enabling major reductions in transport energy required (and associated delta-V) for many important operations. \* It has most material resources needed for Space and Lunar structures and operations, including some of the direly needed water resources (hydrogen in particular). \* Last but not least, it is only a very short distance from Earth (in 'time' and 'delta V), indeed the Moon is part of 'Earth Space' and an ideal platform to observe all of Cis-Lunar space across the full electromagnetic spectrum.

Mars Colonization is possible-We have the tech

**Bollard, 10** (Pat, Formor Marine, The War Starts Here, Scientists Urge Immediate Colonization of Mars, http://patdollard.com/2010/11/scientists-urge-immediate-colonization-of-mars/, JG)

Mars is a six-month flight away, possesses surface gravity, an atmosphere, abundant water, carbon dioxide and essential minerals. They propose the missions start by sending two two-person teams, in separate ships, to Mars. More colonists and regular supply ships would follow. The technology already exists, or is within easy reach, they wrote. An official for NASA said the space agency envisions manned missions to Mars in the next few decades, but that the planning decidedly involves round trips. President Obama informed NASA last April that he “‘believed by the mid-2030s that we could send humans to orbit Mars and safely return them to Earth. And that a landing would soon follow,’” said agency spokesman Michael Braukus. No where did Obama suggest the astronauts be left behind. “We want our people back,” Braukus said. Retired Apollo 14 astronaut Ed Mitchell, who walked on the Moon, was also critical of the one-way idea. “This is premature,” Mitchell wrote in an e-mail. “We aren’t ready for this yet.” Davies and Schulze-Makuch say it’s important to realize they’re not proposing 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 wrote, while acknowledging the proposal is a tough sell for NASA, with its intense focus on safety. They think the private sector might be a better place to try their plan. “What we would need is an eccentric billionaire,” Schulze-Makuch said. “There are people who have the money to put this into reality.” Indeed, British tycoon Richard Branson, PayPal founder Elon Musk and Amazon.com Inc. CEO Jeff Bezos are among the rich who are involved in private space ventures. Isolated humans in space have long been a staple of science fiction movies, from “Robinson Crusoe on Mars” to “2001: A Space Odyssey” to a flurry of recent movies such as “Solaris” and “Moon.” In many of the plots, the lonely astronauts fall victim to computers, madness or aliens. Psychological profiling and training of the astronauts, plus constant communication with Earth, will reduce debilitating mental strains, the two scientists said. “They would in fact feel more connected to home than the early Antarctic explorers,” according to the article. But the mental health of humans who spent time in space has been extensively studied. Depression can set in, people become irritated with each other, and sleep can be disrupted, the studies have found. The knowledge that there is no quick return to Earth would likely make that worse. Davies is a physicist whose research focuses on cosmology, quantum field theory, and astrobiology. He was an early proponent of the theory that life on Earth may have come from Mars in rocks ejected by asteroid and comet impacts. Schulze-Makuch works in the Earth Sciences department at WSU and is the author of two books about life on other planets. His focus is eco-hydrogeology, which includes the study of water on planets and moons of our solar system and how those could serve as a potential habitat for microbial life. The peer-reviewed Journal of Cosmology covers astronomy, astrobiology, Earth sciences and life. Schulze-Makuch and Davies contend that Mars has abundant resources to help the colonists become self-sufficient over time. The colony should be next to a large ice cave, to provide shelter from radiation, plus water and oxygen, they wrote. They believe the one-way trips could start in two decades. “You would send a little bit older folks, around 60 or something like that,” Schulze-Makuch said, bringing to mind the aging heroes who save the day in “Space Cowboys.” That’s because the mission would undoubtedly reduce a person’s lifespan, from a lack of medical care and exposure to radiation. That radiation would also damage human reproductive organs, so sending people of childbearing age is not a good idea, he said. There have been seniors in space, including John Glenn, who was 77 when he flew on the space shuttle in 1998. Still, Schulze-Makuch believes many people would be willing to make the sacrifice. The Mars base would offer humanity a “lifeboat” in the event Earth becomes uninhabitable, they said. “We are on a vulnerable planet,” Schulze-Makuch said. “Asteroid impact can threaten us, or a supernova explosion. If we want to survive as a species, we have to expand into the solar system and likely beyond.”

Orbital Colonies are possible-BioHomes

Prado 2002. (Mark Prado has had a variety of jobs in different space organizations including things like NASA, SSI, etc. He went to school majoring in physics. <http://www.permanent.com/s-orbit.htm>) hss

In 1989, NASA completed a small facility called BioHome, which integrated "biogenerative" components for recycling air, water and nutrients from human wastes -- into a single, integrated habitat. Maximum air closure was achieved, and experiments were begun, which continue to date. A little larger than a mobile home, the facility put living quarters in a compartment beside the crops and waste processing facilities, circulating air and water between them. Drinkable water was taken from air condensate. The facility initially focussed on wastewater treatment. Aquatic and semi-aquatic plants known for their ability to process sewage were studied. These were not edible plants, but were instead aquatic and semi-aquatic plants chosen for their history in making excellent compost material for food plants, after they grow based on the sewage. After growing to a certain size, they are harvested, cleaned and composted. This compost has been used as a complete growth media for tomatoes, sorghum, corn, potatoes, cucumbers and squash. The facility grew edible plants, though that information was not available on the web at the time of this writing. PVC pipes slowly moved sewage downstream. The pipes had holes cut in them in which the plants were emplaced. Experiments measured the effectiveness of several plants, each of which can utilize raw human sewage as a complete growth media. Samples of the water were taken at different points in the flow and studied. In the end, the effluent water flowed through an ultraviolet unit to assure complete kill of all microorganisms, especially those pathogenic to humans. This water was then suitable for use in toilets and watering plants. Drinking water came from condensate from the air (e.g., dehumidifier and air conditioner condensate), which was also disinfected by ultraviolet equipment. The plant leaves emitted quite ample supplies of water vapors. It was also found that the plants purified the air of many manmade substances such as formaldehyde, benzene, toluene and other undesirable organics. Foliage plants were placed throughout the living quarters for absorbing the gases from the newly constructed and furnished facility.

\*\*\*Colonization Advantage\*\*\*

Colonization Advantage---1AC

Extinction is Inevitable:

A. Super volcanoes

**Britt 5** (Robert Roy Britt, Livescience Senior Writer, “Super volcanoes will chill the world someday”, http://www.msnbc.msn.com/id/7129908/, 3/8/2005)SV

The eruption of a super volcano "sooner or later" will chill the planet and threaten human civilization, British scientists warned Tuesday. And now the bad news: There's not much anyone can do about it. Several volcanoes around the world are capable of gigantic eruptions unlike anything witnessed in recorded history, based on geologic evidence of past events, the scientists said. Such eruptions would dwarf those of Mount St. Helens, Krakatoa, Pinatubo and anything else going back dozens of millennia. "Super eruptions are up to hundreds of times larger than these," said Stephen Self of Britain's Open University. "An area the size of North America can be devastated, and pronounced deterioration of global climate would be expected for a few years following the eruption," Self said. "They could result in the devastation of world agriculture, severe disruption of food supplies, and mass starvation. These effects could be sufficiently severe to threaten the fabric of civilization." Self and his colleagues at the Geological Society of London presented their report to the British government's Natural Hazard Working Group. "Although very rare, these events are inevitable, and at some point in the future humans will be faced with dealing with and surviving a super eruption," Stephen Sparks of the University of Bristol told LiveScience in advance of Tuesday's announcement. Supporting evidence The warning is not new. Geologists in the United States detailed a similar scenario in 2001, when they found evidence suggesting volcanic activity in Yellowstone National Park will eventually lead to a colossal eruption. Half the United States will be covered in ash up to 3 feet (1 meter) deep, according to a study published in the journal Earth and Planetary Science Letters. Explosions of this magnitude "happen about every 600,000 years at Yellowstone," says Chuck Wicks of the U.S. Geological Survey, who has studied the possibilities in separate work. "And it's been about 620,000 years since the last super explosive eruption there." Past volcanic catastrophes at Yellowstone and elsewhere remain evident as giant collapsed basins called calderas. A super eruption is a scaled up version of a typical volcanic outburst, Sparks explained. Each is caused by a rising and growing chamber of hot molten rock known as magma. "In super eruptions the magma chamber is huge," Sparks said. The eruption is rapid, occurring in a matter of days. "When the magma erupts the overlying rocks collapse into the chamber, which has reduced its pressure due to the eruption. The collapse forms the huge crater." The eruption pumps dust and chemicals into the atmosphere for years, screening the Sun and cooling the planet. Earth is plunged into a perpetual winter, some models predict, causing many plant and animal species to disappear forever. "The whole of a continent might be covered by ash, which might take many years — possibly decades — to erode away and for vegetation to recover," Sparks said. Yellowstone may be winding down geologically, experts say. But they believe it harbors at least one final punch. Globally, there are still plenty of possibilities for super volcano eruptions, even as Earth quiets down over the long haul of its 4.5-billion-year existence. "The earth is of course losing energy, but at a very slow rate, and the effects are only really noticeable over billions rather than millions of years," Sparks said. Human impact The odds of a globally destructive volcano explosion in any given century are extremely low, and no scientist can say when the next one will occur. But the chances are five to 10 times greater than a globally destructive asteroid impact, according to the new British report. The next super eruption, whenever it occurs, might not be the first one humans have dealt with. About 74,000 years ago, in what is now Sumatra, a volcano called Toba blew with a force estimated at 10,000 times that of Mount St. Helens. Ash darkened the sky all around the planet. Temperatures plummeted by up to 21 degrees at higher latitudes, according to research by Michael Rampino, a biologist and geologist at New York University. Rampino has estimated three-quarters of the plant species in the Northern Hemisphere perished. Stanley Ambrose, an anthropologist at the University of Illinois, suggested in 1998 that Rampino's work might explain a curious bottleneck in human evolution: The blueprints of life for all humans — DNA — are remarkably similar, given that our species branched off from the rest of the primate family tree a few million years ago. Ambrose has said early humans were perhaps pushed to the edge of extinction after the Toba eruption — around the same time folks got serious about art and tool making. Perhaps only a few thousand survived. Humans today would all be descended from these few, and in terms of the genetic code, not a whole lot would change in 74,000 years. Sitting ducks Based on the latest evidence, eruptions the size of the giant Yellowstone and Toba events occur at least every 100,000 years, Sparks said, "and it could be as high as every 50,000 years. There are smaller but nevertheless huge eruptions which would have continental to global consequences every 5,000 years or so." Unlike other threats to humanity — asteroids, nuclear attacks and global warming, to name a few — there's little to be done about a super volcano. "While it may in future be possible to deflect asteroids or somehow avoid their impact, even science fiction cannot produce a credible mechanism for averting a super eruption," the new report states. "No strategies can be envisaged for reducing the power of major volcanic eruptions." The Geological Society of London has issued similar warnings going back to 2000. The scientists this week called for more funding to investigate further the history of super eruptions and their likely effects on the planet and on modern society. "Sooner or later a super eruption will happen on Earth, and this issue also demands serious attention," the report concludes.

B. Overpopulation

Mcdougall et al 7 (Rosamund Mcdougall, Co-Chair of the Optimum Population Trust and Joint Policy Director, “Too many people: Earth’s population problem”, Optimum Population Trust, http://www.optimumpopulation.org/opt.earth.html, 6/7/2007)SV

The Earth faces a future of rising populations and growing strains on the planet. Whatever else the future holds, significant population increase is inevitable and the current UN forecast of 9.2 billion by 2050 – itself a 40 per cent increase on the 6.7 billion in 2007 – may turn out to be an underestimate. The environmental damage resulting from population increase is already widespread and serious, ranging from climate change to shortages of basic resources such as food and water. By 2050, humanity is likely to require the biological capacity of two Earths. Without action, longages of humans – the prime cause of all shortages of resources – may cause parts of the planet to become uninhabitable, with governments pushed towards coercive population control measures as a regrettable but lesser evil than conflict and suffering.

C. Environmental damage, Climate change and resource wars

**Klare 6** (Michael T. Klare Ph.D, Professor of peace and world security studies at Hampshire University, “The Coming Resource Wars” http://www.alternet.org/story/33243/the\_coming\_resource\_wars, 3/10/2006)SV

It's official: the era of resource wars is upon us. In a major London address, British Defense Secretary John Reid warned that global climate change and dwindling natural resources are combining to increase the likelihood of violent conflict over land, water and energy. Climate change, he indicated, "will make scarce resources, clean water, viable agricultural land even scarcer" -- and this will "make the emergence of violent conflict more rather than less likely." Although not unprecedented, Reid's prediction of an upsurge in resource conflict is significant both because of his senior rank and the vehemence of his remarks. "The blunt truth is that the lack of water and agricultural land is a significant contributory factor to the tragic conflict we see unfolding in Darfur," he declared. "We should see this as a warning sign." Resource conflicts of this type are most likely to arise in the developing world, Reid indicated, but the more advanced and affluent countries are not likely to be spared the damaging and destabilizing effects of global climate change. With sea levels rising, water and energy becoming increasingly scarce and prime agricultural lands turning into deserts, internecine warfare over access to vital resources will become a global phenomenon. Reid's speech, delivered at the prestigious Chatham House in London (Britain's equivalent of the Council on Foreign Relations), is but the most recent expression of a growing trend in strategic circles to view environmental and resource effects -- rather than political orientation and ideology -- as the most potent source of armed conflict in the decades to come. With the world population rising, global consumption rates soaring, energy supplies rapidly disappearing and climate change eradicating valuable farmland, the stage is being set for persistent and worldwide struggles over vital resources. Religious and political strife will not disappear in this scenario, but rather will be channeled into contests over valuable sources of water, food and energy. Prior to Reid's address, the most significant expression of this outlook was a report prepared for the U.S. Department of Defense by a California-based consulting firm in October 2003. Entitled "An Abrupt Climate Change Scenario and Its Implications for United States National Security," the report warned that global climate change is more likely to result in sudden, cataclysmic environmental events than a gradual (and therefore manageable) rise in average temperatures. Such events could include a substantial increase in global sea levels, intense storms and hurricanes and continent-wide "dust bowl" effects. This would trigger pitched battles between the survivors of these effects for access to food, water, habitable land and energy supplies. "Violence and disruption stemming from the stresses created by abrupt changes in the climate pose a different type of threat to national security than we are accustomed to today," the 2003 report noted. "Military confrontation may be triggered by a desperate need for natural resources such as energy, food and water rather than by conflicts over ideology, religion or national honor." Until now, this mode of analysis has failed to command the attention of top American and British policymakers. For the most part, they insist that ideological and religious differences -- notably, the clash between values of tolerance and democracy on one hand and extremist forms of Islam on the other -- remain the main drivers of international conflict. But Reid's speech at Chatham House suggests that a major shift in strategic thinking may be under way. Environmental perils may soon dominate the world security agenda. This shift is due in part to the growing weight of evidence pointing to a significant human role in altering the planet's basic climate systems. Recent studies showing the rapid shrinkage of the polar ice caps, the accelerated melting of North American glaciers, the increased frequency of severe hurricanes and a number of other such effects all suggest that dramatic and potentially harmful changes to the global climate have begun to occur. More importantly, they conclude that human behavior -- most importantly, the burning of fossil fuels in factories, power plants, and motor vehicles -- is the most likely cause of these changes. This assessment may not have yet penetrated the White House and other bastions of head-in-the-sand thinking, but it is clearly gaining ground among scientists and thoughtful analysts around the world. For the most part, public discussion of global climate change has tended to describe its effects as an environmental problem -- as a threat to safe water, arable soil, temperate forests, certain species and so on. And, of course, climate change is a potent threat to the environment; in fact, the greatest threat imaginable. But viewing climate change as an environmental problem fails to do justice to the magnitude of the peril it poses. As Reid's speech and the 2003 Pentagon study make clear, the greatest danger posed by global climate change is not the degradation of ecosystems per se, but rather the disintegration of entire human societies, producing wholesale starvation, mass migrations and recurring conflict over resources. "As famine, disease, and weather-related disasters strike due to abrupt climate change," the Pentagon report notes, "many countries' needs will exceed their carrying capacity" -- that is, their ability to provide the minimum requirements for human survival. This "will create a sense of desperation, which is likely to lead to offensive aggression" against countries with a greater stock of vital resources. "Imagine eastern European countries, struggling to feed their populations with a falling supply of food, water, and energy, eyeing Russia, whose population is already in decline, for access to its grain, minerals, and energy supply." Similar scenarios will be replicated all across the planet, as those without the means to survival invade or migrate to those with greater abundance -- producing endless struggles between resource "haves" and "have-nots." It is this prospect, more than anything, that worries John Reid. In particular, he expressed concern over the inadequate capacity of poor and unstable countries to cope with the effects of climate change, and the resulting risk of state collapse, civil war and mass migration. "More than 300 million people in Africa currently lack access to safe water," he observed, and "climate change will worsen this dire situation" -- provoking more wars like Darfur. And even if these social disasters will occur primarily in the developing world, the wealthier countries will also be caught up in them, whether by participatin9g in peacekeeping and humanitarian aid operations, by fending off unwanted migrants or by fighting for access to overseas supplies of food, oil, and minerals. When reading of these nightmarish scenarios, it is easy to conjure up images of desperate, starving people killing one another with knives, staves and clubs -- as was certainly often the case in the past, and could easily prove to be so again. But these scenarios also envision the use of more deadly weapons. "In this world of warring states," the 2003 Pentagon report predicted, "nuclear arms proliferation is inevitable." As oil and natural gas disappears, more and more countries will rely on nuclear power to meet their energy needs -- and this "will accelerate nuclear proliferation as countries develop enrichment and reprocessing capabilities to ensure their national security." Although speculative, these reports make one thing clear: when thinking about the calamitous effects of global climate change, we must emphasize its social and political consequences as much as its purely environmental effects. Drought, flooding and storms can kill us, and surely will -- but so will wars among the survivors of these catastrophes over what remains of food, water and shelter. As Reid's comments indicate, no society, however affluent, will escape involvement in these forms of conflict.

Colonization Advantage---1AC

Space colonization prevents every future extinction scenario.

Huang 5 (Michael Huang, editor of Spaceflight or Extinction, April 11, 2005, “The top three reasons for humans in space,” online:<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.

Colonization Advantage---Extn: Extinction Inevitable

Space colonization must be a first priority to save humankind.

Falconi 81 (Oscar, BS degree in Physics from M.I.T. and a physicist and consultant in the computer and electro-optical fields, <http://www.oscarfalconi.com/space/>) OP

As the years pass, it has become more and more apparent that intelligent life on this earth has very little time remaining, and that we're about to experience a terrifying, unpreventable holocaust! No, this conclusion isn't reached by religious Armageddon-type considerations. Not at all. All life on earth is threatened by political and environmental problems that are quickly coming to a climax: World War III, nuclear wastes, atmospheric pollution, and many more, each by itself able to put an end to man. This book frankly examines these many causes of our destruction and gives incisive and logical arguments that will convince the reader that the colonization of space must be our generation's very first priority and must be undertaken immediately in order to save our fine civilization and to preserve our culture. The fact that the colonization of space is the only way to save our civilization is an important concept. In this book it is shown that mankind is very possibly alone in the universe. We therefore have an enormous responsibility to prevent our destruction. This can only be done by colonizing space with self-sufficient backup civilizations, a task we are presently quite capable of accomplishing, both technically and financially, within the next 25 years.

Super Tsunamis

Turchin 8 (Alexei Turchin Ph.D, Professor of the Philosophy of Science, Research Fellow in “Science for Longer Life”, “Structure of the Global Catastrophe: Risks of human extinction in the XXI”, 2008) SV

Ancient human memory keeps enormous flooding as the most terrible catastrophe. However on the Earth there is no such quantity of water that ocean level has raised above mountains. (Messages on recent discovery of underground oceans are a little exaggerated - actually it is a question only of rocks with the raised maintenance of water - at level of 1 percent.) Average depth of World Ocean is about 4 km. And limiting maximum height of a wave of the same order - if to discuss possibility of a wave, instead of, whether the reasons which will create the wave of such height are possible. It is less, than height of high-mountainous plateaus in the Himalayas where too live people. Variants when such wave is possible is the huge tidal wave which has arisen if near to the Earth fly very massive body or if the axis of rotation of the Earth would be displaced or speed of rotation would change. All these variants though meet in different "horror stories" about a doomsday, look impossible or improbable. So, it is very improbable, that the huge tsunami will destroy all people - as the submarines, many ships and planes will escape. However the huge tsunami can destroy a considerable part of the population of the Earth, having translated mankind in a post-apocalyptic stage, for some reasons: 1. Energy of a tsunami as a superficial wave, decreases proportionally 1/R if the tsunami is caused by a dot source, and does not decrease almost, if a source linear (as at Earthquake on a break). 2. Losses on the transmission of energy in the wave are small. 3. The considerable share of the population of the Earth and a huge share of its scientific and industrial and agricultural potential is directly at coast. 4. All oceans and the seas are connected. 5. To idea to use a tsunami as the weapon already arose in the USSR in connection with idea of creations gigaton bombs. Good side here is that the most dangerous tsunami are generated by linear natural sources - movements of geological faults, and the most accessible for artificial generation sources of a tsunami are dots: explosions of bombs, falling of asteroids, collapses of mountain.

The Soviets’ Dead Hand

**Thompson 9** (Nicholas Thompson, Editor of New Yorker, CNN, Bloomberg, and fellow of the New American Foundation, “Inside the Apocalyptic Soviet Doomsday Machine”, http://www.wired.com/politics/security/magazine/17-10/mf\_deadhand, 9/21/2009) SV

Yarynich is talking about Russia's doomsday machine. That's right, an actual doomsday device—a real, functioning version of the ultimate weapon, always presumed to exist only as a fantasy of apocalypse-obsessed science fiction writers and paranoid über-hawks. The thing that historian Lewis Mumford called "the central symbol of this scientifically organized nightmare of mass extermination." Turns out Yarynich, a 30-year veteran of the Soviet Strategic Rocket Forces and Soviet General Staff, helped build one. The point of the system, he explains, was to guarantee an automatic Soviet response to an American nuclear strike. Even if the US crippled the USSR with a surprise attack, the Soviets could still hit back. It wouldn't matter if the US blew up the Kremlin, took out the defense ministry, severed the communications network, and killed everyone with stars on their shoulders. Ground-based sensors would detect that a devastating blow had been struck and a counterattack would be launched. The technical name was Perimeter, but some called it Mertvaya Ruka, or Dead Hand. It was built 25 years ago and remained a closely guarded secret. With the demise of the USSR, word of the system did leak out, but few people seemed to notice. In fact, though Yarynich and a former Minuteman launch officer named Bruce Blair have been writing about Perimeter since 1993 in numerous books and newspaper articles, its existence has not penetrated the public mind or the corridors of power. The Russians still won't discuss it, and Americans at the highest levels—including former top officials at the State Department and White House—say they've never heard of it. When I recently told former CIA director James Woolsey that the USSR had built a doomsday device, his eyes grew cold. "I hope to God the Soviets were more sensible than that." They weren't. The system remains so shrouded that Yarynich worries his continued openness puts him in danger. He might have a point: One Soviet official who spoke with Americans about the system died in a mysterious fall down a staircase. But Yarynich takes the risk. He believes the world needs to know about Dead Hand. Because, after all, it is still in place.

Super volcanoes cause extinction-either by the initial impact or the follow on effects

**Turchin 8** (Alexei Turchin Ph.D, Professor of the Philosophy of Science, Research Fellow in “Science for Longer Life”, “Structure of the Global Catastrophe: Risks of human extinction in the XXI”, 2008) SV

Probability of eruption of a supervolcano of proportional intensity is much more, than probability of falling of an asteroid. However modern science cannot prevent and even predict this event. (In the future, probably, it will be possible to pit gradually pressure from magmatic chambers, but this in itself is dangerous, as will demand drilling their roofs.) The basic hurting force of supereruption is volcanic winter. It is shorter than nuclear as it is heavier than a particle of volcanic ashes, but they can be much more. In this case the volcanic winter can lead to a new steady condition - to a new glacial age. Large eruption is accompanied by emission of poisonous gases - including sulphur. At very bad scenario it can give a considerable poisoning of atmosphere. This poisoning not only will make its of little use for breath, but also will result in universal acid rains which will burn vegetation and will deprive harvest of crops. The big emissions carbon dioxide and hydrogen are also possible. At last, the volcanic dust is dangerous to breathe as it litters lungs. People can easily provide themselves with gas masks and gauze bandages, but not the fact, that they will suffice for cattle and pets. Besides, the volcanic dust simply covers with thick layer huge surfaces, and also pyroclastic streams can extend on considerable distances. At last, explosions of supervolcanoes generate a tsunami.

Yellowstone is a threat to humanity

**Krystek 4 (**Lee Krystek, Masters in Science and Technology, “Is the Super Volcano Beneath Yellowstone Ready to Blow?” http://unmuseum.mus.pa.us/supervol.htm, 2004) SV

That doesn't mean that there isn't (as one scientist put it) a proverbial giant dragon sleeping under Yellowstone. It may well one day awake and lay waste to much of the western United States. The Yellowstone Volcano Observatory, however, watches the park carefully and analyzes the continuous geological changes occurring in the region. It is likely that the imminent threat of another catastrophic explosion would not go unnoticed by their modern instruments. So far, however, activity is business-as-usual at the park. Still, the super volcano at Yellowstone, and its kin around the world are a credible threat to man. Even the United States Geological Survey, usually conservative about such matters, admits that should a major eruption occur the results would have "global consequences that are beyond human experience and impossible to anticipate fully."

Yellowstone eruption probability high

**Achenbach 9** (Joel Achenbach, Writer for National Geographic, “When Yellowstone Explodes”, http://ngm.nationalgeographic.com/2009/08/yellowstone/achenbach-text/1, August 2009) SV

Intrigued, Smith set out to resurvey benchmarks that park workers had placed on various roads throughout the park beginning in 1923. His survey revealed that the Hayden Valley, which sits atop the caldera to the north of the lake, had risen by some 30 inches over the inter­vening decades. But the lower end of the lake hadn't risen at all. In effect, the north end of the lake had risen and tipped water down into the southern end. The ground was doming. The volcano was alive. Smith published his results in 1979, referring in interviews to Yellowstone as "the living, breathing caldera." Then in 1985, heralded by a "swarm" of mostly tiny earthquakes, the terrain subsided again. Smith modified his metaphor: Yellowstone was now the "living, breathing, shaking caldera." In the years since, Smith and his colleagues have used every trick they can devise to "see" beneath the park. Gradually, the proportions and potential of the subterranean volcanic system have emerged. At the shallowest level, surface water percolates several miles into the crust, is heated, and boils back up, supplying the geysers and fumaroles. About five to seven miles deep is the top of the magma chamber, a reservoir of partially melted rock roughly 30 miles wide. Basaltic magma is trapped inside the chamber by denser, overlying rhyolitic magma, which floats on top of the liquid basalt like cream on milk. By looking at the way sound waves created by earthquakes propagate through subsurface rock of varying densities, the scientists have discovered that the magma chamber is fed by a gigantic plume of hot rock, rising from the Earth's upper mantle, tilted downward to the northwest by 60 degrees, its base per­haps 400 miles below the surface. When the plume pumps more heat into the chamber, the land heaves upward. Small earthquakes allow hydro­thermal fluids to escape to the surface, easing the pressure inside the chamber, which causes the ground to subside again. After the 1985 earthquake swarm, Yellowstone fell eight inches over the course of a decade or so. Then it rose again, faster this time. Since 2004, portions of the caldera have surged upward at a rate of nearly three inches a year, much faster than any uplift since close observations began in the 1970s. The surface continues to rise despite an 11-day earthquake swarm that began late in 2008, causing a flurry of apocalyptic rumors on the Internet.

The human population is consuming resources at an ever-increasing exponential rate.

**McNeil 8** (Donald G McNeil, Professor of Economics, “Malthus Redux: Is Doomsday Upon Us, Again?”, http://www.nytimes.com/2008/06/15/world/americas/15iht-15mcneil.13714561.html, 6/15/08) SV

First, some background about Malthus: Robert Malthus was probably the first economist to raise the spectre of environmental destruction. He explained that though our resources tend to grow at a constant linear rate, the growing human population tends to consume those resources at an ever-increasing exponential rate. Eventually, we'll run out of resources. Malthus presented the world with two options: practise abstinence or die early in famines, wars, natural disasters and epidemics. Malthus has been declared dead and buried many times over since he wrote his original essay in 1798. Optimists point out that he did not realise that technology can solve all our problems, because it, too, can advance at an exponential rate. But recent natural disasters, food riots around the world and looming epidemics (such as the H1N1 virus) have shown that Malthus is not quite buried yet: there seem to be some truths that simply won't go away. Like the debate between believers and atheists, the debate between Malthus's supporters and environmental optimists probably cannot be settled by reason alone. Each side marshals its own group of scientists to present facts and logical arguments - yet neither side has been entirely convincing. As Pascal suggested, in such cases where reason fails, the best we can do is wager. The environmental debate really boils down to a bet on whether humans are subject to the laws of economics and nature. The optimists dispute the seriousness of deforestation, desertification, species extinction and climate change. They are betting that technology can outwit the law of diminishing marginal returns forever and continue to provide enough to satisfy the growing appetite of today's wasteful consumers. Malthusians are taking the view that ultimately the planet cannot support our growing needs and will end in disaster unless we stop our waste and unnecessary consumption. So, let's wager. On the one hand, we may bet with Malthus that we need to slow down our consumption to protect our natural resources and ecosystems. If we are right, humankind continues to exist and the planet is saved. If we are wrong, humankind continues to exist and we just waste less food, water and energy, and stop chasing after the latest fashion. On the other hand, we may bet that technology will always save us and that we can continue our waste. If we are right, we lose nothing. But if we are wrong, most or all of humankind dies in famines, natural disasters and wars.If you were a reasonable person, which side of Malthus's wager would you take? I suspect the rational person would agree that it would be most prudent to bet with Malthus. We have nothing to lose and the world to gain.

Ecological doomsday is inevitable-Space colonization is key to regreen Earth

**Howerton 96** (Alexander Howerton, Editor at Countdown News, “Why bother about space?”, <http://www.allbusiness.com/professional-scientific/scientific-research/536396-1.html>, 1/1/1996) SV

A second argument--and one of the most compelling--for developing space lies in the necessity of protecting our home planet. Humans are beginning to exert great pressure on the ecosystems of Mother Earth. Even conservative population estimates predict 10 billion people by 2050--nearly twice as many as we have now--with no indication of the growth rate slowing. Industry has developed to a point where we can wield amazing power and accomplish great feats. It all occurs, however, within the earth's biosphere, so any waste products stay right here, creeping into our food chain and atmosphere. Conservation is a noble cause, but it is ultimately a losing proposition. The best we can hope for is to slow down the rate of pollution and depletion of natural resources. We merely delay the inevitable day of our own destruction. Science has devised possible solutions to our problems. Less-polluting energy sources, electric cars, and alternative urban designs, to name just a few, hold the promise of improving our lives and chances of survival. Yet, we have invested so much in our current way of doing things, both financially and psychically, that our present systems stringently resist change. As we develop a space-based economy, we will have the opportunity to develop new systems and technologies, and these new discoveries and inventions will filter down to Earth, improving everyone's standard of living. Eventually, our space infrastructure will develop to such a degree that we can allocate resources and real estate based on their most-efficient use. The moon, with no ecosystem to damage, can become the seat of heavy industry. The earth, relieved of its population pressure and industrial burden as people migrate, can be allowed to regreen. The whole planet can be devoted to agriculture and preservation of the environment, with only a few strategically located small urban areas to serve as distribution centers. Free-floating space stations can be adapted to whatever purpose the builders have in mind. The benefits of an industrialized society will finally be within everyone's grasp. There is a counterargument that humans will take their polluting ways with them wherever they go. This may be true, but if we do not develop an off-world economy, we are doomed to drown in our own filth. Moreover, as we advance into the heavens, we will learn, as we have in our past explorations, to treat our environment and our fellow humans with an increasing degree of respect and care. One cannot advance into space without considering how to eat, excrete, or breathe--in short, what it means to be alive. And one cannot examine those aspects of living without gaining a new appreciation for life. The advance into space will make us more ecologically aware, for space is our environment. Our molecules originated in the stars. Now our bodies, minds, and spirits must return to space, the source of our existence. Only then will we truly be able to understand and care for our beautiful, precious Earth.

We’ve hit the peak of the sustainable population size

**CBD 11** (Center for Biological Diversity, “Overpopulation: a Key Factor in Species Extinction”, http://www.biologicaldiversity.org/campaigns/overpopulation/index.html, 2/17/2011) SV

The world’s human population doubled from 1 to 2 billion between 1800 and 1930, and then doubled again by 1975. Sometime in 2011, it’s expected to top 7 billion. This staggering increase and the massive consumption it drives are overwhelming the planet’s finite resources. We’ve already witnessed the devastating effects of overpopulation on biodiversity: Species abundant in North America two centuries ago — from the woodland bison of West Virginia and Arizona’s Merriam’s elk to the Rocky Mountain grasshopper and Puerto Rico’s Culebra parrot — have been wiped out by growing human numbers. As the world’s population grows unsustainably, so do its unyielding demands for water, land, trees and fossil fuels — all of which come at a steep price for already endangered plants and animals. Most biologists agree we’re in the midst of the Earth’s sixth mass extinction event; species are disappearing about 1,000 times faster than is typical of the planet’s history. This time, though, it isn’t because of geologic or cosmic forces but unsustainable human population growth. Today’s global human population stands at 6.9 billion. Every day, the planet sees a net gain of roughly 250,000 people. If the pace continues, we’ll be on course to reach 8 billion by 2020 and 9 billion by 2050. By any ecological measure, Homo sapiens sapiens has exceeded its sustainable population size. Just a single human waste product — greenhouse gas — has drastically altered the chemistry of the planet’s atmosphere and oceans, causing global warming and ocean acidification.

Space colonization solves resource wars

**Globus 7 (**Al Globus, Senior Researcher at NASA, “Space Settlement and War”, <http://www.space.com/4140-space-settlement-war.html>, 8/7/2007) SV

Space settlement can make resource wars a thing of the past, something we only read about in history books, because space settlement can deliver far, far more resources at far, far less cost. Less money, less death, less destruction, and infinitely less stupidity. Resources and territory are not the only reasons for war, but they cause a lot of them. The U.S. has spent far more defending oil access in the Mid-East than it would cost to build space settlements. Perhaps it's time to change direction. Perhaps it's time to make Earth a bit healthier for children and other living things. Perhaps it's time to choose life over war. Perhaps it's time to start building space settlements.

Colonization Advantage---Extn: Colonization Key

Colonization is key-it’s time to leave Earth or face extinction

**Fox News 10** (Fox News, “Abandon Earth or Face Extinction, Stephen Hawking Warns – Again”, http://www.foxnews.com/scitech/2010/08/09/abandon-earth-face-extinction-warns-stephen-hawking/, 6/9/10) SV

It's time to abandon Earth, warned the world's most famous theoretical physicist. In an interview with website Big Think, Stephen Hawking warned that the long-term future of the planet is in outer space. "It will be difficult enough to avoid disaster on planet Earth in the next hundred years, let alone the next thousand, or million. The human race shouldn't have all its eggs in one basket, or on one planet," he said. "I see great dangers for the human race," Hawking said. "There have been a number of times in the past when its survival has been a question of touch and go. The Cuban missile crisis in 1963 was one of these. The frequency of such occasions is likely to increase in the future." "But I'm an optimist. If we can avoid disaster for the next two centuries, our species should be safe, as we spread into space," he said.

Colonization’s a key insurance policy for human survival

**LT, 09** (London Telegraph, Human colony on mars would make the world a better place, <http://www.telegraph.co.uk/science/science-news/6162355/Human-colony-on-Mars-will-make-the-world-a-better-place.html>, JG)

"We should establish a self-supporting colony on Mars," suggests J Richard Gott, professor of astrophysical sciences as Princeton University in the US. "That would make us a two-planet species and improve our long-term survival prospects by giving us two chances instead of one." As one might expect, his belief in the species-saving potential of space exploration is echoed by Sir Richard, whose Virgin Galactic company plans to offer orbital flight for paying passengers. "If we are going to survive as a civilisation we need low energy and environmental access to space on an industrial scale," he told the magazine. Environmental scientists Wallace Broecker, who coined the term "global warming", and James Lovelock, who invented the Gaia theory that the planet behaves like a living organism, agree that urging consumers to reduce their carbon consumption is now not enough to save the world. Prof Broecker urges greater research into methods of removing CO2 from the atmosphere, while Lovelock says we must begin preparing for a warmer planet. "Our best course of action is to spend at least as much effort adapting to global heating as in attempts to slow or stop it happening," he says. Many of the experts call for swift action to improve education and health standards in the developing world. Max Tegmark, a cosmologist at the Massachusetts Institute of Technology, says that radical changes to the curriculum are necessary to prepare children for a hi-tech future: "for youngsters, learning a global language and typing should trump long division and writing cursive". Jimmy Wales, the founder of free online encyclopedia Wikipedia, argues that the world will only become a better place when people learn to confront their own prejudices, challenging everyone to spend a month immersing themselves in books and websites opposed to their own world view. "You may find that you were mistaken. And if it turns out that you were right, so much the better." One of the few voices of optimism in the cacophony of doomsday warnings comes from Elon Musk, the US entrepreneur behind PayPal, the online payment system. His recipe for a better world? Look on the bright side of live, and appreciate your good fortune.

Our only chance of survival is to move into space.

Daily Mail 10 (UK news service, <http://www.dailymail.co.uk/sciencetech/article-1301482/Human-race-colonise-space-face-extinction-warns-Stephen-Hawking.html>) OP

‘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.’

Humanity’s survival depends on colonizing space, while we still can.

Space Settlement 11 (The mission of the Space Settlement Institute is to help promote the human colonization and settlement of outer space. It’s founder, Alan Wasser, former Chairman of the Executive Committee (CEO) of the National Space Society (NSS) and NSS Board Member, active member of the Space Colonization Technical Committee (SCTC) of the American Institute of Aeronautics and Astronautics (AIAA), former Senior Associate of the Space Studies Institute, “Why should humanity expand outward? And why now?”, http://www.space-settlement-institute.org/) OP

Humanity's survival depends on moving out into the cosmos while the window of opportunity for doing so still exists. Besides helping to ensure the survival of humankind, the settling of space - including the establishment of permanent human settlements on the moon and Mars - will bring incalculable economic and social benefits to all nations. The settlement of space would benefit all of humanity. It would open a new frontier, provide resources and room for growth of the human race without despoiling the Earth, energize our society, and create a lifeboat so that humanity could survive even a planetwide catastrophe. Now is the time for the settling of space to leap from the pages of fiction to reality. It is now time to ignite what future historians will regard as the human species' greatest endeavor.

Space colonization fulfills our obligation to protect our future.

Falconi 81 (Oscar, BS degree in Physics from M.I.T. and a physicist and consultant in the computer and electro-optical fields, <http://www.oscarfalconi.com/space/>) OP

The adventure is the colonization of space. The argument is that man may soon destroy himself on earth before he can set up a backup civilization elsewhere. Now man may or may not be the only life in the universe capable of abstract thought, but we surely must agree that much would be lost if man's existence were to cease right now. Trillions of trillions of potentially happy and productive man-years would never come to pass. We are obligated to do all we can, now, to protect this future! In the last generation or two, man has clearly reached some sort of milestone or turning point. The present is unprecedented, and so the future is completely unpredictable. For the first time in man's history, many things seem to be doubling every decade or two, such as population, research, energy usage, pollution, nuclear capability, total knowledge, and more. In addition, man has achieved the ability to destroy himself and all his future generations. The probability of man's self-destruction is clearly increasing at a rate much greater than, for instance, population growth. An in-depth study could well uncover some alarming statistics here. It behooves us to immediately begin work toward getting a self-sufficient colony away from earth. We just may be the only life in the universe with the foresight to have "moved out" before it destroyed itself. So, should America go all-out for space colonization? What follows can only touch the surface of this question. The points that are made, however, are felt to be convincing enough to warrant immediate and forceful action.

With the risk of extinction, a backup colony is our first priority.

Falconi 81 (Oscar, BS degree in Physics from M.I.T. and a physicist and consultant in the computer and electro-optical fields, <http://www.oscarfalconi.com/space/>) OP

In the field of reliability, one or two backup systems is the key to long life - and this principle certainly applies to our one and only earth-bound civilization which is precariously close to extinction. A backup colony, in space, is urgently required and must be made our generation's 1st priority. Remember the young lady who put all her eggs in one basket - and lost them all? Mankind must not make the same fatal error. At stake is an incomprehensible number of human lives, as yet unborn.

Space colonization good –survival, growth, and destiny.

Globus 1996(Al Globus has bachelors in science and works at NASA Ames Research Center. Date isn’t in article last date on bibliography was 1996. http://space.alglobus.net/Basics/why.html)hss

There are three noble reasons to colonize space. Survival. Sooner or later, for one reason or another, civilization, humanity, and eventually life itself will be wiped off this planet. Consider the dinosaurs. The dinosaurs were destroyed because they had no space program. They couldn't even see the asteroid that blasted them into extinction. If they had detected it, there was nothing they could do about it. The dinosaurs weren't the only ones. Earth has suffered mass extinction again and again. Only a vigorous space program can find next asteroid headed our way and make sure it misses. Growth. Successful things grow. Those that don't die out. That is the story of nearly four billion years of life on this planet. Space colonization will permit sustainable growth for the foreseeable future. Not just economic growth, but growth of Life itself. Earth is already fully colonized. Life is everywhere, at least in a thin layer on the outside of the planet. In most cases, growth for one species or people is a loss for others. Space is empty, growth there comes at no one's expense. Destiny. Sometimes I think of Life as a person. After the dinosaurs were wiped out, Life said "Well, that didn't work. I think we need something spacefaring, and made primates." Only mankind has the technology to get life into space. If we don't do it, it won't happen. Life will be limited to planet Earth, and Earth alone, waiting for some catastrophe to wipe it out. Mankind can reach out into space, creating a solar system wide civilization of immense beauty and diversity, or stay on Earth fighting over limited resources. It is our choice.

Colonization Advantage---Now Key Time

Now is key, time is critical.

Daily Mail 10 (UK news service, <http://www.dailymail.co.uk/sciencetech/article-1301482/Human-race-colonise-space-face-extinction-warns-Stephen-Hawking.html>) OP

In an interview with the website Big Think, Professor Hawking said he was an optimist but the next few hundred years had to be negotiated carefully if humans were to survive. Stephen Hawking has warned that humans will only survive if we leave Earth and venture into space ‘I see great danger for the human race,’ he said. ‘There have been a number of times in the past when survival has been a question of touch and go. ‘The Cuban missile crisis in 1963 is one of these. The frequency of such occasions is likely to increase in the future. We shall need great care and judgment to negotiate them all successfully.

We must start developing colonies now – cant delay any longer.

Engdahl 2008 (Sylvia Engdahl has written many non-fiction books on space exploration and development. November 5, 2008. <http://www.sylviaengdahl.com/space/survival.htm>) hss

I have called this stage in our evolution the “Critical Stage.” Paul Levinson [the Director of Connected Education] uses different terminology for the same concept. He says that we have only a narrow window to get into space, a relatively short time during which we have the capability, but have not yet run out of the resources to do it. I agree with him completely about this. Expansion into space demands high technology and full utilization of our world’s material resources (although not destructive utilization). It also demands financial resources that we will not have if we deplete the material resources of Earth. And it demands human resources, which we will lose if we are reduced to global war or widespread starvation. Finally, it demands spiritual resources, which we are not likely to retain under the sort of dictatorship that would be necessary to maintain a “sustainable” global civilization.

Colonization Advantage---Laundry List Impact

Colonization solves a laundry list of terrestrial problems

Engdahl 2008 (Sylvia Engdahl has written many non-fiction books on space exploration and development. November 5, 2008. <http://www.sylviaengdahl.com/space/survival.htm>) hss

Although thus not viewed as a beneficial enterprise by many, it is our position that Space Colonization can help lead to solutions to many of the emerging problems of our Earth, such as those listed above, both technical and sociological. The breadth of the enterprise far exceeds our normal single-purpose missions and, therefore, its benefits are greater. Among the technical attributes of Space Colonization are the potential of developing low-cost, nonpolluting energy, enhanced food-production techniques, pollution/waste and water purification, development of disease-amelioration techniques, and the development of techniques to help protect Earth from potential meteoroid impact hazards.

Colonization Advantage---Impact Calc

High Consequence impacts come first-If we wait, we’re doomed to an undesirable future

Sullivan 7 (Gen. Gordon Sullivan, Chair of CNA Corporation Military Advisory Board and Former Army Chief of Staff, “National Security and the Threat of Climate Change”, http://securityandclimate.cna.org/report/National%20Security%20and%20the%20Threat%20of%20Climate%20Change.pdf, 2007) SV

“We seem to be standing by and, frankly, asking for perfectness in science,” Gen. Sullivan said. “People are saying they want to be convinced, perfectly. They want to know the climate science projections with 100 percent certainty. Well, we know a great deal, and even with that, there is still uncertainty. But the trend line is very clear.” “We never have 100 percent certainty,” he said. “We never have it. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield. That’s something we know. You have to act with incomplete information. You have to act based on the trend line. You have to act on your intuition sometimes.” In discussing how military leaders manage risk, Gen. Sullivan noted that significant attention is often given to the low probability/high consequence events. These events rarely occur but can have devastating consequences if they do. American families are familiar with these calculations. Serious injury in an auto accident is, for most families, a low probability/high consequence event. It may be unlikely, but we do all we can to avoid it. During the Cold War, much of America’s defense efforts focused on preventing a Soviet missile attack—the very definition of a low probability/high consequence event. Our effort to avoid such an unlikely event was a central organizing principle for our diplomatic and military strategies. When asked to compare the risks of climate change with those of the Cold War, Gen. Sullivan said, “The Cold War was a specter, but climate change is inevitable. If we keep on with business as usual, we will reach a point where some of the worst effects are inevitable.” “If we don’t act, this looks more like a high probability/high consequence scenario,” he added. Gen. Sullivan shifted from risk assessment to risk management. “In the Cold War, there was a concerted effort by all leadership—political and military, national and international—to avoid a potential conflict,” he said. “I think it was well known in military circles that we had to do everything in our power to create an environment where the national command authority—the president and his senior advisers—were not forced to make choices regarding the use of nuclear weapons.

Try or Die for Colonization-Its Space or Extinction

**Engdahl 6** (Sylvia Engdhal, professor at various different graduate schools and author, “Space and Human Survival: My Views on the Importance of Colonizing Space”, <http://www.sylviaengdahl.com/space/survival.htm>, 11/2/2006) SV

Because the window *is* narrow, then, we not only have to worry about immediate perils. The ultimate, unavoidable danger for our planet, the transformation of our sun, is distant—but if we don’t expand into space now, we can never do it. Even if I’m wrong and we survive stagnation, it will be too late to escape from this solar system, much less to explore for the sake of exploring. I realize that what I’ve been saying here doesn’t sound like my usual optimism. But the reason it doesn’t, I think, is that most people don’t understand what’s meant by “space humanization.” Some of you are probably thinking that space travel isn’t going to be a big help with these problems, as indeed, the form of it shown in today’s mythology would not. Almost certainly, you’re thinking that it won’t solve the other problems of Earth, and I fear you may be thinking that the other problems should be solved first. One big reason why they should not is the “narrow window” concept. The other is that they *could* not. I have explained why I believe the problem of war can’t be solved without expansion. The problem of hunger is, or ultimately will be, the direct result of our planet’s limited resources; though it could be solved for the near-term by political reforms, we are not likely to see such reforms while nations are playing a “ zero-sum game” with what resources Earth still has. Widespread poverty, when not politically based, is caused by insufficient access to high technology and by the fact that there aren’t enough resources to go around (if you doubt this, compare the amount of poverty here with the amount in the Third World, and the amount on the Western frontier with the amount in our modern cities). Non-contagious disease, such as cancer, is at least partially the result of stress; and while expansion won’t eliminate stress, overcrowding certainly increases it. The problem of atmospheric pollution is the result of trying to contain the industry necessary to maintain our technology within the biosphere instead of moving it into orbit where it belongs. In short, all the worldwide problems we want to solve, and feel we should have solved, are related to the fact that we’ve outgrown the ecological niche we presently occupy. I view them not as pathologies, but as natural indicators of our evolutionary stage. I would like to believe that they’ll prove spurs to expansion. If they don’t, we’ll be one of evolution’s failures.

Colonization Solvency—Resource Wars

Even signaling a commitment to colonizing space solves resource wars.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

7.1. Expansion into near-Earth space is the only alternative to endless "resource wars" As an alternative to the "resource wars" already devastating many countries today, opening access to the unlimited resources of near-Earth space could clearly facilitate world peace and security. The US National Security Space Office, at the start of its report on the potential of space-based solar power ( SSP) published in early 2007, stated: "Expanding human populations and declining natural resources are potential sources of local and strategic conﬂict in the 21st Century, and many see energy as the foremost threat to national security" [38]. The report ended by encouraging urgent research on the feasibility of SSP: "Considering the timescales that are involved, and the exponential growth of population and resource pressures within that same strategic period, it is imperative that this work for "drilling up" vs. drilling down for energy security begins immediately" [38]. Although the use of extra-terrestrial resources on a substantial scale may still be some decades away, it is important to recognise that simply acknowledging its feasibility using known technology is the surest way of ending the threat of resource wars. That is, if it is assumed that the resources available for human use are limited to those on Earth, then it can be argued that resource wars are inescapable [22,37]. If, by contrast, it is assumed that the resources of space are economically accessible, this not only eliminates the need for resource wars, it can also preserve the benefits of civilisation which are being eroded today by "resource war-mongers", most notably the governments of the "Anglo-Saxon" countries and their "neo-con" advisers. It is also worth noting that the $1 trillion that these have already committed to wars in the Middle-East in the 21st century is orders of magnitude more than the public investment needed to aid companies sufficiently to start the commercial use of space resources. Industrial and financial groups which profit from monopolistic control of terrestrial supplies of various natural resources, like those which profit from wars, have an economic interest in protecting their profitable situation. However, these groups' continuing profits are justified neither by capitalism nor by democracy: they could be preserved only by maintaining the pretence that use of space resources is not feasible, and by preventing the development of low-cost space travel. Once the feasibility of low-cost space travel is understood, "resource wars" are clearly foolish as well as tragic. A visiting extra-terrestrial would be pityingly amused at the foolish antics of homo sapiens using longrange rockets to fight each other over dwindling terrestrial resources—rather than using the same rockets to travel in space and have the use of all the resources they need!

Solves resource wars.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

As discussed above, the claim that the Earth's resources are running out is used to justify wars which may never end: present-day rhetoric about "the long war" or "100 years war" in Iraq and Afghanistan are current examples. If political leaders do not change their viewpoint, the recent aggression by the rich "Anglo-Saxon" countries, and their cutting back of traditional civil liberties, are ominous for the future. However, this "hellish" vision of endless war is based on an assumption about a single number—the future cost of travel to orbit—about which a different assumption leads to a "heavenly" vision of peace and ever-rising living standards for everyone. If this cost stays above 10,000 Euros/kg, where it has been unchanged for nearly 50 years, the prospects for humanity are bleak. But if humans make the necessary effort, and use the tiny amount of resources needed to develop vehicles for passenger space travel, then this cost will fall to 100 Euros/kg, the use of extra-terrestrial resources will become economic, and arguments for resource wars will evaporate entirely.The main reason why this has not yet happened seems to be lack of understanding of the myriad opportunities by investors and policy-makers. Now that the potential to catch up half a century of delay in the growth of space travel is becoming understood, continuing to spend 20 billion Euro-equivalents/year on government space activities, while continuing to invest nothing in developing passenger space travel, would be a gross failure of economic policy, and strongly contrary to the economic and social interests of the public. Correcting this error, even after such a costly delay, will ameliorate many problems in the world today.

Colonization Solvency-- Nuke War/Super-volcanoes/Asteroids

Colonization solves Earth extinction scenarios- nuke war, super-volcanoes, asteroids, ect.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

Investment in low-cost orbital access and other space infrastructure will facilitate the establishment of settlements on the Moon, Mars, asteroids and in man-made space structures. In the first phase, development of new regulatory infrastructure in various Earth orbits, including property/usufruct rights, real estate, mortgage financing and insurance, traffic management, pilotage, policing and other services will enable the population living in Earth orbits to grow very large. Such activities aimed at making near-Earth space habitable are the logical extension of humans' historical spread over the surface of the Earth. As trade spreads through near-Earth space, settlements are likely to follow, of which the inhabitants will add to the wealth of different cultures which humans have created in the many different environments in which they live. Success of such extra-terrestrial settlements will have the additional benefit of reducing the danger of human extinction due to planet-wide or cosmic accidents [27]. These horrors include both man-made disasters such as nuclear war, plagues or growing pollution, and natural disasters such as super-volcanoes or asteroid impact.It is hard to think of any objective that is more important than preserving peace. Weapons developed in recent decades are so destructive, and have such horrific, long-term sideeffects that their use should be discouraged as strongly as possible by the international community. Hence, reducing the incentive to use these weapons by rapidly developing the ability to use space-based resources on a large scale is surely equally important [11,16]. The achievement of this depends on low space travel costs which, at the present time, appear to be achievable only through the development of a vigorous space tourism industry.

Colonization Solvency—Mindset Shift

Colonizing space causes a mindset shift here on Earth.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

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].

Colonization Advantage--- Solvency---Environment

There are intangible benefits of space exploration

Siegfried 2003 Space Colonization—Benefits for the World W. H. Siegfried The Boeing Company, Integrated Defense Systems http://www.aiaa.org/participate/uploads/acf628b.pdf

Aside from the more demonstrable returns that would come from Space Colonization, there are a host of intangible benefits (U.S. Office of Management and Budget, 2000; Mankins, 2001; Mankins, 1997; Siegfried, 2000a; Siegfried, 1999). Mankind has always been goal-driven. The accessibility of journeys to space destinations could become a great motivational factor to the general population and a goal for emerging societies (Koelle, 2002). It could become a new commercial industry similar to the explosive growth of travel and adventure trips spawned by the jet age. We could expand our living space, create at least a second home for Earth-based life forms through development of lunar colonics and, eventually, perhaps terraforming Mars. We can potentially sublimate some of our ethnic strife in a common reach to the universe. We will better understand our Earth’s environment and evolutionary history and rekindle the spirit of adventure that we experienced during the frontier days. Space Colonization will benefit from burgeoning technology here on Earth but will also spawn the creation of as-yetundreamed leaps. It could lead to potential storage or disposal venues for waste material and, by its very nature, provide the impetus for whole new generations of transportation, housing, and environmental control systems. The development of low-cost access systems will spawn flight rates similar to our terrestrial tourist frequencies and, coupled with the development of new space businesses and a space infrastructure, will implement humankind’s expansion throughout space. It has been 30 years since we left our Moon. It is time to return, this time to stay (Siegfried, 1997; Siegfried, 2001; Siegfried, 2000b)

\*\*\*Colonization Good---Misc\*\*\*

Colonization Good---Energy/Resources

Space colonization solves environmental problems.

Engdahl 2008 (Sylvia Engdahl has written many non-fiction books on space exploration and development. November 5, 2008. <http://www.sylviaengdahl.com/space/survival.htm>) hss

The emerging nations’ need for power must be balanced against potential environmental damage from such dangers as fossil fuel emissions (if there were enough fuel available), which could be greater than nuclear energy risks. Currently, the United States annually consumes approximately 3 trillion Kwh’s of electrical energy and, if this rate grows at only 2% per year, by 2050 United States power requirements will be around 9 trillion Kwh’s per year. Total world needs, assuming a very low use by developing nations (not a conservative estimate) easily exceeds an estimated 20 trillion Kwh’s by 2050. Even with an attendant tripling of non-nuclear systems, such as hydroelectric to avoid fossil fuel depletion, nuclear power system generation would have to increase by a factor of 6 to meet requirements. This increase in nuclear energy production flies in the face of a rising discontent with adverse environmental effects of nuclear waste disposal, where some plants are being converted to utilize fossil fuels. A clean renewable source of energy must be found and implemented. Space Colonization can lead to solutions to this problem.

Colonization of Space would become self-sustaining and result in the eventual colonization of the galaxy

North American AstroPhysical Observatory (NAAPO) Last modified: May 13, 2006. <http://www.bigear.org/CSMO/PDF/CS08/cs08p10.pdf>

The next step would be in the future, with the development of small self-supporting colonies in space. This seems highly speculative now, but much technological progress can be expected on a 1,000 year time scale, which is short compared to the scope of this essay. In space, solar energy would be readily available, and sufficient sources of raw materials would probably be found in asteroids and planetary satellites. The **development of this type of economy would be significant, since if it was successful in being self-sustaining, then it could eventually result in units leaving the solar system under thermonuclear power, and slowly moving out to colonize the galaxy**, over a period of 1 million years or so. There are about 100 billion stars in the galaxy, and there are probably planetary systems near a large fraction of them that are a source of raw materials, with the star available for energy, so in this sense the long term limits to growth would be pushed back far beyond the present ones. The percentage annual growth rate of the total human population even with space colonization is never likely to be as large as the current rate of about 2 percent (unless almost all of the human population is wiped out and the growth starts from a low base level again). The reason is that according to the laws of physics it would be impossible for a wave of colonizing spacecraft to move out through the galaxy faster than the speed of light.\* (\*Assuming colonies produced a uniform population density in the galaxy, the fractional increase per unit time of volume of space populated by a wave of colonizers moving at the speed of light (c) is equal to 4πr 2 c/(4/3)or 3 = 3c/r where r is the radius of the volume colonized. Thus, the fractional rate would be 2 percent per year when r equals 150 light-years, but less than 2 percent if r is greater. Furthermore, actual velocities would be well below the speed of light reducing the rate even more. Thus, it seems that the current human population increase rate is unlikely to be ever again attained. At 1 percent of the speed of light, a few million years would suffice to complete the colonization.) Of course, it is quite possible that humans would not be the only intelligent species colonizing the galaxy in this way. In that case growth of a different sort — intellectual growth above that developed by just being in space — would very likely result from the meeting of the two cultures — even if the population and economic growth were thereby limited. Thus, the effort to establish habitations in space should be encouraged. Even though the cost of putting man in space is significant, so was the cost to the European courts of the 15th and 16th centuries of sending Columbus (and others) out to explore the western Atlantic. We cannot expect to predict the most important benefits that would accrue from a prolonged effort in establishing man in space. Some less important ones would be a great advance in understanding the nature of the universe, of which the phenomena on earth are only an insignificant part; the tapping of new energy sources, possibly including the production and controlled feeding of miniature black holes; and a new realization of the vast range of capabilities of human beings to live satisfying lives in unconventional environments. While we would not expect the colonization of space to have an immediate effect on the pressure of population against resources back on earth, **in the long term it probably would be beneficial as new technology developed in space was applied back on earth**. This sort of transfer between colonies and parent societies has been a pattern during the last million years. Surely we owe to future generations this opportunity for future growth and development of the human species.

Colonization Good---Economy

Space colonization helps the economy.

Engdahl 2008 (Sylvia Engdahl has written many non-fiction books on space exploration and development. November 5, 2008. <http://www.sylviaengdahl.com/space/survival.htm>) hss

There are also many sociological benefits of Space Colonization. We must remember that such an endeavor cannot be implemented by one any agency or single government. A world policy would be needed. In the United States, the combined efforts of NASA, DOE, DOI, DOT, DOC, and others would be focused in addition to our broad industrial base and the commercial world. It should be noted that the eventual space tourism market (tapping in to the world annual $3,400 billion market or the United States $120 billion per year “adventure travel” market) (Reichert, 1999) will not be based on the work of isolated government agencies but, rather, evolve from a synergistic combination of government, travel industry, hotel chains, civil engineering, and, yes, a modified version of industry as we know it today. The change in emphasis from our present single-objective missions to a broadband Space Colonization infrastructure will create employment here on Earth and in space for millions of people and will profoundly change our daily life on Earth. This venue, initiated by short suborbital followed by short orbital and then orbital hotel stays (Collins, 2000) has already begun with brief visits to the ISS. Once systems evolve that can reduce the cost of a “space ticket” to some $10,000 to $50,000 US, the market will grow.

Colonization Good- Competitiveness

New Exploration programs are key to US competitiveness

**Bacchus 11** (James Bacchus, Former Member of Congress & Sponsor of ISS and Kennedy Space Center, “American competitiveness needs space program”, http://thehill.com/blogs/congress-blog/economy-a-budget/150091-american-competitiveness-needs-space-program, 3/16/2011) SV

The return of the space shuttle Discovery from its 39th and final mission was the beginning of the end of America’s space shuttle program. Was it also the beginning of the end of America’s human exploration of space? After three decades, the United States is retiring the shuttle fleet, which has kept busy in recent years building the $100 billion International Space Station, and taking crew and cargo back and forth to and from the station and the Kennedy Space Center in Florida. The final mission of the Discovery completed the U.S. portion of the space station, which is the combined effort of sixteen countries. Only two more missions remain for the shuttle fleet. The Endeavour is due to launch from Cape Canaveral on April 19, and the Atlantis on June 28. Discovery will now be prepared for display at the Smithsonian National Air and Space Museum. The other two spacecraft are likewise destined for museums. It is unclear what -- if anything -- will replace the shuttle as a craft for continued human space flight. NASA has rockets that can send robotic probes to explore outer space. But the shuttle was America’s only way for humans to get there. The hope is that retiring the aging and expensive shuttles will free up federal money for developing a new launch system that can take us beyond the low earth orbit of the station -- just 220 miles up -- and into deep space. The heavy lift of a 21st-century spacecraft could take us back to the Moon, on to Mars, and into the beckoning beyond. The hope, too, is that private U.S. commercial space companies have advanced to the point where they can make smaller spacecraft capable of ferrying people as well as provisions to and from the station. Yet, for all the considerable promise of private commercial space exploration, it is not at all clear that commercial rockets will be able to be “man-rated” by NASA to taxi astronauts any time soon. And, sadly, one of the very few recent examples of bipartisanship in Washington has been the utter bipartisan failure thus far to figure out what to do next in human space flight, how to make it work, and how to pay for it at a price our chosen leaders think we can afford. While the Congress and the President try to find some way to work together to sort all this out, the only way we will have to get American astronauts to the space station, once the shuttles stop flying, will be on the Russian Soyuz spacecraft. The Russians are charging us the bargain basement price of $55 million for each seat. Meanwhile, back on earth, in my former Congressional district in Florida, which includes the Kennedy Space Center, thousands of workers are likely to be laid off later this year with the end of the shuttle program. Several decades ago, following the shutdown of the Apollo moon shot program, Florida’s “space coast” became, for a time, a ghost town. Some of those left jobless didn’t even bother to close the front doors of their abandoned homes when they left town. The fear at the Cape and along the coast is that it will happen again. Unemployment in Florida is already 12%. The Florida real estate market is one of the worst in the country. The loss of the shuttle program will ripple throughout the region. At a time of growing concern about American competitiveness, does it make sense to throw away the critical mass and the critical skills of thousands of space workers whose labors have secured and sustained America’s comparative advantage in what will surely be one of the key global industries of the coming century? But the approaching end of the shuttle program is about much more than the loss of much-needed jobs by hard-working people in my hometown. For far too long, far too many in both our political parties in the Congress and in successive presidential administrations alike have treated human space flight as just another job-producing public works project. That’s not how I saw it years ago when I was vice president of the space club at South Seminole Junior High School in Central Florida, and we were reaching for the moon. That’s not how anyone who has ever worked for America’s space program, or in any way been a part of that program, sees it. As we see it, the space shuttle Discovery was rightly named. If America stands for anything, it stands for discovery. Our historic task as Americans is to discover more. It is to use our freedom to extend as far as we can the ultimate reach of human experience, knowledge, and understanding. To fulfill this task, we must reach for the stars.

Committing to colonization solves US STEM decline.

Siegfried 2003 Space Colonization—Benefits for the World W. H. Siegfried The Boeing Company, Integrated Defense Systems http://www.aiaa.org/participate/uploads/acf628b.pdf

Problems within the education program in the United States have been analyzed many times. Rising illiteracy, 35% of all scientist and engineers being foreign born, and the 50% or higher foreign doctorate candidates who return to their country of origin after receiving degrees are examples. United States science and engineering schools are recognized throughout the world for their standards of excellence, but the number of United States students is declining based on a decreasing interest by the younger generation in the sciences and engineering. We must encourage young students to select engineering and science for studies as is happening in the rest of the world. Space Colonization can provide that stimulus. During the Apollo program, as NASA spending increased, so, too, did the number of doctorates received (Fig. 3). When NASA spending decreased following the Apollo program, so did the number of doctorates received a few years later (Collins, 2000). This time lag occurred because many students were well on their way to achieving their degrees. Once it was clear that funding and federal support had been reduced, the student population plummeted. We now face the prospect of many of the people trained in the sciences reaching retirement. Where are the replacements? A long-term worldwide commitment to Space Colonization could help. We must convince our present elementary school students to commit to science and engineering for these are the keys to our future.

\*\*\*Constellation Advantage\*\*\*

Constellation Advantage---Leadership Internal Links

Obama’s cancellation of Constellation sends a signal of US weakness and locks the US out of future Space hegemony

Newton 11 (Elizabeth K Newton Ph.D, Professor of Physics – University of Alabama, Former Administrator for NASA, “United States Space Policy and International Partnership”, http://www.sciencedirect.com/science/article/pii/S026596461000113X. 1/8/2011) SV

3. Will the USA have more influence on the world stage? 3.1. Perceptions of style President Obama’s 2010 policy is notable for the shift over the 2006 version, which most agree to be more a stylistic change of tone, rather than one of substance. The messages conveying the need for multilateral action are likely to be welcome to external audiences’ ears and suggest a more consultative approach. That said, the cancellation of the Constellation program was done without prior notice or consultation with international partners, and much of the debate on the subject has centered on the domestic repercussions of the decision, not the impact on the partners. There is evidently a mismatch between intent and such unilateralist actions. 3.2. Perceptions of reliability as a partner The president’s request and congressional authorization for continued funding of the ISS’s operations delivers on commitments made to international partners beginning in the mid-1980s when the program was conceived. However, without a successor system to the Shuttle, the USA has abrogated intergovernmental agreements to provide crew and cargo transportation, and crew rescue, as partial compensation for partner investments in the ISS’s infrastructure and operations. Reliance on the Russian Soyuz for limited down-mass cargo transport seriously inhibits the value that can be realized from ISS utilization until a commercial solution is available. In addition, the USA’s unilateral abandonment of the Moon as a near-term destination shakes partners’ political support for their exploration plans, some of which were carefully premised on US intentions, and more than five years of collaborative development of lunar base plans. 3.3. Leadership The USA is a majority funder for many space programs and is a technology leader, two features which have provided sufﬁcient motivation for partners to accept US leadership, even when unfortunately high-handed. It is a stunning failure of political will to lack a successor system to the retiring Space Shuttle, and so the US cedes leadership in human spaceﬂight with its inability to access the ISS independently, for itself or for its partners, until a new commercial capability has been demonstrated. The USA further relinquishes leadership when abandoning years of work on strategic planning and guidance, the evaluation of alternatives, and orchestration of diverse but important contributions that were manifested in the Global Exploration Strategy. Sudden redirections without consultation are not hallmarks of leadership and will no doubt motivate partners to do more unilateral planning and execution, at least for a while. Finally, leadership in the future is at risk: how can the USA hope to inﬂuence outcomes and protect interests---strategic, commercial, and cultural---on the Moon if it is not present?

Obama’s proposed budget has effectively ended the Space hegemony Kennedy instilled in the world

**Cherry 5/29** (Mary Alys Cherry, Senior writer for Houston Editorial, “Moon Men: US Space Leadership Slipping”, http://www.yourhoustonnews.com/bay\_area/news/article\_9857fa1d-60e9-511c-81a7-e7eb08e87c1f.html, 5/29/11)SV

While America pauses to remember President Kennedy’s moon challenge 50 years ago, three famous astronauts think we have “strayed widely from President Kennedy’s vision and the will of the American people.” Neil Armstong and Eugene Cernan, the first and last men to walk on the moon, joined Jim Lovell, whose ill-fated Apollo 13 mission cut short his journey to the lunar surface, have written a column in USA Today, suggesting that President Obama advisors, “in searching for a new and different NASA strategy with which the president could be favorably identified, have ignored NASA’s operational mandate.” After tracing America’s awesome achievements of the past five decades, the retired astronauts note how the Constellation program NASA was developing to venture back to the moon and on to Mars enjoyed near unanimous support in Congress and the Bush administration but fell behind schedule and was deemed “not viable” by a review panel, due to inadequate funding. SHOCK WAVESWhen the president failed to include funds for Constellation in his 2010 budget, “it sent shock waves throughout NASA, the Congress and the American people. Nearly $10 billion had been invested in design and development of the program,” they said. “The response to Kennedy's bold challenge a half-century ago has led to America's unchallenged leadership in space. We take enormous pride in all that has been accomplished in the past 50 years. And we have the people, the skills and the wherewithal to continue to excel and reach challenging goals in space exploration. LEADERSHIP SLIPPINGHowever, they continue, “today America's leadership in space is slipping. NASA's human spaceflight program is in substantial disarray with no clear-cut mission in the offing. We will have no rockets to carry humans to low-Earth orbit and beyond for an indeterminate number of years. “Congress has mandated the development of rocket launchers and spacecraft to explore the near-solar system beyond Earth orbit. But NASA has not yet announced a convincing strategy for their use. After a half-century of remarkable progress, a coherent plan for maintaining America's leadership in space exploration is no longer apparent. “Kennedy launched America on a new ocean. For 50 years we explored the waters to become the leader in space exploration. Today, under the announced objectives, the voyage is over. John F. Kennedy would have been sorely disappointed.”

Control of Space is inevitable-Revival of Constellation is just key to ensure US hegemony

**Dinerman 10** (Taylor Dinerman, Consultant for DOD, Senior Editor at Hudson,“National Space Policy: From Strength to Weakness, Part 2”, http://www.hudson-ny.org/1440/national-space-policy-strength-weakness-2, 7/29/11) SV

What is so worrisome about the new Obama space policy goals, released in the New Space Policy document on June 28th -- especially those programs related to the internationalization of American space power -- is that they create opportunities for those who would undermine this power. The objective of these people, has long been to ensnare Washington in a net of agreements, policies and treaties. Eventually these will make it impossible for the US to project force without passing first through what Senator John Kerry (D, MA) called a "Global Test, " which is to say getting the approval of the international elite for anything that requires the use or even the threat of force. **In fifty years or less, we will have transitioned from a global economy to one that is beginning to encompass the Solar System; the only question is whether the US will lead the way** and embed its values out there, or whether they will be someone else's. When the Obama administration released its report, most of the media stressed that the president was reaching out for an unprecedented level of "Global Cooperation" -- supposedly in contrast to the Bush administration's "unilateralist approach to space." This simplistic and limited view of the facts may fit within the mindset of the mainstream media, but it clashes not only with the historic facts, but also with political realities. For decades, America's space programs have been used to project power of both the hard and soft varieties. Allies have long benefited from indirect, and, in rare cases from direct access to the Defense Department's various space systems. Throughout the world, every minute of every day, people use the Global Positioning System (GPS) signals, most of the time without even realizing that they come from a set of US military satellites. In the civilian realm the International Space Station which is now almost complete has been largely built and paid for by US taxpayers. This is particularly important in dealing with issues surrounding the future of the GPSl, which has become the *de facto* world wide standard for what are termed Global Navigation Satellite Systems (GNSS) and timing purposes. While Russia, China and Europe are all trying to build rival constellations, the GPS system which now includes more than 30 satellites, will, if it not wrecked by budget cuts or policy mistakes, continue to be the best and most effective and most reliable system. It is also essential for US military operations. If US control over the system is compromised, this will result in other nations having an effective veto over US military operations. The new space policy does not, directly, aim at this result, but it does order the US government to "Engage with foreign GNSS providers to encourage compatibility and interoperability, promote transparency in civil service provision and, and enable market access for US industry. " The key phrase here is "civil service provision." This seems to refer to the "Publicly Regulated Signal (PRS)," which is the lightly disguised military aspect of Europe's Galileo satellite navigation project. In the early years of this program, the Europeans wanted to entwine the GPS military signals with those the PRS, thereby preventing the US from using its own system without European cooperation. Fortunately, the State Department and the Defense Department were able to stop this "overlay" problem dead in its tracks with the signing, in 2004, of a formal deconfliction agreement. It appears as if the US side may now be ready to reopen this question. The contradictions of the administration's space proposals are nowhere better seen than in the way that NASA is treated. The attempt to cancel the Constellation program, the goal of which was to return permanently to the Moon before going on the Mars has, for now, shown that those foreign space agencies and leaders who had advised their political masters to stay out of the US program were right in saying that the US was an unreliable partner. Do NASA or the White House really believe that their new offers of cooperation will not be met with the same - or perhaps an even greater measure of skepticism about America's commitment to long term space exploration? The current bitter and angry debate over the future of Constellation and the rest of the US manned space program is something with which no sane foreign space agency wants to get involved. As American space leadership is an inescapable fact of international life, this naturally gives rise to resentment and envy among the nation's rivals and foes. For roughly half a century, the US government has made it a principal goal to, as the Eisenhower administration put it in a classified policy document from December 1959, "seek to increase international cooperation in selected activities relating to the peaceful exploration and use of outer space ... " Ike's people made sure to add that "International arrangements for cooperation in outer space activities should consider the net advantage to U.S. security." **The space policy** claims that the administration is committed to American space leadership, yet by its actions so far, it **has undermined that leadership and put this country on a path to becoming a second rate space power**. Previous administrations have got to share some of the blame for this, particularly in the Nixon-Ford-Carter era when the Saturn V Moon rocket program was cancelled and the Shuttle was starved of development funding. For the most part, the best that can be said of this new policy is that it could have been worse. There is also the strong possibility that relatively uncontroversial international space science programs will see their budgets cut by the next congress. **Constellation was an essential part of the delicate political balance that NASA had achieved**. The attempt to destroy it, whether it succeeds or not, has endangered all of NASA's programs. Anything with the label "international" will now be a ripe target for budget cutters, after all foreign space scientists do not vote in US elections. This could happen in spite of NASA's traditional "No exchange of funds" principal, whereby the space agency never pays for any foreign hardware or services but only acquires them in exchange for something from the US side. For example, Italy has provided the US with a number of pressurized modules for the Space Station in exchange for the US flying Italian astronauts on the Space Shuttle and for giving Italian scientists access to experimental facilities on the station. There have been exceptions, the late 1990s NASA did provide the Russians with some cash to help finish the first space station modules. There was a good deal of suspicious activity surrounding these payments and few people in Washington want to repeat the experience. Trying to manipulate another nation's space policy is not something to be done lightly. It is difficult to underestimate the harm that Administrator Charles Bolden did to NASA when he told the Al Jeezera network on July 1st that outreach to the Muslim world is now an important NASA priority. As Charles DeGaulle once put it, " Towards the complicated Middle East. I flew with simple ideas." ( "*Vers L'Orient compliqué, je volais avec des idées simples.")* Even diplomats who have spent a lifetime working in that area have to watch carefully every word they say in both public and private. There is a fine line between flattering one's hosts and groveling before them. Bolden seems to have stepped over it, or at least to have come very close. For all Presidents since Lyndon Johnson, the primary task of all NASA administrator is "*Don't embarrass the President."* The same applies to all senior officials; but due to its small size and to its symbolic importance, this is particularly true for NASA. Unfortunately for the leadership at the space agency, they have now done it twice: first with the disastrous roll-out of the proposal to cancel Constellation and replace it with an ill-defined dog's breakfast of concepts and plans; and now with clumsy attempt to deploy NASA's soft power, its ability to show the world spectacular and peaceful examples of America's technological and scientific accomplishments.

Failure to revive the Constellation program kills Space Leadership-key infrastructure, tech and knowledge

**Spudis & Zubrin 10** (Paul D. Spudis, planetary scientist, and Robert Zubrin, Lockheed Martin Aeronautics, Washington Times, “NASA’s Mission to Nowhere”

http://www.marssociety.org/home/press/tms-in-the-news/nasa%E2%80%99smissiontonowhere, 5/31/2010)SV

Although we are known for holding different opinions on the order and importance of specific objectives in space, we are united in our concern over this move to turn away from the Vision for Space Exploration (hereafter referred to as Vision). Vision gave NASA’s human spaceflight program a clear direction: to reach the moon and Mars. Congressional authorization bills in 2005 (under Republican leadership) and 2008 (under Democratic leadership) endorsed this goal. The agency created the Constellation program to build the Ares 1 and Ares 5 launch vehicles, the Orion spacecraft and other hardware needed to go to the moon and Mars. A timeline was set, and objectives were articulated to achieve Vision’s first major milestone - a sustainable return to the moon by the end of the present decade to gain knowledge, reacquire operational experience and use local resources to create capabilities for our reach to Mars and beyond. Vision had its roots in the 2003 report of the Columbia Accident Investigation Board, which asserted that the goals associated with human spaceflight must be worthy of its costs and risks. In canceling Constellation and Vision, the administration is proposing to return NASA to its pre-Columbia template of operating on a “flexible path” involving no commitment to any specific timeline, achievement or objective. This new direction, coming just as the space-shuttle program is set to end, threatens America’s human spaceflight effort not merely with stagnation but also with cancellation. The new plan proposes to contract with private companies to design and develop vehicles for human flights to low Earth orbit (LEO) and the International Space Station. The agency will research advanced technologies in the coming five years before picking a heavy-lift rocket design. Human missions are next - to an asteroid in 15 years and to orbit Mars in 25 years. A human Mars landing supposedly will occur afterward - sometime. The idea of contracting with the private sector for launch and transport to LEO is not new. This capability was encouraged and started under Vision. The difference under the new direction is the termination of any capability by the federal government of the United States to send people into space. For 50 years, America has maintained this ability through an infrastructure of cutting-edge industrial hardware, specialized facilities and a skilled work force. By adopting the new program, we will lose - probably irretrievably - this space-faring infrastructure and, most certainly, our highly trained, motivated and experienced work force. It will be prohibitively expensive and difficult to restart our manned program after five to 10 years of agency navel-gazing, effectively signaling the end of America’s manned space program and our leadership in space. NASA falters without specific direction or a stated destination. The history of the agency is replete with research projects disconnected from flight missions that produced no real hardware or technology. Taking five years (or even one year) to “study” the technologies of a heavy-lift rocket is not only pointless - it is destructive. We currently possess all the knowledge, technology and infrastructure necessary to build a heavy-lift launch vehicle.

No Constellation means the US loses US Space Heg and China takes over

**Kislyakov 11** (Andrei Kislyakov, Voice of Russia Industry Experts, “China Gaining Ground in Space”, http://english.ruvr.ru/\_print/50403764.html, 5/22/11) SV

China is going to play a major role in the global space exploration program. Soon, a new center for space research may emerge in the Eastern hemisphere and push the current players aside. China's achievements in science and technology, as well as its consolidation of space programs in the countries of the Asia-Pacific region, which have a tremendous economic potential, will contribute to its development. China recently unveiled its 2011 plans for manned spaceflight development, taking further steps to approach the establishment of its first space station. The strong interest China holds in its space program, together with billions worth of investment in the field, is interpreted – by a NASA advisor – as a “potent political symbol” that can impact the current space power balance among space industry-pursuing countries. China’s Manned Space Engineering Office announced in its media briefing on April 24 that the country will place its focus on the rendezvous and docking project this year, and plans to launch the first piece of its space station – the Tiangong-1 Space Module – into orbit by the end of the year. In general, China wants to push its space station program into reality during the next decade, as the country already fired its first human being into space in 2003 and saw its first spacewalk in 2008. The space station will comprise of an 18.1-meter long core module and two 14.4-meter long laboratory units for experiments. The maximum diameter of each module will be 4.2 meters, with a launch weight ranging between 20 and 22 tons. A cargo spaceship lighter than 13 tons will also be developed to transport supplies and equipment to the space station. Although the 60-ton space station is only one-seventh the weight of the International Space Station (at 419 tons), it will still bring China to the center of the international space arena. The progress is even more significant given the U.S. plans to withdraw its space shuttle fleet from the International Space Station. Furthermore, the International Space Station is only expected to be operational through 2020, or 2028 at the latest. The space station program is the final phase of China’s space development Project 921, which it began in 1992. If the Tiangong-1 Module is launched later this year as planned, an unmanned spacecraft will also be launched in an attempt to dock with the Module, and then two piloted spacecraft will follow. Wang Zhaoyao, spokesman for the program, says that Chinese scientists are developing technologies to ensure that the Tiangong-2 Module will be able to support three astronauts in space for about 20 days, and Tiangong-3, which is expected to be launched in 2015, can support them over 40 days. They are also working on ensuring the safety of supply deliveries. Looking back in the ground one can see China is seeking to be a space industry contender to the United States and Russia as it began construction of its new space launch center in Hainan Province. It will be the base for launching new-generation rocket-carriers and space vehicles like geosynchronous satellites, polar-orbiting satellites, space stations and deep-space exploration satellites. The center located in Wenchang City is set to be operational by 2013 and will allow China to grow their international commercial space launches because of its 19 degree proximity to the north of the equator, requiring rockets to consume less fuel and carry more weight. Moreover, Hainan has the advantage of being easily accessible via port thus making it easier to ship satellite components. China currently makes use of its space facility in the Jiuquan Satellite Launch Center located on the border with the Gansu Province and the Inner Mongolia Autonomous Region. In view of its ambitious space projects China looks forward to developing international cooperation in the field. Moreover, two years ago at the 59th International Astronautical Congress in Glasgow, Sun Laiyan, chief of the China National Space Administration, announced that China was prepared to lead the Asia-Pacific Space Cooperation Organization (APSCO). No doubt the participating world leaders in space research, representing the United States, Russia and Europe, did not underestimate the significance and far-reaching consequences of the Chinese initiative. Formally, APSCO was established by China, Thailand and Pakistan back in 1992. On October 28, 2005 China, Mongolia, Pakistan, Thailand, Iran, Peru, Bangladesh and Indonesia signed the APSCO Convention, shortly followed by Turkey. The participation of China, Pakistan and Iran, with their dynamically developing missile programs, will turn APSCO into an authoritative high-tech group. Such members of the organization as Thailand and Indonesia have already launched their own satellites. Thus, with China as its leader, the organization has a good chance of becoming very successful. Last Fall Pakistani Ambassador to China Masood Khan announced in Beijing that next year China and Pakistan are collaborating to launch a joint space communications satellite. The new satellite, named Paksat-1R, is expected to bring immense economic benefits to Pakistan. It is the culmination of an agreement reached during Pakistan President Asif Ali Zardari’s visit to China in 2008 to launch the satellite and set up a joint communications project. Ambassador Khan’s remarks came while addressing an official function in Beijing to mark the anniversary of the establishment of the China Great Wall Industry Corporation (CGWIC). Established in 1980, the CGWIC is the sole commercial organization authorized by the Chinese government to provide satellites, commercial launch services, and carry out international space cooperation. Ambassador Khan expressed the hope that a Pakistani astronaut will travel aboard a Chinese spacecraft in the not too distant future. Although China has been following the initiatives of world leaders in space exploration, it has been making new technological breakthroughs. Three successful manned flights have inspired Beijing to build its own orbital laboratory. At the same time Beijing is making progress in developing a new generation of carrier rockets, a program of outer space exploration, including launching an artificial Moon satellite and preparing for a manned expedition to the Moon. China's success in space exploration and its leadership in the Asia-Pacific region are evident. If backed up by the potential of APSCO, Beijing may turn into a leading global space power. While the space exploration programs within the Asia-Pacific region are gaining pace, NASA, the Russian Federal Space Agency (Roscosmos) and the European Space Agency (ESA) cannot decide on a shared direction for their joint space programs. In spite of encouraging official statements on the need to promote international cooperation in space exploration, both the United States and Europe are set on carrying out their own research, as well as getting useful information to ensure their strategic independence and safety. A good example of such policy is, although recently cancelled, NASA's Constellation Program aimed at developing U.S. space technologies for conducting large-scale space exploration, which does not envisage participation of other countries. Another project of this kind is the U.S.-Russian International Space Station program. Despite NASA's public statements, the United States sees the use of Russian spaceships as a forced measure. In addition, NASA has failed to clearly formulate its vision of the ISS future once the Space Shuttle Program is over. Cooperation between Russia and Europe in space is less dramatic and has not resulted in any impressive joint programs. The declared Roscosmos - ESA program of developing a new space shuttle system has not seen any practical steps yet. Moreover, Europeans consider any dependence on "the Russians" in organizing manned flights would be unacceptable. However, in terms of finance and technology, space exploration programs are hard to implement without the involvement of other countries. As Andrei Ionin, a corresponding member of the Tsiolkovsky Russian Academy of Cosmonautics, puts it: "Today we must think about who our key partners in space exploration are. This may be the right moment to start looking eastward, rather than westward. Centers of economic, technological and political power have been shifting to the Asia-Pacific region, where China, Japan and South Korea are experiencing dynamic development." Once the Asia-Pacific Space Cooperation Organization has advanced to the practical stage, there will be another reason for "looking eastward."

The cancellation of Constellation will kill US Space leadership

Bishop 10 (Rob Bishop, United States Representative, “Space Cuts Short-Sighted”, http://www.deseretnews.com/article/700011837/Space-cuts-short-sighted.html, 2/25/10) SV

Roughly 40 years later, President Barack Obama has proposed a NASA budget that would end our efforts to get back to the moon, cancel the replacement for the space shuttle, cripple our capabilities in space and hurt our national security. This "one small budget step" would be a giant leap backward for American leadership in space and security.For years, we've known the space shuttle would be phased out. The replacement, which has already been through extensive research, development and testing, is the Ares rocket, part of the Constellation program. The Ares, named by Time magazine as the No. 1 invention of 2009, was successfully test-launched less than four months ago. NASA itself called it a "spectacular launch." Everything seemed on-course for America to retain a safe and reliable vehicle for space travel and maintain leadership in space — until Obama released his proposed budget this month. The Obama budget would cancel the Constellation program, cancel the Ares I rocket for manned space travel, cancel the Ares V rocket for cargo and cancel the Orion manned space capsule. The only apparent replacement for all of this is some nebulous funding for grants to commercialize our space exploration with no tested or proven alternative. It would be one thing if gutting the space program was an attempt to save money. But it isn't. In fact, the Obama plan does not eliminate wasteful spending. It actually adds an additional $1.5 billion to the NASA budget, but spends it in the wrong places. The president's proposals for NASA will, however, destroy U.S. leadership in space exploration. Russia and China will control space. Instead of sending 40 or so American astronauts to space each year, we will end up sending four or five. And they will essentially be trying to hitch a ride on a Russian or Chinese rocket. The Obama plan will also destroy 20,000 private sector jobs, if not more. By my estimation, we stand to lose around 2,000 jobs right here in Utah — a complete contradiction to an administration that say jobs are the priority. And these aren't minimum wage jobs. They are high-skilled jobs in science, math and engineering. This seems hypocritical from an administration that says it wants to encourage kids to take science, math and engineering classes.

Cancellation of Constellation will cut thousands of jobs and kill Space Leadership

**Aderholt 10** (Robert Aderholt, United States Representative, “The President’s Space Policy Will Compromise American Jobs and American World Leadership”, http://www.redstate.com/robertaderholt/2010/06/29/the-presidents-space-policy-will-compromise-american-jobs-and-american-world-leadership/, 6/29/10)SV

On May 5, 1961, Alan Shepard became the first American in space. Since then, there has been no turning back for the U.S. space program and we have led the world in space exploration ever since. Throughout the next 50 years, NASA would land astronauts on the moon, launch the Hubble space telescope and help build the International Space Station (ISS). However, the President now wants to severely downgrade the one task which makes NASA unique — human exploratory space flight. On February 1, 2010, the Administration announced a budget which proposes to eliminate the NASA Constellation program. Since that time, NASA has canceled the awarding of contracts or put on hold parts of numerous contracts which were a part of the regular fiscal year 2010 work for the Constellation program, despite the fact that Congress must first approve its termination before it becomes final policy. President Obama and NASA are putting American jobs in jeopardy because of a drastic proposal that isn’t even actual law. This plan put forth by the President is simply that – a plan, and NASA should not be assuming that this plan will be approved by Congress. Since February, I have fought the President’s proposal to cancel Constellation because it will forfeit America’s leadership in space and it will cut thousands of jobs in Alabama and the entire nation. During the last month, contractors, under intense pressure from NASA regarding contract termination liability, have already begun laying off workers and canceling subcontracts, despite the fact that Congress has not approved the President’s proposal. That’s why I have introduced the “Protecting Human Space Flight Act of 2010” this week. This bill directs NASA to use FY2010 appropriated funds for what it was intended to do – work on the Constellation program, not a termination liability account. President Obama has been saying for years that the goal of his Administration is to save or create American jobs. With the President’s new proposal for NASA, he is doing just the opposite.

Reviving the Space Program is key to reestablish space leadership

Cernan 10 (Eugene A Cernan, Navy Captain and Apollo Commander, Testimony before the House Committee on Science and Technology, http://www.marklarson.com/genecernan/House\_Hearing\_ Statement.pdf, 5/26/2010)SV

With the submission of FY2011 budget, The Administration and the originators of this proposal were either misinformed or showing extreme naivete, or I can only conclude, are willing to take accountability for a calculated plan to dismantle America’s leadership in the world of Human Space Exploration resulting in NASA becoming nothing more than a research facility. In either case, I believe this proposal is a travesty which flows against the grain of over 200 years of our history and, today, against the will of the majority of Americans. The space program has never been an entitlement, it’s an investment in the future – an investment in technology, jobs, international respect and geo-political leadership, and perhaps most importantly in the inspiration and education of our youth. Those best and brightest minds at NASA and throughout the multitudes of private contractors, large and small, did not join the team to design windmills or redesign gas pedals, but to live their dreams of once again taking us where no man has gone before. If this budget proposal becomes the law of the land, these technicians, engineers, scientists, a generation removed from Apollo, yet re-inspired by the prospect of going back to the moon and on to Mars, will be gone – where I don’t know – but gone. America’s human space flight program has for a half century risen above partisan differences from Eisenhower to Kennedy to the present day. The challenges and accomplishments of the past were those of a nation – never of a political party or of any individual agenda. Those flags that fly on the moon today are neither blue flags nor are they red flags – they are American Flags. We are at a cross road. If we abdicate our leadership in space today, not only is human spaceflight and space exploration at risk, but I believe the future of this country and thus the future of our children and grandchildren as well. Now is the time for wiser heads in the Congress of the United States to prevail. Now is the time to overrule this Administration’s pledge to mediocrity. Now is the time to be bold, innovative and wise in how we invest in the future of America. Now is the time to re-establish our nation’s commitment to excellence.

Failure to revive Constellation kills Space Leadership – NASA collapses and China & Russia surpass the US

**Hawking 11** (William R Hawking Ph.D,Senior Fellow in National Security Studies at the U.S. Business and Industry Council Education Foundation, “Forfeiting US Leadership in Space”, http://www.familysecuritymatters.org/publications/id.8906/pub\_detail.asp, 3/7/2011) SV

The National Aeronautics and Space Administration (NASA) has put out its 2011 Strategic Plan. Its first goal is to "extend and sustain human activities across the solar system." As the lead civilization of the current era, it is America's duty to advance human achievement. Yet, there is very little in the NASA plan or budget to fulfill this noble goal. The NASA plan relies first and foremost on "expanding efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration." But without the shuttle or a replacement space vehicle, the U.S. will be dependent on the Russians for access to the ISS. Yes, the Russians, who lost both the Space Race and the Cold War in the last century, are now poised to control the ISS. The Russians, it should be remembered, were invited into the ISS because the U.S., even though it was the richest nation on the planet and the world's most advanced scientific state, was looking for other countries to put up money for the ISS to lighten its own "burden." It would be hard to find a better example of the old adage "penny wise, but pound foolish." NASA notes the danger. Its strategic plan has as a goal "reducing the risk of relying exclusively on foreign crew transport capabilities." But the road to that goal will be a long one. The report talks about creating “architectures" that will then lead to a "roadmap for affordable and sustainable human space exploration." So after 30 years of relying on shuttles that were designed in the 1970s, NASA is back to square one. NASA knows, "The core elements to a successful implementation are a space launch system and a multipurpose crew vehicle to serve as our national capability to conduct advanced missions beyond low Earth orbit. Developing this combined system will enable us to reach cislunar space, near-Earth asteroids, Mars, and other celestial bodies." Tragically, no one higher up in Washington, either at the White House or in Congress, has cared enough about the nation's future in space to do anything about funding such a project. As long as there are still satellites that can beam down episodes of "American Idol" to a nation of couch potatoes, who cares about achieving anything more? NASA is one of the few government programs than actually deserves to be called an investment. Its 2012 request of $18 billion is only 0.4 percent of a $3.7 trillion Federal budget. The bailout money given to the AIG insurance company would have funded NASA for a decade. Yet, the technology the space program has generated for society has rewarded taxpayers many times over. And developing new generations of scientific breakthroughs will continue to be a major strategic goal of the program. NASA's role extends beyond the agency's own work. It has served as a stimulus for education and industry. It's 2011 report states, "One of NASA's top strategic goals is to Inspire students to be our future scientists, engineers, explorers, and educators through interactions with NASA’s people, missions, research, and facilities." At a time when the performance of American students in math and science has fallen behind that of most of the world, there needs to be a new push to stimulate the public imagination and to provide rewarding careers for a new generation of innovative thinkers. But with NASA doing less in space, from where is the inspiration to come? Designing more video games? The NASA report raises concerns about how to keep even its current high-skilled workforce employed, noting. "The retirement of the Space Shuttle in 2011 is ushering in a tran­sition period for the Nation’s human space flight workforce." New programs, such as "development of a heavy-lift rocket and crew capsule to carry explorers beyond Earth’s orbit, including a mission to an asteroid next decade" are supposed to provide some jobs, but not enough. Shifting work to "greentechnology" and the study of "global warming" will not lead to new adventures in manned space exploration Meanwhile, China is positioning itself to lead humankind' further into space. The state news agency Xinhua reported Friday, "The world's largest design, production and testing base for rockets is being built in Tianjin" as part of China's expanding space program. Twenty of the 22 plants have been completed, and some of are ready for operation. The base is designed to meet China's growing demand for space technology for the next thirty years. By integrating the industrial chain, the base will be able to produce the whole spectrum of rockets for China's lunar missions, its own space station and other ambitious projects according to Liang Xiaohong, deputy head of the China Academy of Launch Vehicle Technology. China is still behind the United States, having only sent its first multi-man orbital mission aloft in 2008, but it has big ideas. Beijing plans 20 space missions this year, and wants to land an unmanned vehicle on the Moon in 2013. China sent a spacecraft to orbit the Moon last October. The stirring vision of giant space stations, commercial shuttle flights and extensive moon bases given to the public in the classic 1968 film *2001: A Space Odyssey* has become a sad testimony to three decades of lost American opportunities. I have seen this once great American spirit of adventure reborn in China. I have been amazed (and alarmed) by displays of Chinese plans to build bases on the Moon, then move farther into the solar system. I grew up in a confident America animated by futuristic thinking, but that drive has faded. Beijing is now the home of energy and ambition. What happens in space is not divorced from what happens on Earth. Though clearly helpful to military space projects, NASA is charted as a civilian organization in line with idealist notions about the heavens being a clean slate free of power politics. There are no such illusions in China. Beijing's manned-space program is placed under the General Armament Department within the Ministry of Defense. The Long March rockets used for space launches are similar in design to China's nuclear-tipped intercontinental ballistic missiles. More important, is the spirit demonstrated in the space effort. History has not been kind to nations that stagnate in the face of a rising competitor. The desire to succeed is the most important element in any strategy. The NASA strategic plan claims, "Humanity’s interest in the heavens has been universal and enduring. Humans are driven to explore the unknown, discover new worlds, push the boundaries of our scientific and technical limits, and then push further. NASA is tasked with developing the capabilities that will support our country’s long-term human space flight and exploration efforts." But where is the higher national leadership with the vision to back these efforts? The frontier spirit that built America has waned. Both political parties are too busy looking at the mud around their feet to look up at the sky. So much for the "giant leap for mankind" so bravely stated over 40 years ago. But what can be expected in a country where Buzz Aldrin, who with Neil Armstrong were the first men to walk on the Moon, ends up on "Dancing with the Stars" performing for an audience most of whom had never heard of him. Nothing could better portray the decline of American civilization.

Colonization funding is critical to US Space Leadership – No Coherent plan, Morale & Funding

Armstrong et al 11 (Neil Armstrong, NASA Astronaut and First Man on the Moon, Jim Lovell and Gene Cernan, Former Apollo Mission Commanders, “Is Obama Grounding JFK’s Space Legacy?”, <http://www.usatoday.com/news/opinion/forum/2011-05-24-Obama-grounding-JFK-space-legacy_n.htm>, 5/24/2011) SV

President Obama's proposed 2011 budget did not include funds for Constellation, therefore essentially canceling the program. It sent shock waves throughout NASA, the Congress and the American people. Nearly $10 billion had been invested in design and development of the program. Many respected experts and members of Congress voiced concern about the president's proposal. Some supported the president's plan,but most were critical. The supporters' biases were often evident, particularly when there was a vested or economic interest in the outcome. Obama's advisers, in searching for a new and different NASA strategy with which the president could be favorably identified, ignored NASA's operational mandate and strayed widely from [President Kennedy's vision](http://www.americanrhetoric.com/speeches/jfkriceuniversity.htm) and the will of the American people. "We intend to be first. In short, our leadership in science and in industry, our hopes for peace and security, our obligations to ourselves as well as others, all require us to make this effort, to solve these mysteries, to solve them for the good of all men, and to become the world's leading space-faring nation." — President Kennedy Congress, realizing the devastating effects to the plans, program and morale of those trying to keep America in the forefront of exploring the universe and expanding the human frontier, worked diligently to steer NASA's program back toward Kennedy's goals. Congress passed an authorization bill directing NASA to begin development of a large rocket capable of carrying humans toward the moon and beyond and to continue development of a multipurpose spacecraft based on the configuration that was being developed in the Constellation program. However, the president's 2012 budget reduced funding significantly below the authorized amount for both the big rocket and the multipurpose crew vehicle. On the other hand, the president's budget had significantly increased funding over the congressional direction in the area of space technology research programs and the development of rockets and spacecraft by the commercial entrepreneurs. Congress stated that rather than depending on NASA subsidies, the development of commercial sources to supply cargo and crew to the International Space Station should be a partnership between government and industry. Entrepreneurs in the space transportation business assert that they can offer such service at a very attractive price — conveniently not factoring in the NASA-funded development costs. These expenditures, including funds to insure safety and reliability, can be expected to be substantially larger and more time consuming than the entrepreneurs predict. The response to Kennedy's bold challenge a half-century ago has led to America's unchallenged leadership in space. We take enormous pride in all that has been accomplished in the past 50 years. And we have the people, the skills and the wherewithal to continue to excel and reach challenging goals in space exploration. But today, America's leadership in space is slipping. NASA's human spaceflight program is in substantial disarray with no clear-cut mission in the offing. We will have no rockets to carry humans to low-Earth orbit and beyond for an indeterminate number of years. Congress has mandated the development of rocket launchers and spacecraft to explore the near-solar system beyond Earth orbit. But NASA has not yet announced a convincing strategy for their use. After a half-century of remarkable progress, a coherent plan for maintaining America's leadership in space exploration is no longer apparent.

New Colonization programs are key to secure Space Hegemony

**Tyson 10** (Peter Tyson, Writer for NOVA at PBS, “Buzz Aldrin’s Timetable for Colonizing Space”, <http://buzzaldrin.com/buzz-aldrins-timetable-for-colonizing-mars/>, 9/21/2010) SV

“No, it’s probably going to take three decades,” Aldrin said, and went on to outline his proposal for securing a lasting human presence on Mars. Exactly 50 years after Kennedy’s announcement, on September 12, 2012, Aldrin says, the U.S. President should proclaim a “global space doctrine.” The doctrine would serve as a road map for space exploration, including a stepped program to put human residents on Mars. The President should reaffirm that doctrine eight years and two months later, on the 50th anniversary of the fulfillment of Kennedy’s goal — the 1969 moon landing. And then every five years after that, until the 70th anniversary of his and Armstrong’s first steps on the moon. “It was 66 years from the Wright Brothers at Kitty Hawk to landing at Tranquility Base,” Aldrin says. It’s good to put a number in people’s minds, he added, and 70 years feels about right to him to get to the start of a sustained human outpost on Mars. America should act now, Aldrin says. With the Apollo program 40 years ago, the U.S. gained a dominant position in space exploration. But other countries, including the foursome loosely known as BRIC — Brazil, Russia, India, and China — have their eyes on space. (“You might call them the wannabes of space leadership,” Aldrin told me.) Russia, for one, plans to send a soil-sampling mission to Phobos, one of the martian moons, in 2011. Aboard will be a Chinese satellite to orbit the Red Planet. “If we don’t shape up what we’re doing, we’re going to find the Russians clearly leading missions to Mars,” Aldrin says. In a speech last April, President Obama outlined an ambitious plan for exploring the solar system that included a manned flight to Mars sometime after 2030. But he did not provide a detailed road map of how to get there.

Constellation---Solvency---Plan Fixes Constellation

The plan’s singular focus on establishing human settlements fixes the problems of Colonization---it was forced into doing too many unrelated tasks at once

Schmitt et al 9 – Harrison H. Schmitt, geologist, Apollo 17 astronaut, Former Chair NASA Advisory Council, Andy Daga, Lunar surface architecture and technology consultant, and Jeff Plescia, Applied Physics Laboratory, The Johns Hopkins University, 2009, “Geopolitical Context of Lunar Exploration and Settlement,” online: http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf

Between 2005 and 2008, the NASA Advisory Council continuously reviewed all aspects of the Constellation Program, NASA’s effort to implement the Vision for Space Exploration put forth by then-President George W. Bush. The Council’s conclusion can be summarized as follows: Constellation constitutes an extremely important, technically wellconceived, highly challenging, and grossly under-funded effort to return Americans to deep space, including eventual flights to Mars.

By lack of congressional and Bush Administration action, Constellation not only never received the Administration’s promised funding; but the program nonetheless was required:

1) to continue the construction of the international space station, which was badly under-budgeted by NASA, the Office of Management and Budget, and ultimately the Congress, prior to Mike Griffin’s tenure as NASA Administrator;

2) to accommodate numerous major cost over-runs in the Science programs, which are largely protected from major revision or cancellation by congressional interests;

3) to manage the Agency without hire and fire authority, which is particularly devastating to the essential hiring of young engineers; and

4) to absorb the legislative redirection and inflation-related costs of several Continuing Resolutions.

Whatever course is set by the new Administration, these four fundamental budgetary restrictions to success must be eliminated or the risk of program failure and of loss of future missions and crews will reach unacceptable levels.

Constellation---Solvency---Colonization

Colonization programs include Constellation

**Crisostomo 10** (Christian Crisostomo, Researcher and Technology Expert, “NASA's Constellation Program Planning To Take Initiative For Moon”, http://www.opentalkmagazine.com/technology/space-discovery/3021-nasas-constellation-program-planning-to-take-initiative-for-moon-colonization.html, 11/12/2010) SV

The Constellation program started as a planned successor to the Apollo program. It is a multi-faceted project that concentrated on three primary factors: the need to apply improved technologies to current spacefaring technology, the need to go beyond the current achievements in space travel and **the need to initiate research to eventually colonize other planets**. The program was literally meant to be taken as a first step towards the future human exploration of the entire interplanetary neighborhood. Application of advanced 21st century technology would be crucial for the Constellation program’s success. On the navigation and safety part, the Orion crew module and the Altair lunar module will be installed with the most advanced computers to aid astronauts in their journey. Spacesuits will be redesigned and redeveloped to provide astronauts with highly improved mobility during extra-vehicular activity. Numerous fail-safe devices are to be installed to ensure the safety of the crew; even if the mission doesn’t turn out to be a success. Various systems are also slated for research and improvement to make the astronauts’ stay at the moon better and much more pleasant. The Apollo program previously used the gigantic Saturn V rocket to send both the Apollo Command/Service module and Lunar module into the moon. The Constellation program however, plans to launch both modules separately. This was a plan to cut costs of lifting heavier payloads off into space, and also because of the large difference in size of both modules. Upon reaching low-Earth orbit, both modules would be docked together, and would be guided on its trip to the moon by an Earth Departure Stage. The initial plan of the Constellation program was to send astronauts to the moon by the year 2020 and let them stay for about a week. The next stage involves the establishment of a base camp that would let more astronauts stay for about half a year. After that, NASA plans to create a permanent thriving colony that can live on the moon using the resources available there by the year 2030-2050.

\*\*\* Leadership Adv Nuts and Bolts \*\*\*

Leadership Adv---Uniqueness

The rest of the world is venturing into space now, the US will be left behind.

Zey 10 (Dr. Michael G., exec. dir. of the Expansionary Institute, Ph. D. in Sociology from Rutgers University, http://www.examiner.com/future-trends-in-national/as-us-abandons-manned-flight-china-russia-europe-train-for-space-colonization-with-mars500) OP

From the 1950s to the 1970s the United States and the former USSR dominated space exploration. Now, a number of countries, including a variety of European and Asian countries as well as Brazil have been sending up communication and military satellites and making preparations for ambitious manned space missions. A few years ago China became the third nation to launch a human into space. Japan just announced its plans to establish a robotic moon colony by 2020. To prepare for human space flight to distant orbs, a number of countries this week initiated a project called Mars500, a mission designed to examine the physical and psychological stresses astronauts might encounter during a 520-day trip to Mars. An international team of six researchers will experience this simulated manned mission to Mars housed in a virtual spacecraft sitting inside a large hangar at Moscow's Institute for Medical and Biological Problems. The spacecraft is actually a series of interconnected steel cylinders called "Bochka," or barrel. Inside the spacecraft are small (32 square feet) windowless living quarters, personal cabins furnished with a bed, desk, chair and shelves. The self-contained environment is equipped with enough food, water, and other supplies to last the whole trip as well as video games, books, and other materials to amuse the crew during their leisure hours. The crew will spend the first 250 days “flying” to Mars, and after landing will explore the simulated model of the Martian terrain attached to the spacecraft module. Then the crew will embark on a 230-day return flight, finally exiting the enclosed environment in November, 2011. The six-person crew was chosen from hundreds of applicants. The commander, a recently-married Russian commander named Aleksei Sitev, 38, has worked at Russia’s cosmonaut training centre. The doctor, Sukhrob Kamolov, 32, and one of the researchers, Aleksander Smoleyevsky, 33, are also Russian. Other researchers include Wang Yue, 26, from China’s space training centre, and Diego Urbina, 27, an Italian- Colombian. The flight engineer is 31 year old Frenchman Romain Charles. Mars500 will provide these countries with a wealth of knowledge about the technological obstacles and psychological trials and tribulations a space crew will encounter both during the flight to Mars and while on the planet itself. By mission’s end China, Russia, and the European Space Agency will be years ahead of the US on the space learning curve. Clearly the US is falling behind in the global space race. Recently the Obama administration decided to direct NASA's funding away from manned space flight to the Moon and beyond. The US is even ending its shuttle program this year. Although the President did give lip service to the goal of colonizing Mars in the mid-2030s, many critics, including Mars Society president Robert Zubrin, were unmoved by this weak and ambiguous commitment to space exploration. "It basically means that they don't have to start working on it while they're in office," Zubrin said. Sadly, it appears that Obama plans to expend little energy or resources on the space program for the remainder of his term. He will provide the occasional “vote of confidence” to private companies such as SpaceX when they successfully launch rockets they have constructed. However, while SpaceX’s recent successful launch of Falcon 9 is laudable, many have suggested that the company was merely replicating technological feats NASA achieved half a century ago. The Mars500 program must serve as a wake-up call to the administration and the American public that the rest of the world is about to venture “where no man has gone before,” and leave America in its “space dust” in the process. The next Congress must pressure the President to reconsider his decision to decelerate the US space program, and convince him to begin the process of restoring the American space program to its former glory.

Now is the key time to reaffirm our space leadership.

Defense News 11 (Defense News is part of the Gannett Government Media Corporation and the leading military and government news periodical publisher in the world, Boeing Chief: U.S. Should Lead in Space Tech, http://www.defensenews.com/story.php?i=3469482&c=AIR&s=TOP) OP

James Albaugh, Boeing president and chief executive, warned that the United States risks losing a leadership role in space if Congress and military leaders don't reinvest in new space technologies over the next decade. "We can't afford the so-called rebuilding years of our space capability," he said during an April 8 speech at the National Space Symposium, here. "The next decade must be about reaffirming our leadership role in space." While Congress debates how it will fill the gap after the shuttle is retired and a new NASA launch technology is made operational, and military leaders scramble to develop new measures to protect U.S. satellites, Albaugh said, the next decade for the U.S. space program will be its "most crucial" since the 1950s. To keep the U.S. space program ahead of international competitors like China, Albaugh said, advancing space propulsion technologies by cutting its astronomical costs and increasing its efficiency will be critical. "We must identify the enabling technologies that with commitment and openness to big ideas will allow us to take the next big bold step forward," he said. "In my view, propulsion is the great enabler." NASA tapped Boeing to help develop the Ares I rocket designed to launch astronauts into space after the retirement of the space shuttle. It will construct the upper stage and instrument unit avionics starting in late 2009. A year after China demonstrated its ability to attack satellites by striking one of its own weather satellites with a ballistic missile, Albaugh said, it's also important to develop methods to protect U.S. space assets. Air Force Space Command officials have said increasing the Department of Defense's ability to monitor space assets and potential attacks tops their priority list. Boeing was contracted to help develop the Air Force's Space Based Space Surveillance system back in 2004. "We can clearly see our international competitors fast approaching in the rear view mirror," he said. "This is not the time to take a backseat. If we do, the consequences will be non-recoverable and future generations will judge us harshly."

Must start developing space now – China has the potential to challenge US supremacy

AFAR 2004 (The Association for Asian Research is a non-profit, non-governmental research institute that provides current affairs stories. The Chinese Threat to American Leadership in Space (Part II), http://asianresearch.org/articles/2979.html) hss

For the already cited Colonel Stokes, the fact that China has sent a man into Space is not worrisome in itself, but rather indicates the technological level now achieved by China in the field of space carriers, as Beijing - worrying over the possibility of losing definitive control over Taiwan - “is developing space-based capabilities that could be used in the event of a conflict in the Taiwan Strait”, aware that “Space assets will play a major role in any future use of force against Taiwan and in preventing foreign intervention in a Taiwan scenario”. The technical progress derived from initiating the Shenzhou 5 operation and subsequent “manned missions” could be used to develop not only ballistic missiles, but also anti-satellite weapons and mini-satellites for espionage. According to USA experts, Beijing will be able to launch small recognition satellites within the next three to five years to control China's periphery and the eastern Pacific Ocean. With regard to the space program's success - one that has been supported by a strong political will as the presupposition of its geostrategic vision - China, therefore, has the potential to challenge the US supremacy in Space, especially now that it is supported by significantly increasing funds. In March 2002 the Chinese Financial Minister, Xiang Huaicheng, announced an increase in military expenditure for 2002 of 17.5%, “…bringing the publicly reported total to $20 billion” (NASA currently receives $15.5 billion a year, while "Unclassified U.S. military space programs command a further $8.5 billion a year in federal spending.”). Consequently, this makes China the second greatest military spender in the world and the first in Asia. Moreover, the rate of Chinese economic growth has suggested to American analysts that “annual defense spending could increase in real terms three to four fold between now and 2020”.

Leadership Adv---Uniqueness--- China/Moon

China is kicking our ass in the new space race

Fortenberry, 05 ( Thomas, American author, editor, reviewer, and publisher. Founder of Mind Fire Press and the international literary arts journal Mindfire, he has judged many literary contests, including The Georgia Author of the Year Awards and The Robert Penn Warren Prize for Fiction. Among other awards, such as twice winning Best Novella of the Year, he has also been nominated for the Pushcart Prize, thomasfortenberry.net, China Colonizing moon, <http://thomasfortenberry.net/?p=188>, JG)

As I have been warning about for years, we are dangerously close to losing the new space race. We basically abandoned space after the moon landings, and have puttered along ever since with minimal effort by occasionally launching robotic probes. Sadly, a large number of those malfunctioned, were lost, or were stupidly mis-programmed and slammed into their targets like billion dollar bullets. We also kept the space shuttles flying (mostly), even though they were originally slated for phase out by 1980 at the latest. Not one to sit around, China has been leapfrogging ahead technologically in its quest to become the dominant power on earth. Beyond amazing military and economic expansions, they have also created a vibrant space program. They recently completed a series of manned space voyages and are now announcing their next great leap forward. China plans to put men on the moon by 2017. I mean Yue by 2017. But leave it to the practical Chinese to realize going to the moon should not just be a prestige-boosting photo opt, like it may have been largely for some in the past. They are sending their taikonauts with a purpose: to harvest helium 3, which is touted as the perfect energy source. And a nation like China, with the largest population and the world’s fastest growing, nay, dare I say booming, economy, needs all the fuel it can get. This excerpt from the below article spells out some of their goals: The project also includes setting up a moon-based astronomical telescope, measuring the thickness of the moon’s soil and the amount of helium-3 on the moon — an element some researchers say is a perfect, nonpolluting fuel source. Some scientists believe there is enough helium-3 on the moon to power the world for thousands of years. So, while we waste 3 billion dollars a month cleaning sand out of hummers in Bush’s Iraqi playground, the Chinese are planning on the conquest of the moon — well, I mean if you think that voyaging to, placing men on, exploring, and harvesting its natural resources constitutes colonization. It stated several years ago it planned to colonize the moon in 20 years, so anyone who thinks differently is a fool. My guess is that if the Chinese get there first before we ever wake up and return, we can kiss any Lunar Colony good bye. Much like Taiwan being forbidden from even officially declaring independence, when they want something they do it and have the military and economic might to back it up. They will not fear us or anyone else who dares to stand in the giant’s way, because they could collapse our economy overnight if they saw fit to call in the massive debts the Bush administration has rung up on the Chinese credit card. If we let them settle on the moon first, when ever we decide to return we will find the moon already has a proprietor and its lands may be closed to new business, especially foreigners. Notice in the article that America has scrambled to unveil a new manned moon mission set for, you guessed it, 2018. Gee, we’ve had since 1969 to be colonizing the moon, and now that someone else is on the way we finally get our ass in gear a full year too late. But who knows when it will really be given the usual cost overruns, cutbacks, experimentation, and red tape wrangling that always occurs. What an embarrassment.

US is already losing “space race” with China.

Malik 6 (Tariq, managing editor at Space.com, “Article: Race the Red Planet: Production Begins on Mars Mission Mini-Series”, May, 11. 2006, http://www.space.com/2398-race-red-planet-production-begins-mars-mission-mini-series.html) OP

China too - with its steady string of human spaceflight successes and lofty space station and lunar plans--also provides a real life hook in a time where human spaceflight seems to lack the emphatic and unified public support that pushed NASA to the Moon during the Apollo era. Some members of Congress have even said that the U.S. is already in a new space race with China, and already losing.

If US doesn’t act now China will gain the majority of lunar resources

AFAR 2004 (The Association for Asian Research is a non-profit, non-governmental research institute that provides current affairs stories. The Chinese Threat to American Leadership in Space (Part II). http://asianresearch.org/articles/2979.html) hss

China, if it succeeded in its goal, would acquire enormous international prestige. However, most significantly, by establishing permanent bases on the Moon, China would gain the ability to exploit lunar resources and therefore gain important technological advantages over other nations (including nuclear fusion, using the helium 3 isotope), with concrete consequences on Earth's activities. Walker's conclusion is that the Chinese space program has yet to be taken seriously by American politicians. Nevertheless, it represents a serious challenge to the US leadership in Space. The US must answer such a challenge by developing new technologies (for instance, the nuclear plasma propulsion system) in order to reach the Moon and Mars faster than currently possible, and to travel more frequently and thriftily into Earth's low orbit.

Leadership Adv---Uniqueness---China

Lack of U.S. plans to return humans to the moon is crippling space leadership---China is surging ahead

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

Recent media reports suggest that China is stepping up their program to send people to the Moon just as America appears to be standing down from it. This circumstance has re-awakened a longstanding debate about the geopolitical aspects of space travel and with it some questions. Are we in a race back to the Moon? Should we be? And if there is a “space race” today, what do we mean by the term? Is it a race of military dimensions or is such thinking just an artifact of the Cold War? What are the implications of a new space race?

Many in the space business purport to be unimpressed by the idea that China is going to the Moon and publicly invite them to waste money on such a stunt. “No big deal” seems to be the attitude – after all America did that over 30 years ago. NASA Administrator Charles Bolden recently professed to be unmoved by the possible future presence of a Chinese flag on the Moon, noting that there are already six American flags on the Moon.

Although it is not currently popular in this country to think about national interests and the competition of nations in space, others do not labor under this restriction. Our current human spaceflight effort, the International Space Station (ISS), has shown us both the benefits and drawbacks of cooperative projects. Soon, we will not have the ability to send crew to and from the ISS. But that’s not a problem; the Russians have graciously agreed to transport us – at $50 million a pop. Look for that price to rise once the Shuttle is fully retired.

The US faces losing the new space race – Cutbacks

LT, 10 (London Telegraph, US faces loosing space race to Russia and China, <http://www.telegraph.co.uk/science/space/7595237/US-faces-losing-space-race-to-Russia-and-China.html>, JG)

The United States faces losing the space race to Russia and China because of cutbacks that will be introduced in Barack Obama's new space programme. Neil Armstrong, the first man on the moon, warned that Barack Obama's proposal 'destines our nation to become one of second- or even third-rate stature' The president is set to make his case to a sceptical space community at the Kennedy Space Centre in Florida, but faces a battle with Congress over his plans to virtually scrap the Constellation project, which is designed to return Americans to the moon by 2020. The White House has been forced on the defensive as it has tried to explain the president's decision to favour a complicated system of public and private flights to the International Space Station and other destinations. In advance of the president's speech, his spokesman Robert Gibbs said the new plans would "provide more jobs for the area, greater investment in innovation, more astronaut time in space, more rockets launching sooner, and a more ambitious and sustainable space program for America's future". But opposition is rising in Congress, which must approve the plans, leading Mr Obama to retain a small part of Constellation as a compromise. "That just drags out the pain and slows everything down for a long time," said Brewster Shaw, the chairman of Boeing's space division. China this week announced that it intends to leapfrog the US by putting a large spacecraft in orbit before the end of this decade, at which point American astronauts are still likely to be riding to the ISS on Russian vehicles. They also announced plans to launch three spacecraft between 2011 and 2016 to form the basis of a manned space station. Americans retain great pride in winning the space race with the Soviet Union, and the president himself has spoken of the excitement he experienced as a boy watching the Apollo landings. Though it is rarely said publicly, consecutive US administrations have however determined that the old levels of spending on space are unaffordable. Mr Obama's space experts have insisted that cooperation with other nations is the only realistic option in the long term.

China is starting a second space race

Time, 08 (The New Space Race: China vs. The US, <http://www.time.com/time/world/article/0,8599,1712812,00.html>, JG)

Both the U.S. and China have announced intentions of returning humans to the moon by 2020 at the earliest. And the two countries are already in the early stages of a new space race that appears to have some of the heat and skullduggery of the one between Washington and Moscow during the Cold War, when space was a proxy battleground for geopolitical dominance. On Monday, the U.S. Department of Justice announced the indictment of a former Boeing engineer for passing sensitive information about the U.S. space program to the Chinese government. According to the indictment, Dongfan Chung, a 72-year-old California man who worked for Boeing until September 2006, gave China documents relating to military aircraft and rocket technology, as well as technical information about the U.S. Space Shuttle. U.S. officials say the Chung case is part of a pattern of escalating espionage by China. "We're seeing this on all fronts," says Dean Boyd, a spokesman for the Justice Department's National Security Division. Since October 2006, the Justice Department has prosecuted more than a dozen high-profile cases involving China, including industrial espionage and the illegal export of military technology. In an unrelated case also announced Monday, a Defense Department employee was arrested in Virginia for passing classified information about the sale of U.S. military technology to Taiwan to alleged Chinese agents. The scale of Chung's alleged espionage is startling. According to the Justice Department, Chung may have been providing trade secrets to Chinese aerospace companies and government agents since 1979, when he was an engineer at Rockwell International, a company acquired by Boeing in 1996. He worked for Boeing until his retirement in March 2003, and continued to work as a contractor for the company until September 2006. The indictment alleges that Chung gave China documents relating to the B-1 bomber and the Delta IV rocket, which is used to lift heavy payloads into space, as well as information on an advanced antenna array intended for the Space Shuttle. According to the indictment, Chinese officials gave Chung a shopping list of information to acquire for them. In one instance, Chung said that he would send documents through an official in China's San Francisco consulate. In another, a Chinese contact suggested he route information through a man named Chi Mak, a naturalized U.S. citizen who also worked as an engineer in California and who was convicted last year of attempting to provide China with information on an advanced naval propulsion system. The indictment charges that Chung was a willing participant. "Having been a Chinese compatriot for over 30 years and being proud of the achievements by the people's efforts for the motherland, I am regretful for not contributing anything," Chung allegedly wrote in an undated letter to one of his mainland contacts. (Chung's lawyer has maintained his client's innocence.) China's manned space program, codenamed Project 921, is indeed a matter of considerable national pride for a country that sees space exploration as confirmation of superpower status. China is pouring substantial resources into space research, according to Dean Cheng, an Asian affairs specialist at the U.S.-based Center for Naval Analysis. With a budget estimated at up to $2 billion a year, China's space program is roughly comparable to Japan's. Later this year, China plans to launch its third manned space mission — a prelude to a possible lunar foray by 2024. With President George W. Bush vowing to return American astronauts to the moon by 2020, some competition is perhaps inevitable. China's space program lags far behind that of the U.S., of course. "They're basically recreating the Apollo missions 50 years on," says Joan Johnson-Freese, chair of the National Security Studies Department at the U.S. Naval War College and an expert on China's space development. "It's a tortoise-and-hare race. They're happy plodding along slowly and creating this perception of a space race." But there may be more at stake than national honor. Some analysts say that China's attempts to access American space technology are less about boosting its space program than upgrading its military. China is already focusing on space as a potential battlefield. A recent Pentagon estimate of China's military capabilities said that China is investing heavily in anti-satellite weaponry. In January 2007, China demonstrated that it was able to destroy orbiting satellites when it brought down one of its own weather satellites with a missile. China clearly recognizes the significance of this capability. In 2005, a Chinese military officer wrote in the book *Joint Space War Campaigns,* put out by the National Defense University, that a "shock and awe strike" on satellites "will shake the structure of the opponent's operations system of organization and will create huge psychological impact on the opponent's policymakers." Such a strike could hypothetically allow China to counterbalance technologically superior U.S. forces, which rely heavily on satellites for battlefield data. China is still decades away from challenging the U.S. in space. But U.S. officials worry espionage may be bringing China a little closer to doing so here on Earth.

China’s aggressive actions in the international space race prove them a threat

Quigley 2009 (Erik N. Quigley is Major in USAF. Edited by Advanced Space Research Elective advisors: Lt Col Richard Rogers, Lt Col Brian Tichenor. “GEO-POLITICAL CONSIDERATIONS TO CHINA‘S RISE IN SPACE POWER” http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA539644&Location=U2&doc=GetTRDoc.pdf) hss

While it is understandable that economic, technological and cultural reasons may justify China‘s ‗peaceful‘ build-up of space capability, US leaders ought to scrutinize China‘s military motives. China knows there are ―important political, security, and economic benefits tied to space‖ and may choose to defend these gains at any cost.14 China views US space platforms as a strategic center for America‘s defense architecture and is looking to match, suppress, or surpass this capability.15 The PLA has been carefully absorbing and reacting to US published material on space warfare and counter-space operations and is even developing its own doctrine for warfare in space.16 Furthermore, Chinese political leaders have been reluctant to discuss their military (space) modernization strategy, which reinforces US suspicions about Chinese intentions.17 This lack of transparency with the Chinese keeps the US guessing whether China has a true space control advantage, and will likely result in the US overestimating China‘s true space capability. US leadership needs to better understand where China is heading with their newfound economic prosperity and what end-order military effects result from this financial success. While China‘s political leaders are reluctant to disclose their motives, the PLA has often been open with its intention to dominate space. In a March 2007 statement to the US-China Economic and Security Review Commission, Mary Fitzgerald claimed that Chinese military scientists stated and believe that ―whoever loses space loses the future.‖18 Fitzgerald contends that the Chinese believe that space warfare will become the ―core of future non-contact combat‖ and that without space dominance, a nation-state puts itself in the disadvantageous position of ―being defeated first and then going to war.‖19 Her recommendation to the commission warned that with China‘s immense progress in new concept weapons such as lasers, ―America should cease to be complacent about the sanctity of its orbital assets‖.20 To truly assess whether or not China‘s build-up of military space capability is a legitimate threat to US national interests, US leaders must first ask whether or not they view China‘s space build-up as peaceful acts towards regional stability or as an act of war. Jim Oberg, the author of *Space Power Theory*, contends that ―the Chinese government has obviously selected space operations as an area to prove their status as a modern great power.‖21 Oberg‘s opinion aside, a look at the recent unclassified facts of China‘s recent infatuation with military space build-up is necessary to form an independent assessment.

China is building many space weapons now – could be used against US

Quigley 2009. (Erik N. Quigley is Major in USAF. Edited by Advanced Space Research Elective advisors: Lt Col Richard Rogers, Lt Col Brian Tichenor. “GEO-POLITICAL CONSIDERATIONS TO CHINA‘S RISE IN SPACE POWER” http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA539644&Location=U2&doc=GetTRDoc.pdf) hss

Second, China has made significant offensive military space progress in recent years. Dating back to 1998, a Pentagon report to Congress stated that the PLA was building lasers capable of damaging sensors on space-based reconnaissance and intelligence satellites.26 Since that time, Larry Wortzel, former director of the Strategic Studies Institute of the US Army War College, confirms that the PLA is exploring a variety of space weapons through theoretical, basic, and applied research. These include: satellite jamming, collisions between space bodies, kinetic energy weapons, space-to-ground attack weapons, high-power laser weapons, high-power 7 microwave and electromagnetic weapons systems, and particle beam weapons.27 If these trends are accurate, it appears that the Chinese may be posturing for an Astropolitik strategy, or dictum, that ―who controls Low-Earth Orbit controls Near-Earth Space. Who controls Near-Earth space dominate Terra [earth].‖28 In addition to satellite disruption, denial and destruction capability, China is now contemplating space military benefits of strategic bombing with their new unmanned space plane under development, named the Shenlong. If heat shielding and hypersonic technology prove successful, this vehicle could strategically bomb at will with free maneuver in the transverse region of the atmosphere.29 According to Richard Fisher, ―the development of the Shenlong should be viewed as a second warning of China‘s commitment to building combat capabilities in space.‖30 He further contends that the platform ―may be intended to attack targets on earth‖, or ―carry out counter-space combat missions.‖31 Evidence of these types of Chinese military space threats and capabilities armed with the knowledge that China is willing to use them should cause US senior leadership to demand direct answers of China‘s true intentions for military space application. China‘s persistent claim that all military space build-up is strictly for peaceful purposes may not satisfy what the DoD learned from the Cold War where the Soviets contended, ―that nearly every military space application could be described as peaceful, even the stationing of weapons in space (as a defensive measure, of course).‖32

Until good communication with china exists the US must develop space now to maintain space superiority.

Quigley 2009 (Erik N. Quigley is Major in USAF. Edited by Advanced Space Research Elective advisors: Lt Col Richard Rogers, Lt Col Brian Tichenor. “GEO-POLITICAL CONSIDERATIONS TO CHINA‘S RISE IN SPACE POWER” http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA539644&Location=U2&doc=GetTRDoc.pdf) hss

Therefore, until the US achieves full, open communication with China, US leadership should posture its military counter-space capability along with its political and economic muscle. By doing so, the US can prepare for the worst-case scenario as recommended in a Dec 2007 report to Congress, ―mistrust over space goals and mutual uncertainty should result in the need 8 for worst-case planning.‖33 Furthermore, senior US leaders should re-evaluate their perceptions of China‘s space military threat to avoid contentment with US‘s space superiority. As described best in astro-politics, ―the lack of an enemy in space is most assuredly causing complacency in the United States, stunting the expansion of its space capabilities.‖34 With China‘s aggressive space military build-up, they may be the very ―enemy‖ that wakes up the US space industry.

US must take first step toward space development – maintains our position of dominance over China.

Quigley 2009 (Erik N. Quigley is Major in USAF. Edited by Advanced Space Research Elective advisors: Lt Col Richard Rogers, Lt Col Brian Tichenor. “GEO-POLITICAL CONSIDERATIONS TO CHINA‘S RISE IN SPACE POWER” http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA539644&Location=U2&doc=GetTRDoc.pdf) hss

In order for the US to be successful with deterring China‘s rise in space power, they need to be first to the punch – they must establish and maintain an aggressive offense to develop, procure and posture US military space assets similar to the effort given during the nuclear arms race of the Cold War. Leading space theorists such as Jim Oberg and Everett Dolman suggest that weaponizing space is inevitable.85 If this is to be the case, the US cannot afford to lose this race of controlling space. Oberg agrees that the US cannot afford to lose this opportunity (to be the first to field them), otherwise it will likely find itself held hostage to the state that does.86 Whatever the solution, a geo-political consideration to tactfully assess this space race is required so as not to diminish the years of good economic relations with China.

The space development of China threatens US dominance and resources.

The Heights 11 (independent student newspaper of Boston College, February 3, 2011, “Reaching for the moon”, http://www.bcheights.com/opinions/reaching-for-the-moon-1.1949997) OP

Obama's goal may not sound exciting or imaginative, but it still parallels the race to space. China has emerged as the new global competitor to the U.S., with advanced technology and energy initiatives. Similar to the U.S. competition with the U.S.S.R., though currently on a smaller scale, the development of China threatens the dominance of the American superpower. China is not alone in its threat. Dependency on oil reserves and the environmental factors of pollution and global warming that hover just around the corner call for the American people to notice that our dominance is slipping away and resources are slowly disappearing. Obama's goals call on us to realize this dependency and this competition, to have our own Sputnik moment where we see others have surpassed us and we aim to regain our ground.

Space Leadership Advantage---Colonization Key/Space Control Inevitable

Control of Space is inevitable but colonization programs are key to secure US hegemony

**Dinerman 10** (Taylor Dinerman, Consultant for DOD, Senior Editor at Hudson,“National Space Policy: From Strength to Weakness, Part 2”, http://www.hudson-ny.org/1440/national-space-policy-strength-weakness-2, 7/29/11) SV

What is so worrisome about the new Obama space policy goals, released in the New Space Policy document on June 28th -- especially those programs related to the internationalization of American space power -- is that they create opportunities for those who would undermine this power. The objective of these people, has long been to ensnare Washington in a net of agreements, policies and treaties. Eventually these will make it impossible for the US to project force without passing first through what Senator John Kerry (D, MA) called a "Global Test, " which is to say getting the approval of the international elite for anything that requires the use or even the threat of force. **In fifty years or less, we will have transitioned from a global economy to one that is beginning to encompass the Solar System; the only question is whether the US will lead the way** and embed its values out there, or whether they will be someone else's. When the Obama administration released its report, most of the media stressed that the president was reaching out for an unprecedented level of "Global Cooperation" -- supposedly in contrast to the Bush administration's "unilateralist approach to space." This simplistic and limited view of the facts may fit within the mindset of the mainstream media, but it clashes not only with the historic facts, but also with political realities. For decades, **America's space programs have been used to project power of both the hard and soft varieties**. Allies have long benefited from indirect, and, in rare cases from direct access to the Defense Department's various space systems. Throughout the world, every minute of every day, people use the Global Positioning System (GPS) signals, most of the time without even realizing that they come from a set of US military satellites. In the civilian realm the International Space Station which is now almost complete has been largely built and paid for by US taxpayers. This is particularly important in dealing with issues surrounding the future of the GPSl, which has become the *de facto* world wide standard for what are termed Global Navigation Satellite Systems (GNSS) and timing purposes. While Russia, China and Europe are all trying to build rival constellations, the GPS system which now includes more than 30 satellites, will, if it not wrecked by budget cuts or policy mistakes, continue to be the best and most effective and most reliable system. It is also essential for US military operations. If US control over the system is compromised, this will result in other nations having an effective veto over US military operations. The new space policy does not, directly, aim at this result, but it does order the US government to "Engage with foreign GNSS providers to encourage compatibility and interoperability, promote transparency in civil service provision and, and enable market access for US industry. " The key phrase here is "civil service provision." This seems to refer to the "Publicly Regulated Signal (PRS)," which is the lightly disguised military aspect of Europe's Galileo satellite navigation project. In the early years of this program, the Europeans wanted to entwine the GPS military signals with those the PRS, thereby preventing the US from using its own system without European cooperation. Fortunately, the State Department and the Defense Department were able to stop this "overlay" problem dead in its tracks with the signing, in 2004, of a formal deconfliction agreement. It appears as if the US side may now be ready to reopen this question. The contradictions of the administration's space proposals are nowhere better seen than in the way that NASA is treated. The attempt to cancel the Constellation program, the goal of which was to return permanently to the Moon before going on the Mars has, for now, shown that those foreign space agencies and leaders who had advised their political masters to stay out of the US program were right in saying that the US was an unreliable partner. Do NASA or the White House really believe that their new offers of cooperation will not be met with the same - or perhaps an even greater measure of skepticism about America's commitment to long term space exploration? The current bitter and angry debate over the future of Constellation and the rest of the US manned space program is something with which no sane foreign space agency wants to get involved. As American space leadership is an inescapable fact of international life, this naturally gives rise to resentment and envy among the nation's rivals and foes. For roughly half a century, the US government has made it a principal goal to, as the Eisenhower administration put it in a classified policy document from December 1959, "seek to increase international cooperation in selected activities relating to the peaceful exploration and use of outer space ... " Ike's people made sure to add that "International arrangements for cooperation in outer space activities should consider the net advantage to U.S. security." **The space policy** claims that the administration is committed to American space leadership, yet by its actions so far, it **has undermined that leadership and put this country on a path to becoming a second rate space power**. Previous administrations have got to share some of the blame for this, particularly in the Nixon-Ford-Carter era when the Saturn V Moon rocket program was cancelled and the Shuttle was starved of development funding. For the most part, the best that can be said of this new policy is that it could have been worse. There is also the strong possibility that relatively uncontroversial international space science programs will see their budgets cut by the next congress. **Constellation was an essential part of the delicate political balance that NASA had achieved**. The attempt to destroy it, whether it succeeds or not, has endangered all of NASA's programs. Anything with the label "international" will now be a ripe target for budget cutters, after all foreign space scientists do not vote in US elections. This could happen in spite of NASA's traditional "No exchange of funds" principal, whereby the space agency never pays for any foreign hardware or services but only acquires them in exchange for something from the US side. For example, Italy has provided the US with a number of pressurized modules for the Space Station in exchange for the US flying Italian astronauts on the Space Shuttle and for giving Italian scientists access to experimental facilities on the station. There have been exceptions, the late 1990s NASA did provide the Russians with some cash to help finish the first space station modules. There was a good deal of suspicious activity surrounding these payments and few people in Washington want to repeat the experience. Trying to manipulate another nation's space policy is not something to be done lightly. It is difficult to underestimate the harm that Administrator Charles Bolden did to NASA when he told the Al Jeezera network on July 1st that outreach to the Muslim world is now an important NASA priority. As Charles DeGaulle once put it, " Towards the complicated Middle East. I flew with simple ideas." ( "*Vers L'Orient compliqué, je volais avec des idées simples.")* Even diplomats who have spent a lifetime working in that area have to watch carefully every word they say in both public and private. There is a fine line between flattering one's hosts and groveling before them. Bolden seems to have stepped over it, or at least to have come very close. For all Presidents since Lyndon Johnson, the primary task of all NASA administrator is "*Don't embarrass the President."* The same applies to all senior officials; but due to its small size and to its symbolic importance, this is particularly true for NASA. Unfortunately for the leadership at the space agency, they have now done it twice: first with the disastrous roll-out of the proposal to cancel Constellation and replace it with an ill-defined dog's breakfast of concepts and plans; and now with clumsy attempt to deploy NASA's soft power, its ability to show the world spectacular and peaceful examples of America's technological and scientific accomplishments.

Leadership---Internal Link---Moon

Commitment to human space colonization’s key to overall leadership---bolsters hard and soft power---now is key

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

In one of his early speeches defending the Apollo program, President John F. Kennedy laid out the reasons that America had to go the Moon. Among the many ideas that he articulated, one stood out. He said, “whatever men shall undertake, free men must fully share.” This was a classic expression of American exceptionalism, that idea that we must explore new frontiers not to establish an empire, but to ensure that our political and economic system prevails, a system that has created the most freedom and the largest amount of new wealth in the hands of the greatest number of people in the history of the world. This is a statement of both soft and hard power projection; by leading the world into space, we guarantee that space does not become the private domain of powers who view humanity as cogs in their ideological machine, rather than as individuals to be valued and protected.

The Vision was created to extend human reach beyond its current limit of low Earth orbit. It made the Moon the first destination because it has the material and energy resources needed to create a true space faring system. Recent data from the Moon show that it is even richer in resource potential than we had thought; both abundant water and near-permanent sunlight is available at selected areas near the poles. We go to the Moon to learn how to extract and use those resources to create a space transportation system that can routinely access all of cislunar space with both machines and people. Such a system is the logical next step in both space security and commerce. This goal for NASA makes the agency relevant to important national interests. A return to the Moon for resource utilization contributes to national security and economic interests as well as scientific ones.

There is indeed a new space race. It is just as important and vital to our country’s future as the original one, if not as widely perceived and appreciated. It consists of a struggle with both hard and soft power. The hard power aspect is to confront the ability of other nations to deny us access to our vital satellite assets of cislunar space. The soft power aspect is a question: how shall society be organized in space? Both issues are equally important and both are addressed by lunar return. Will space be a sanctuary for science and PR stunts or will it be a true frontier with scientists and pilots, but also miners, technicians, entrepreneurs and settlers? The decisions made now will decide the fate of space for generations. The choice is clear; we cannot afford to relinquish our foothold in space and abandon the Vision for Space Exploration.

Recommitment to colonizing the moon is key to US space leadership.

Newton 11 (Elizabeth, Director for Space Policy- U Alabama-Huntsville, with Michael D. Griffin, United States space policy and international partnership, Space Policy 27 n 1, 2011)

The president’s request and congressional authorization for continued funding of the ISS’s operations delivers on commitments made to international partners beginning in the mid-1980s when the program was conceived. However, without a successor system to the Shuttle, the USA has abrogated intergovernmental agreements to provide crew and cargo transportation, and crew rescue, as partial compensation for partner investments in the ISS’s infrastructure and operations. Reliance on the Russian Soyuz for limited down-mass cargo transport seriously inhibits the value that can be realized from ISS utilization until a commercial solution is available. In addition, the USA’s unilateral abandonment of the Moon as a near-term destination shakes partners’ political support for their exploration plans, some of which were carefully premised on US intentions, and more than five years of collaborative development of lunar base plans. 3.3. Leadership The USA is a majority funder for many space programs and is a technology leader, two features which have provided sufficient motivation for partners to accept US leadership, even when unfortunately high-handed. It is a stunning failure of political will to lack a successor system to the retiring Space Shuttle, and so the US cedes leadership in human spaceflight with its inability to access the ISS independently, for itself or for its partners, until a new commercial capability has been demonstrated. The USA further relinquishes leadership when abandoning years of work on strategic planning and guidance, the evaluation of alternatives, and orchestration of diverse but important contributions that were manifested in the Global Exploration Strategy. Sudden redirections without consultation are not hallmarks of leadership and will no doubt motivate partners to do more unilateral planning and execution, at least for a while. Finally, leadership in the future is at risk: how can the USA hope to influence outcomes and protect interests-- strategic, commercial, and cultural -- on the Moon if it is not present?

Winning the race to the moon is key to U.S. military advantage over China in space

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

Warfare in space is not as depicted in science-fiction movies, with flying saucers blasting lasers at speeding spaceships. The real threat from active space warfare is denial of assets and access. Communications satellites are silenced, reconnaissance satellites are blinded, and GPS constellations made inoperative. This completely disrupts command and control and forces reliance on terrestrially based systems. Force projection and coordination becomes more difficult, cumbersome and slower.

Recently, China tested an ASAT weapon in space, indicating that they fully understand the military benefits of hard space power. But they also have an interest in the Moon, probably for “soft power” projection (“Flags-and-Footprints”) at some level. Sending astronauts beyond low Earth orbit is a statement of their technical equality with the United States, as among space faring nations, only we have done this in the past. So it is likely that the Chinese see a manned lunar mission as a propaganda coup. However, we cannot rule out the possibility that they also understand the Moon’s strategic value, as described above. They tend to take a long view, spanning decades, not the short-term view that America favors. Thus, although their initial plans for human lunar missions do not feature resource utilization, they know the technical literature as well as we do and know that such use is possible and enabling. They are also aware of the value of the Moon as a “backdoor” to approach other levels of cislunar space, as the rescue of the Hughes communications satellite demonstrated.

Leadership---U.S. Key---Lunar Resources

American loss in the race to the moon destroys free markets for lunar resources

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

The struggle for soft power projection in space has not ended. If space resource extraction and commerce is possible, a significant question emerges – What societal paradigm shall prevail in this new economy? Many New Space advocates assume that free markets and capitalism is the obvious organizing principle of space commerce, but others might not agree. For example, to China, a government-corporatist oligarchy, the benefits of a pluralistic, free market system are not obvious. Moreover, respect for contract law, a fundamental reason why Western capitalism is successful while its implementation in the developing world has had mixed results, does not exist in China. So what shall the organizing principle of society be in the new commerce of space resources: rule of law or authoritarian oligarchy? An American win in this new race for space does not guarantee that free markets will prevail, but an American loss could ensure that free markets would never emerge on this new frontier.

Leadership---Moon Colonization Key

Moon colonization’s key to space leadership

Schmitt et al 9 – Harrison H. Schmitt, geologist, Apollo 17 astronaut, Former Chair NASA Advisory Council, Andy Daga, Lunar surface architecture and technology consultant, and Jeff Plescia, Applied Physics Laboratory, The Johns Hopkins University, 2009, “Geopolitical Context of Lunar Exploration and Settlement,” online: http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf

In spite of the difficulties that have faced Constellation, history tells us that an aggressive program to return Americans to deep space, initially the Moon and then on to Mars, must form an essential component of national policy. The current course of United States in space appears to be to have no national capability to launch its astronauts, at all. Americans would find it unacceptable, as well as devastating to human liberty, if we abandon leadership in deep space to the Chinese, Europe, or any other nation or group of nations. Potentially equally devastating would be loss of access to the energy resources of the Moon as fossil fuels diminish on Earth. In the harsh light of history, it is frightening to contemplate the long-term, totally adverse consequences to the standing of the United States in modern civilization of a decision to abandon deep space. Space does not represent just another large-scale science arena that can be abandoned limited only to the science leadership consequences the United States has suffered in recent decades.

Leadership Adv---Impact---China War

Space race risks China war.

MacDonald, 08 (Bruce, Council on foreign relations chair, China, Space weapons and US security, i.cfr.org/content/publications/attachments/China\_Space\_CSR38.pdf, JG)

While the United States is likely well ahead of China in offensive space capability, China currently is much less dependent on space assets than the U.S. military, and thus in the near term has less to lose from space conflict if it became inevitable. China’s far smaller space dependence, which hinders its 4 China, Space Weapons, and U.S. Security military potential, ironically appears to give it a potential relative nearterm offensive advantage: China has the ability to attack more U.S. space assets than vice versa, an asymmetry that complicates the issue of space deterrence, discussed later. This asymmetric Chinese advantage will likely diminish as China grows increasingly dependent on space over the next twenty years, and as the United States addresses this space vulnerability. Thus, the time will come when the United States will be able to inflict militarily meaningful damage on Chinese space-based assets, establishing a more symmetric deterrence potential in space. Before then, other asymmetric means are available to the United States to deter China, though at possibly greater escalatory risk. That is, the United States could threaten to attack not just Chinese space assets, but also ground-based assets, including ASAT commandand- control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and thus might climb the escalatory ladder to a more damaging war both sides would probably want to avoid.

Taiwan war = China Destroys US Space Assets = US China War

MacDonald, 08 (Bruce, Council on foreign relations chair, China, Space weapons and US security, i.cfr.org/content/publications/attachments/China\_Space\_CSR38.pdf, JG)

Looming in the background, however, is the possibility of war over Taiwan, a plausible if unlikely scenario that could bring the United States and China into conflict. China might then be tempted to attack U.S. military satellites as a casualty- free way to signal resolve, dissuade Washington from further involvement in a Taiwan conflict, and significantly compromise U.S. military capabilities if such dissuasion failed. Such Chinese actions could well escalate any conflict between the United States and China.

Leadership Adv---Impact---Chinese ASATs

Chinese space dominance = ASAT threat to the US.

MacDonald, 08 (Bruce, Council on foreign relations chair, China, Space weapons and US security, i.cfr.org/content/publications/attachments/China\_Space\_CSR38.pdf, JG)

With China’s demonstration of an ASAT weapon, the United States is concerned that China might soon deploy a substantial ASAT arsenal, consisting of either a fleet of the ASATs it tested in 2007, coorbital small satellites (“space mines”), or, later, a more advanced ASAT capability based on technologies such as lasers, microwaves, or cyberweapons. Such a Chinese deployment could substantially reduce the effectiveness of U.S. fighting forces. While more traditional counterspace capabilities like jammers have a long and well-recognized role in electronic warfare, their effects are localized and temporary and thus can be tailored. Offensive counterspace capabilities could permanently damage or destroy costly satellites and leave substantial harmful debris in space if they physically destroy the satellites.

US is vulnerable to Chinese ASATS – Reliance on Satellites

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

The US is the world's foremost space power today, but this position is not assured in perpetuity. Of all the nations in the world, the US is the most reliant on space, and is therefore the most vulnerable to the disruption of its space assets - a weakness China fully intends to exploit in the event of a conflict. Furthermore, the US's quest for full spectrum dominance in the space arena represents a power tactic challenging China's core national interests. Given the US threat to China's security, it is hardly surprising that Beijing's military doctrine is shaped to counter the US effort. A recent example of this doctrine was China's anti-satellite (ASAT) test in January, 2007, which represented something of a wake-up call for the US. Furthermore, China's reckless act in low Earth orbit (LEO) represented a high-leverage, asymmetric threat with the potential to inflict a highly disproportionate impact on US military capability and security. Since many US space-based assets serve both civilian and military users, their destruction, and even the threat of their destruction, could have devastating economic and military consequences, ultimately wreaking havoc on the US and global economy. Against this background, it is inevitable concerns are being raised by military theorists and space analysts.

US is vulnerable to Chinese ASATS – Reliance on Satellites

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

For example, "Is a space doctrine emerging in China, and if so, what are its contours?"; "Is China developing a preemptive strategy?"; and "What is the role of deception in Chinese military space strategy?" Chapter 3 addresses these questions while steering clear of the blogosphcre-based misinformation that seems to seethe around the subjects of space doctrine and strategy. While it is necessary to establish a doctrine for fighting in the harsh and unforgiving space environment, the best national strategy in the world is of no value without space assets, without which doctrine cannot be implemented. The advanced space hardware of the US comprises a complex network of space-based command, control, communications, and surveillance and reconnaissance capabilities that form the key to American combat operations, as evidenced in Operation Desert Storm. These assets, however, are relatively soft and mostly defenseless, and, while they embody the very nature of American military might and power, they are also the source of deep vulnerability - a weakness the Chinese military recognizes. To that end, the Chinese are developing conventional weapon systems designed to disable American satellites and destroy US ground stations. In Chapter 4, US and Chinese space hardware is described and comparisons made between current and future space weapon systems, ranging from American and Chinese ASAT capabilities to direct attack and directed-energy weapons. Given the inordinate American dependence on its space assets and the perceived asymmetric advantage of China's counterspace program, the US is pursuing a strategy aimed at responding to asymmetric warfare by continuing to utilize its military dominance to deter and defeat adversaries. This tenet of space dominance is addressed in Chapter 5, which explains how the US will defend the High Frontier and how China's intentions to match the US may ultimately and inevitably fall short.

Leadership Adv---Impact---Accidental War

Regaining leadership key to decrease risk of accidental space conflict.

MacDonald 8 (Bruce W., senior director of the Nonproliferation and Arms Control Program with the USIP Center for Conflict Analysis and Prevention, “China, space weapons, and U.S. security”, Council on Foreign Relations, http://books.google.com/books?hl=en&lr=&id=

o0GkabrNftIC&oi=fnd&pg=PP2&dq=USChina+Space+Race+for+Resources&ots=OTkneA1pzZ&sig=ZNn15blP7hbdiwS4E0EjD98Rr44#v=onepage&q&f=false) OP

The United States faces a serious challenge as its military and economic prowess increasingly depend upon space infrastructure that grows more vulnerable as worldwide space technology advances, especially in China, While the United States will likely remain the preeminent space power at least for the next twenty to thirty years, it will no longer enjoy the level of near monopoly on military space capability that it has enjoyed since the fall of the Soviet Union. As China becomes a credible space power with a demonstrated offensive counter-space capability, the question for U.S. policy is what kind of feasible and stable space regime best serves U.S. long-term security interests. This question should be addressed early in the new administration's tenure, if not earlier.

The fundamental U.S. security interest in the wake of China's 2007 ASAT test should be deterring China and others from attacking U.S. assets in space, using both a combination of declaratory policy, military programs, and diplomacy, and promoting a more stable and secure space environment. At the same time, the United States and China should both pursue diplomatic options to increase clarity and minimize misunderstanding on space-related matters, and reduce the chances of accidental conflict. This comprehensive mix of military and diplomatic measures is more likely to achieve U.S. space and larger national security objectives than either by itself.

Leadership Adv---Impact---Coalitions

American Leadership leads to future international coalitions

Stone 2011 (Christopher Stone is a space policy analyst and strategist. The Space Review. “American leadership in space: leadership through capability”. March 11, 2011. http://www.thespacereview.com/article/1797/1) hss

If America wants to retain its true leadership in space, it must approach its space programs as the advancement of its national “security, prestige and wealth” by maintaining its edge in spaceflight capabilities and use those demonstrated talents to advance international prestige and influence in the space community. These energies and influence can be channeled to create the international space coalitions of the future that many desire and benefit mankind as well as America. Leadership will require sound, long-range exploration strategies with national and international political will behind it. American leadership in space is not a choice. It is a requirement if we are to truly lead the world into space with programs and objectives “worthy of a great nation”.

Leadership doesn’t preclude international cooperation.

Stone 2011 (Christopher Stone is a space policy analyst and strategist. The Space Review. “American leadership in space: leadership through capability”. March 11, 2011. http://www.thespacereview.com/article/1797/1) hss

Finally, one other issue that concerns me is the view of the world “hegemony” or “superiority” as dirty words. Some seem to view these words used in policy statements or speeches as a direct threat. In my view, each nation (should they desire) should have freedom of access to space for the purpose of advancing their “security, prestige and wealth” through exploration like we do. However, to maintain leadership in the space environment, space superiority is a worthy and necessary byproduct of the traditional leadership model. If your nation is the leader in space, it would pursue and maintain superiority in their mission sets and capabilities. In my opinion, space superiority does not imply a wall of orbital weapons preventing other nations from access to space, nor does it preclude international cooperation among friendly nations. Rather, it indicates a desire as a country to achieve its goals for national security, prestige, and economic prosperity for its people, and to be known as the best in the world with regards to space technology and astronautics. I can assure you that many other nations with aggressive space programs, like ours traditionally has been, desire the same prestige of being the best at some, if not all, parts of the space pie. Space has been characterized recently as “congested, contested, and competitive”; the quest for excellence is just one part of international space competition that, in my view, is a good and healthy thing. As other nations pursue excellence in space, we should take our responsibilities seriously, both from a national capability standpoint, and as country who desires expanded international engagement in space.

Leadership Adv---Solvency---Funding

Funding space advancement increases leadership for the US.

Stone 2011 (Christopher Stone is a space policy analyst and strategist. The Space Review. “American leadership in space: leadership through capability”. March 11, 2011. http://www.thespacereview.com/article/1797/1) hss

The world has recognized America as the leaders in space because it demonstrated technological advancement by the Apollo lunar landings, our deep space exploration probes to the outer planets, and deploying national security space missions. We did not become the recognized leaders in astronautics and space technology because we decided to fund billions into research programs with no firm budgetary commitment or attainable goals. We did it because we made a national level decision to do each of them, stuck with it, and achieved exceptional things in manned and unmanned spaceflight. We have allowed ourselves to drift from this traditional strategic definition of leadership in space exploration, rapidly becoming participants in spaceflight rather than the leader of the global space community. One example is shutting down the space shuttle program without a viable domestic spacecraft chosen and funded to commence operations upon retirement of the fleet. We are paying millions to rely on Russia to ferry our astronauts to an International Space Station that US taxpayers paid the lion’s share of the cost of construction. Why would we, as United States citizens and space advocates, settle for this? The current debate on commercial crew and cargo as the stopgap between shuttle and whatever comes next could and hopefully will provide some new and exciting solutions to this particular issue. However, we need to made a decision sooner rather than later.

Leadership Adv---Solvency--- Capabilities

Boosting space capabilities solves US space leadership.

Stone 2011 (Christopher Stone is a space policy analyst and strategist. The Space Review. “American leadership in space: leadership through capability”. March 11, 2011. http://www.thespacereview.com/article/1797/1) hss

When it comes to space exploration and development, including national security space and commercial, I would disagree somewhat with Mr. Friedman’s assertion that space is “often” overlooked in “foreign relations and geopolitical strategies”. My contention is that while space is indeed overlooked in national grand geopolitical strategies by many in national leadership, space is used as a tool for foreign policy and relations more often than not. In fact, I will say that the US space program has become less of an effort for the advancement of US space power and exploration, and is used more as a foreign policy tool to “shape” the strategic environment to what President Obama referred to in his National Security Strategy as “The World We Seek”. Using space to shape the strategic environment is not a bad thing in and of itself. What concerns me with this form of “shaping” is that we appear to have changed the definition of American leadership as a nation away from the traditional sense of the word. Some seem to want to base our future national foundations in space using the important international collaboration piece as the starting point. Traditional national leadership would start by advancing United States’ space power capabilities and strategies first, then proceed toward shaping the international environment through allied cooperation efforts. The United States’ goal should be leadership through spacefaring capabilities, in all sectors. Achieving and maintaining such leadership through capability will allow for increased space security and opportunities for all and for America to lead the international space community by both technological and political example.

Leadership Adv---AT: Backlash

Collaboration with Asian countries increases perceptions of US leadership

Friedman February 14, 2011 (Lou Friedman recently stepped down after 30 years as Executive Director of [The Planetary Society](http://www.planetary.org/home/). He continues as Director of the Society's LightSail Program and remains involved in space programs and policy. “American leadership” The Space Review. http://www.thespacereview.com/article/1778/1) hss

American leadership in space is much more desired that resented—except when it gets used unilaterally, as in the past Administration’s call for “dominance in cislunar space.” Asian countries (China, Japan, India) are especially interested in lunar landings; Western countries, including the US, much less so. However, cooperating with Asian countries in lunar science and utilization would be both a sign of American leadership and of practical benefit to US national interests. Apollo 11 astronaut Buzz Aldrin has been a leader advocating such cooperation. At the same time American leadership can be extended by leading spacefaring nations into the solar system with robotic and human expeditions to other worlds. The US can’t do everything alone. Climate monitoring, Earth observation, space weather prediction, and ultimately asteroid deflection are huge and vital global undertakings that require international participation. That is also true with exploration projects sending robots and human to other worlds. American leadership in these areas is welcomed and used by other countries, even as they develop their own national programs. The US government should make more of this and not treat it as an afterthought—or even worse, prohibit American leadership as the House of Representatives is doing this week by banning any China collaboration or cooperation. (The proposed House continuing resolution for fiscal year 2011 prohibits OSTP or NASA funds to be used for anything to do with China.)

AT: China space = peaceful

China is upgrading technology to compete with the US Militarily – Taiwan

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

Space activities are normally considered dual-use in nature, meaning the same space technologies that can lift a human into orbit can easily be used to deliver a warhead onto a target. As with the Americans and the Soviets in the late 1950s and early 1960s, Beijing's most important justification and motivation for pursuing a manned space program is based firmly in the military arena, which is not surprising, since national security remains a potent justification for the large expenditures demanded by a space program. To that end, US space-based military assets have been routinely studied by the Chinese during the two Gulf Wars, and the campaigns in Kosovo, Afghanistan, and Iraq. From observing US military operations, such as Desert Storm, the Chinese soon realized that the military strength of the US was largely due to its advanced command, control, intelligence, surveillance, and reconnaissance abilities. These capabilities mostly rely on military satellites - assets the Chinese hope to match before employing their use in an attack on Taiwan (Panel 1.4). To achieve this goal, China is constructing a space-based surveillance infrastructure, including 20 differential global-positioning system stations to enhance the accuracy of the PLA's short-range ballistic missiles targeting Taiwan.

Motive of China Space Program – Challenge the US Military

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

While international relations, political progression, and the other incentives cited in this section undoubtedly contribute to China's overall influence and provide Beijing with opportunities for international leadership, the true purpose of China's spaceflight program lies in the dual-use nature of space technology. Although Beijing is loath to mention the military utility of its spaceflight program, the development of space hardware, combined with China's space doctrine, has several negative-sum aspects for the US, which may lead to future confrontation in space.4 While many readers may be familiar with the recent successes of Beijing's manned spaceflight program, China's human space program and lunar exploration missions are intended to counteract concerns and divert attention from China's military uses of space. In reality, by striving to be a major space power, China has increased its comprehensive national power (CNP),\* but its improving military space capabilities have resulted in the US viewing China as potentially coming into conflict with its own interests. The rise of China as a potential peer competitor raises concerns for the US, which, as we shall discover later, will increasingly define the rising dragon by military considerations, given the inherently military nature of the Chinese spaceflight program.

AT: China-US cooperation inevitable

Co-op is highly unlikely

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

China has embarked on an ambitious space program designed to compete with the US in both the civil and military arenas of space exploration and space utilization. Concerns regarding China's military intentions and its ambitions to land taikonauts on the Moon have led some to question whether the US should cooperate with China. Others have argued that any Sino-US cooperation is out of the question, citing concerns of technology leaks or inadvertent assistance, possibly leading to China becoming a more formidable space power. Given the financial burdens that a space race would impose, it would seem to be in the interests of both the US and China to consider opportunities for cooperation. Such a partnership would ensure that the space infrastructure remains intact for the international community. However, given the extremely limited transparency between the two countries and the technological lead maintained by the US, any incentive to cooperate is unlikely.

Major Hurdles b4 we can cooperate with China

Seedhouse, 10 (Eric, Med. Science PhD, The New Space Race: China vs. The US, JG)

Ultimately, while arguments can be made for the benefits of cooperation, in reality, pursuing this path would require both the US and China to share resources and technology - a step neither is willing to take, regardless of the potential benefits. Undoubtedly, one of the most important security challenges in the next decade will be how the US deals with China, but it is unlikely that the option of cooperation will be on the table. Some of the reasons why the US will not entertain the notion of collaboration have been discussed in this chapter. Perhaps a more powerful reason is the nature of the national security relationship between Beijing and Washington - a dynamic reminiscent of the US-Soviet relationship in the late 1950s and early 1960s. Back then, the US maintained the high ground in nuclear power, believing that although the Soviets were making progress, the US still had an unmatched ability to decimate the Soviet Union with strategic airpower. After the Sputnik shock, the US had to recalibrate, as evidenced by President Eisenhower's broad educational effort to reassert American leadership in space while raising the public's understanding of the global security situation. The difference this time around is that there will be no Sputnik shock and, with US superiority in space all but assured, there is no incentive for Washington to seek common ground with the Chinese. While the potential clash of interests may not yet be sufficiently severe to be visible to casual observers, the course would appear to be set towards greater competition rather than collaboration.

\*\*\* Aerospace Industry Advantage \*\*\*

Aerospace---Uniqueness

The Aerospace industry risks collapse now due to the lack of new flight system development and an aging workforce.

Newton 11 (Elizabeth, Director for Space Policy- U Alabama-Huntsville, with Michael D. Griffin, United States space policy and international partnership, Space Policy 27 n 1, 2011)

2.3. Sustainment of national capability The DoD’s acquisition changes portend an improvement in the USA’s ability to sustain its aerospace industrial base. Block buys will create more predictable, higher volume demand for suppliers, intended to help stabilize the workforce. Nevertheless, the ‘greying’ of the aerospace workforce, with more than half eligible for retirement in the next five years, creates continued risk that valuable knowledge will not be transferred to the younger workforce, because opportunities for experience on flight systems are limited.

Lack of a clear space policy dooms the aerospace industry.

AIAA, 3/30 [AIAA (American Institute of Aeronautics and Astronautics) march 30th 2011 http://intranet.aiaa.org/industryresources/PDF/MaserTestimony.pdf]

In his prepared testimony, Maser stated that the aerospace industry, which directly supports more than 800,000 jobs nationwide, is imperiled by the lack of a clear space policy. Maser explained that the uncertainty that the current space policy imposes on the industrial base creates three unique problems for the nation: first, it makes it impossible for the space industrial base to plan for current or future needs, harming the industry‟s ability to meet NASA‟s needs and retain its engineering and science workforce; second, it harms the industry‟s ability to recruit future workers because students who are currently enrolled in science, technology, engineering and math (STEM) programs will be wary of entering an enterprise that lacks a clear direction and mission, and which has no guarantee of longevity; and last, it harms U.S. national security by driving up short-term fixed costs for the Department of Defense to offset the uncertainty in the needed volume of materials for a robust military presence in space. Maser noted that while there is uncertainty about the best way to address these problems through the creation of a focused space policy for the nation, there is no doubt that “unfortunately, though, we do not have the luxury of waiting until we have all the answers. We must not „let the best be the enemy of the good.‟ In other words, selecting a configuration that we are absolutely certain is the optimum configuration is not as important as expeditiously selecting one of the many workable configurations, so that we can move forward.”

The Aerospace industry is on the brink of collapse- high retirement threatens employment.

Sturtevant, 9[Dan Sturtevant 2009“the future of the aerospace workforce” <http://www.emtect.com/Reports/Future_of_the_Aerospace_Workforce.pdf> ]

The U.S. aerospace industry is rapidly approaching a critical juncture. Its workforce is dominated by baby boomers on the verge of retirement. This phenomenon exists across all labor segments. Managers, engineers, and workers in the technical trades have average ages in the 50s. The following chart shows the age distribution of aerospace workers by age. It shows the age distribution of the U.S. workforce as a point of reference 1 : The current situation was arrived at because most of today’s employees were inspired to enter the field during the space race and Apollo program. The aerospace industry went through a rapid expansion at that time. Many of these baby boomers stayed in the industry over the course of their careers. Because industry demands have not substantially risen since that time, there was little career opportunity for succeeding cohorts... until now.

Aerospace---AT: resiliency

AT: its resilient- no, its not.

Walker 02 (Robert, chair of the Commission, former chair of the House Science Committee, FINAL REPORT OF THE COMMISSION ON THE FUTURE OF THE UNITED STATES AEROSPACE INDUSTRY, http://trade.gov/static/aero\_rpt\_aero\_commission.pdf)

The contributions of aerospace to our global leadership have been so successful that it is assumed U.S. preeminence in aerospace remains assured. Yet the evidence would indicate this to be far from the case. The U.S. aerospace industry has consolidated to a handful of players—from what was once over 70 suppliers in 1980 down to 5 prime contractors today. Only one U.S. commercial prime aircraft manufacturer remains. Not all of these surviving companies are in strong business health. The U.S. airlines that rely upon aerospace products find their very existence is threatened. They absorbed historical losses of over $7 billion in 2001 and potentially more this year. The industry is confronted with a graying workforce in science, engineering and manufacturing, with an estimated 26 percent available for retirement within the next five years. New entrants to the industry have dropped precipitously to historical lows as the number of layoffs in the industry mount. Compounding the workforce crisis is the failure of the U.S. K-12 education system to properly equip U.S. students with the math, science, and technological skills needed to advance the U.S. aerospace industry. The Commission’s urgent purpose is to call attention to how the critical underpinnings of this nation’s aerospace industry are showing signs of faltering— and to raise the alarm. This nation has generously reaped the benefits of prior innovations in aerospace, but we have not been attentive to its health or its future. During this year of individual and collective research, the Commission has visited and spoken with aerospace leaders in the United States, Europe, and Asia. We noted with interest how other countries that aspire for a great global role are directing intense attention and resources to foster an indigenous aerospace industry. This is in contrast to the attitude present here in the United States. We stand dangerously close to squandering the advantage bequeathed to us by prior generations of aerospace leaders. We must reverse this trend and march steadily towards rebuilding the industry.

Aerospace---Solvency---Govt Funding

NASA funding key to jump start aerospace innovation.

Bunn. 7/1 [ Darcy Bunn“U.S. Space Program Has A Goal: Settlement” June 1st, 2011 <http://www.thespacegeneration.com/tag/colonization>]

Greason’s strategy changes the paradigm of how space industry is done in the U.S. He emphasizes the importance of contacting elected representatives about this. My understanding is that he wants NASA to still be the head coordinator of the space program, with an important role in developing advances that would not be able to come from the private sector because there would be no demand for these technologies outside the specific activities NASA is undertaking. Yet there would be a role for private industry which NASA would also facilitate, in areas where customers other than the government would be helping bring down the cost of these developments.

Aerospace---Solvency---Aging Workforce

A new commitment to space exploration key to solve the declining aerospace workforce.

Pace 09 (Scott, Director of the Space Policy Institute-George Washington, A Day Without Space: Economic Security Ramifications, http://www.marshall.org/pdf/materials/728.pdf)

Question: I was struck with space being the catalyst for education. It seems to me that that catalyst is really Russia, India and China. We hear about the maturing engineering workforce in this country; do you have any comments on that? Scott Pace: There was an AIAA conference on science education and inspiring people to go into engineering. I have two thoughts: one is that we have to get kids really young; even high school is sometimes too late to get people interested in it. Kids become interested in it not because they love the elegant beauty of mathematics; some kids are like that and will go for it because hyperbolic functions are beautiful. But a lot of them get into it because there is some existential inspirational thing they can do and they imagine themselves doing it and say, “Okay, I have to go through all this math and science stuff in order to accomplish some higher order goal,” an internal motivation. I wanted to be a solar physicist working in space. I initially started off thinking it would really be cool to work on a space station and do scientific research and be in that kind of environment and I had to take a lot of physics to get there. People need to have a sense of reality that there is a thing that they can achieve and then fall into, “Okay, now I have to do all this math and science -- and it’s interesting.” The second thing is that they have to see that there are, in fact, real jobs. Back in 1992 as the Bush I Space Council was ending, I was the lead writer on a study on the space industrial base and one of the charts that I put in there was sophomore enrolment in aerospace engineering at M.I.T. It followed a wonderful cyclical wave, because as sophomores saw seniors getting jobs, they enrolled and as they saw seniors not getting jobs, they bailed out. It followed the fortunes of the aerospace industry. A part of me feels that the space business, NASA included, is a little hypocritical about some of this encouragement because we are not able to point to hands-on opportunities. Where are the jobs? When Lockheed put out advertisements to work on Orion, they were flooded with thousands of resumes of people who wanted to work on it and be part of it. They had their pick of the best top-notch people, because there was a real opportunity. We don’t create that many opportunities today, not just on the space side but on the defense side, the number of opportunities people have to work on a flight project or work on a major development program keeps going down. Programs become longer and longer and therefore in a person’s career, they work on one or two projects. Not only is that dampening in terms of inspiration, it is also really dangerous for the capability of the work force. You don’t have people who have been on multiple projects. Mike Griffin is a veteran of a dozen or more major launch campaigns. That was normal for someone working in the 1960s and 1970, but that is an extraordinary level of experience for someone in the early 2000s. We need to have more opportunities for hands-on experience to train that next generation. In that picture of the cheering Chinese, that’s great, but where are our folks going to get the opportunity to actually build something, not just PowerPoint charts, but real hardware that ships out the door and into space? If we don’t do that, then a lot of our conversation about encouraging math and science education is just flag waving and bumper stickers. That is not sufficient to get the results we want. We are either serious about having a space program, in which case it is a place to go to answer important questions, or we are not. We need to put actual money where we say our priorities are.

Aerospace---Internal Link---Heg

Continued aerospace industry innovation is key to US leadership.

Walker 02 (Robert, chair of the Commission, former chair of the House Science Committee, FINAL REPORT OF THE COMMISSION ON THE FUTURE OF THE UNITED STATES AEROSPACE INDUSTRY, http://trade.gov/static/aero\_rpt\_aero\_commission.pdf)

Aerospace will be at the core of America’s leadership and strength in the 21st century. The role of aerospace in establishing America’s global leadership was incontrovertibly proved in the last century. This industry opened up new frontiers to the world, such as freedom of flight and access to space. It provided products that defended our nation, sustained our economic prosperity and safeguarded the very freedoms we commonly enjoy as Americans. It has helped forge new inroads in medicine and science, and fathered the development of commercial products that have improved our quality of life. Given a continued commitment to pushing the edge of man’s engineering, scientific and manufacturing expertise, there is the promise of still more innovations and new frontiers yet to be discovered. It is imperative that the U.S. aerospace industry remains healthy to preserve the balance of our leadership today and to ensure our continued leadership tomorrow.

Aerospace key to US leadership.

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

Such interest goes directly to the concerns of the Aerospace commission, which stated, “The aerospace industry has always been a reflection of the spirit of America. It has been, and continues to be, a sector of pioneers drawn to the challenge of new frontiers in science, air, space, and engineering. For this nation to maintain its present proud heritage and leadership in the global arena, we must remain dedicated to a strong and prosperous aerospace industry. A healthy and vigorous aerospace industry also holds a promise for the future, by kindling a passion within our youth that beckons them to reach for the stars and thereby assure our nation’s destiny.”

Aerospace---Impact---Economy

Aerospace Key to the Economy

**ITA ’11** (International Trade Administration, AEROSPACE INDUSTRY IS CRITICAL CONTRIBUTOR TO U.S. ECONOMY ACCORDING TO OBAMA TRADE OFFICIAL AT PARIS AIR SHOW, http://trade.gov/press/press-releases/2011/aerospace-industry-critical-contributor-to-us-economy-062111.asp) JL

PARIS – Francisco Sánchez, Under Secretary of Commerce for International Trade, addressed national and international groups at the 2011 Paris Air Show to reinforce the President’s National Export Initiative (NEI) and support the U.S. aerospace industry. “The U.S. aerospace industry is a strategic contributor to the economy, national security, and technological innovation of the United States,” Sánchez said. “The industry is key to achieving the President’s goals of doubling exports by the end of 2014 and contributed $78 billion in export sales to the U.S. economy in 2010.” During the U.S. Pavilion opening remarks, Sánchez noted that the aerospace sector in the United States supports more jobs through exports than any other industry. Sánchez witnessed a signing ceremony between Boeing and Aeroflot, Russia’s state-owned airline. Aeroflot has ordered eight 777s valued at $2.1 billion, and the sales will support approximately 14,000 jobs. “The 218 American companies represented in the U.S. International Pavilion demonstrate the innovation and hard work that make us leaders in this sector,” said Sánchez. “I am particularly pleased to see the incredible accomplishments of U.S. companies participating in the Alternative Aviation Fuels Showcase, which demonstrates our leadership in this important sector and shows that we are on the right path to achieving the clean energy future envisioned by President Obama.” The 2011 Paris Air Show is the world’s largest aerospace trade exhibition, and features 2,000 exhibitors, 340,000 visitors, and 200 international delegations. The U.S. aerospace industry ranks among the most competitive in the world, boasting a positive trade balance of $44.1 billion – the largest trade surplus of any U.S. manufacturing industry. It directly sustains about 430,000 jobs, and indirectly supports more than 700,000 additional jobs. Ninety-one percent of U.S. exporters of aerospace products are small and medium-sized firms.

Global economic crisis causes nuclear great-power war

Mead 9 – Walter Russell Mead, the Henry A. Kissinger Senior Fellow in U.S. Foreign Policy at the Council on Foreign Relations, 2-4, 2009, “Only Makes You Stronger,” The New Republic, http://www.tnr.com/politics/story.html?id=571cbbb9-2887-4d81-8542-92e83915f5f8&p=2

If current market turmoil seriously damaged the performance and prospects of India and China, the current crisis could join the Great Depression in the list of economic events that changed history, even if the recessions in the West are relatively short and mild. The United States should stand ready to assist Chinese and Indian financial authorities on an emergency basis--and work very hard to help both countries escape or at least weather any economic downturn. It may test the political will of the Obama administration, but the United States must avoid a protectionist response to the economic slowdown. U.S. moves to limit market access for Chinese and Indian producers could poison relations for years. For billions of people in nuclear-armed countries to emerge from this crisis believing either that the United States was indifferent to their well-being or that it had profited from their distress could damage U.S. foreign policy far more severely than any mistake made by George W. Bush. It's not just the great powers whose trajectories have been affected by the crash. Lesser powers like Saudi Arabia and Iran also face new constraints. The crisis has strengthened the U.S. position in the Middle East as falling oil prices reduce Iranian influence and increase the dependence of the oil sheikdoms on U.S. protection. Success in Iraq--however late, however undeserved, however limited--had already improved the Obama administration's prospects for addressing regional crises. Now, the collapse in oil prices has put the Iranian regime on the defensive. The annual inflation rate rose above 29 percent last September, up from about 17 percent in 2007, according to Iran's Bank Markazi. Economists forecast that Iran's real GDP growth will drop markedly in the coming months as stagnating oil revenues and the continued global economic downturn force the government to rein in its expansionary fiscal policy. All this has weakened Ahmadinejad at home and Iran abroad. Iranian officials must balance the relative merits of support for allies like Hamas, Hezbollah, and Syria against domestic needs, while international sanctions and other diplomatic sticks have been made more painful and Western carrots (like trade opportunities) have become more attractive. Meanwhile, Saudi Arabia and other oil states have become more dependent on the United States for protection against Iran, and they have fewer resources to fund religious extremism as they use diminished oil revenues to support basic domestic spending and development goals. None of this makes the Middle East an easy target for U.S. diplomacy, but thanks in part to the economic crisis, the incoming administration has the chance to try some new ideas and to enter negotiations with Iran (and Syria) from a position of enhanced strength. Every crisis is different, but there seem to be reasons why, over time, financial crises on balance reinforce rather than undermine the world position of the leading capitalist countries. Since capitalism first emerged in early modern Europe, the ability to exploit the advantages of rapid economic development has been a key factor in international competition. Countries that can encourage--or at least allow and sustain--the change, dislocation, upheaval, and pain that capitalism often involves, while providing their tumultuous market societies with appropriate regulatory and legal frameworks, grow swiftly. They produce cutting-edge technologies that translate into military and economic power. They are able to invest in education, making their workforces ever more productive. They typically develop liberal political institutions and cultural norms that value, or at least tolerate, dissent and that allow people of different political and religious viewpoints to collaborate on a vast social project of modernization--and to maintain political stability in the face of accelerating social and economic change. The vast productive capacity of leading capitalist powers gives them the ability to project influence around the world and, to some degree, to remake the world to suit their own interests and preferences. This is what the United Kingdom and the United States have done in past centuries, and what other capitalist powers like France, Germany, and Japan have done to a lesser extent. In these countries, the social forces that support the idea of a competitive market economy within an appropriately liberal legal and political framework are relatively strong. But, in many other countries where capitalism rubs people the wrong way, this is not the case. On either side of the Atlantic, for example, the Latin world is often drawn to anti-capitalist movements and rulers on both the right and the left. Russia, too, has never really taken to capitalism and liberal society--whether during the time of the czars, the commissars, or the post-cold war leaders who so signally failed to build a stable, open system of liberal democratic capitalism even as many former Warsaw Pact nations were making rapid transitions. Partly as a result of these internal cultural pressures, and partly because, in much of the world, capitalism has appeared as an unwelcome interloper, imposed by foreign forces and shaped to fit foreign rather than domestic interests and preferences, many countries are only half-heartedly capitalist. When crisis strikes, they are quick to decide that capitalism is a failure and look for alternatives. So far, such half-hearted experiments not only have failed to work; they have left the societies that have tried them in a progressively worse position, farther behind the front-runners as time goes by. Argentina has lost ground to Chile; Russian development has fallen farther behind that of the Baltic states and Central Europe. Frequently, the crisis has weakened the power of the merchants, industrialists, financiers, and professionals who want to develop a liberal capitalist society integrated into the world. Crisis can also strengthen the hand of religious extremists, populist radicals, or authoritarian traditionalists who are determined to resist liberal capitalist society for a variety of reasons. Meanwhile, the companies and banks based in these societies are often less established and more vulnerable to the consequences of a financial crisis than more established firms in wealthier societies. As a result, developing countries and countries where capitalism has relatively recent and shallow roots tend to suffer greater economic and political damage when crisis strikes--as, inevitably, it does. And, consequently, financial crises often reinforce rather than challenge the global distribution of power and wealth. This may be happening yet again. None of which means that we can just sit back and enjoy the recession. History may suggest that financial crises actually help capitalist great powers maintain their leads--but it has other, less reassuring messages as well. If financial crises have been a normal part of life during the 300-year rise of the liberal capitalist system under the Anglophone powers, so has war. The wars of the League of Augsburg and the Spanish Succession; the Seven Years War; the American Revolution; the Napoleonic Wars; the two World Wars; the cold war: The list of wars is almost as long as the list of financial crises. Bad economic times can breed wars. Europe was a pretty peaceful place in 1928, but the Depression poisoned German public opinion and helped bring Adolf Hitler to power. If the current crisis turns into a depression, what rough beasts might start slouching toward Moscow, Karachi, Beijing, or New Delhi to be born? The United States may not, yet, decline, but, if we can't get the world economy back on track, we may still have to fight.

Aerospace---Impact--- Economy

Aerospace key to economy, national security, and jobs.

Eisele, 3/7 [Stephen Eisele, US congress, march 7th 2011 “on the issues” http://www.votestephenforcongress.com/Issues.html]

I am a strong supporter of our US defense and aerospace industry and believe in fostering continued commercialization and incentivizing innovation through competition. The aerospace industry plays an important role in our economy and is critical to technological innovations, national security, and helps elevate our industrial base, education, and keeps jobs in the district. Having worked in the Space industry for many years, I am a strong advocate of Space exploration and its benefits to humanity. The space industry is helping lead our economy into its next great leap through advancements in telecommunications, weather observation/monitoring, scientific advancements, and exploration of space which could reap major benefits to improving life on our Planet. Space exploration exemplifies the American spirit and our innate desire to discover and unravel the mysteries of the universe;it inspires us to push the envelope of human thinking, and benefits all Americans through technological spin-offs/breakthroughs as well as the incredible promise of resources that could save our planet and preserve our livelihood. Government can help propel US aerospace excellence by scaling back some of the export controls that have made many US companies less competitive. The US should also promote the use of prizes as an incentive to help achieve the next technological breakthrough through competition. This model was successfully tested at the X PRIZE Foundation.

Aerospace---Impact--- Economy (Spin-offs)

Aerospace spinoff’s help stimulate the economy and military readiness.

Heppenheimer, 7 [T.A. Heppenheimer, 2007, “toward distant suns” http://www.nss.org/settlement/DistantSuns/distantsuns\_chap03.html]

In answering this, it is necessary to be cautious. The best sources of information come from the aerospace industry 's studies and projections done by key people under contract. But such sources must be weighed and assessed with great care, for the aerospace industry is notorious for its self-serving tendencies. Charles Wilson, secretary of defense in the Eisenhower administration, once gained fame for allegedly remarking that "what's good for General Motors is good for the country"; in the aerospace industry, this spirit is alive and well. [Author's footnote: The correct quote: "I have always said that what's good for the country is good for General Motors, and vice versa." Thus, aerospace spokesmen have frequently justified space expenditures on the ground that they lead to spin-offs. A spin-off is a product or process useful in the nonaerospace economy, which was first developed or invented to support the space program. Such a spin-off is the Pillsbury food stick (originally marketed as Space Food Sticks), first developed by Pillsbury under NASA contract as a food for astronauts. A more substantive example of a legitimate spin-off is the Boeing 747. In 1965 Boeing and Lockheed competed to win an Air Force contract to build a large military transport aircraft, the C-5. Lockheed won the contract, but Boeing, not to be outdone, modified its design for the civilian market and put it into production as the 747.

\*\*\*He3 Advantage\*\*\*

He3 Advantage---Moon Key

Now is key for He3 mining-Its first come first serve

**Lasker 6** (John Lasker, Freelance Journalist-Major contributor for magazines (eg. Wired & Christian Science Monitor), “Race to the Moon for Nuclear Fuel”, <http://www.wired.com/science/space/news/2006/12/72276?currentPage=all>, 12/15/2006) SV

"After four-and-half-billion years, there should be large amounts of helium-3 on the moon," said Gerald Kulcinski, a professor who leads the Fusion Technology Institute at the University of Wisconsin at Madison. Last year NASA administrator Mike Griffin named Kulcinski to lead a number of committees reporting to NASA's influential NASA Advisory Council, its preeminent civilian leadership arm. The Council is chaired by Apollo 17 astronaut Harrison Hagan "Jack" Schmitt, a leading proponent of mining the moon for helium 3. Schmitt, who holds the distance record for driving a NASA rover on the moon (22 miles through theTaurus-Littrow valley), is also a former U.S. senator (R-New Mexico). The Council was restructured last year with a new mission: implementing President Bush's "Vision for Space Exploration," which targets Mars as its ultimate destination. Other prominent members of the Council include ex-astronaut Neil Armstrong. Schmitt and Kulcinski are longtime friends and academic partners, and are known as helium-3 fusion's biggest promoters. At the Fusion Technology Institute, Kulcinski's team has produced small-scale helium-3 fusion reactions in the basketball-sized fusion device. The reactor produced one milliwatt of power on a continuous basis. While still theoretical, nuclear fusion is touted as a safer, more sustainable way to generate nuclear energy: Fusion plants produce much less radioactive waste, especially if powered by helium-3. But experts say commercial-sized fusion reactors are at least 50 years away. The isotope is extremely rare on Earth but abundant on the moon. Some experts estimate there a millions of tons in lunar soil -- and that a single Space-Shuttle load would power the entire United States for a year. NASA plans to have a permanent moon base by 2024, but America is not the only nation with plans for a moon base. China, India, the European Space Agency, and at least one Russian corporation, Energia, have visions of building manned lunar bases post-2020. Mining the moon for helium-3 has been discussed widely in space circles and international space conferences. Both China and Russia have stated their nations' interest in helium-3. "We will provide the most reliable report on helium-3 to mankind," Ouyang Ziyuan, the chief scientist of China's lunar program, told a Chinese newspaper. "Whoever first conquers the moon will benefit first."

Earth-bound He3 is running out

Shea and Morgan ‘010

<http://www.fas.org/sgp/crs/misc/R41419.pdf>

www.crs.gov

Dana A. Shea Specialist in Science and Technology Policy Daniel Morgan Specialist in Science and Technology Policy December 22, 2010

The world is experiencing a shortage of helium-3, a rare isotope of helium with applications in homeland security, national security, medicine, industry, and science. For many years the supply of helium-3 from the nuclear weapons program outstripped the demand for helium-3. The demand was small enough that a substantial stockpile of helium-3 accumulated. After several years of demand exceeding supply, a call for large quantities of helium-3 spurred federal officials to realize that insufficient helium-3 was available to meet the likely future demand.

Until 2001, helium-3 production by the nuclear weapons program exceeded the demand, and the program accumulated a stockpile. After the terrorist attacks of September 11, 2001, the federal government began deploying neutron detectors at the U.S. border to help secure the nation against smuggled nuclear and radiological material. The deployment of this equipment created new federal demand for helium-3.

Policymakers now face a number of challenging decisions. In the short term, these decisions are mainly about how to allocate a scarce resource in the face of competing priorities: science versus security, the private sector versus the public sector, and national needs versus international obligations.

Moon is filled with He3

Kazen ‘010 October 03, 2010Casey Kazan via [newscientist.com](http://www.newscientist.com) Daily galaxy editorial staff.

<http://www.dailygalaxy.com/my_weblog/2010/10/china-launches-second-moon-mission-is-mining-helium-3-an-ultimate-goal.html>

In 2007, shortly after Russia claimed a vast portion of the Arctic sea floor, accelerating an international race for the natural resources as global warming opens polar access, China announced plans to map "every inch" of the surface of the Moon and exploit the vast quantities of Helium-3 thought to lie buried in lunar rocks as part of its ambitious space-exploration program

Ouyang Ziyuan, head of the first phase of lunar exploration, was quoted on government-sanctioned news site ChinaNews.com describing plans to collect three dimensional images of the Moon for future mining of Helium 3: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of Helium-3 can reach one to five million tons."

He3 Advantage---Funding Key

Revival of VSE funding is key to not lose the 2nd space race and secure He3

**Williams 7** (Mark Williams, Actor, Writer, and Presenter at BBC, “Mining the Moon: Lab experiments suggest that future fusion reactors could use helium-3 gathered from the moon”, http://www.technologyreview.com/Energy/19296/, 8/23/2007) SV

At the 21st century's start, few would have predicted that by 2007, a second race for the moon would be under way. Yet the signs are that this is now the case. Furthermore, in today's moon race, unlike the one that took place between the United States and the U.S.S.R. in the 1960s, a full roster of 21st-century global powers, including China and India, are competing. Even more surprising is that one reason for much of the interest appears to be plans to mine helium-3--purportedly an ideal fuel for fusion reactors but almost unavailable on Earth--from the moon's surface. NASA's Vision for Space Exploration has U.S. astronauts scheduled to be back on the moon in 2020 and permanently staffing a base there by 2024. While the U.S. space agency has neither announced nor denied any desire to mine helium-3, it has nevertheless placed advocates of mining He3 in influential positions. For its part, Russia claims that the aim of any lunar program of its own--for what it's worth, the rocket corporation Energia recently started blustering, Soviet-style, that it will build a permanent moon base by 2015-2020--will be extracting He3. The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011. Nor does India intend to be left out. (See "India's Space Ambitions Soar.") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, Chandrayaan-1, will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending Chandrayaan-2, a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He3 and bringing it back to fuel fusion-based nuclear reactors on Earth.

He3 Good--- Resource Wars

Control of He3 Resources is Key to Prevent Future Resource Wars

**Lasker 10** (John Lasker, Freelance Journalist-Major contributor for magazines (eg. Wired & Christian Science Monitor), "Technoir", <http://www.godlikeproductions.com/forum1/message1363174/pg1>, 4/3/2010) SV

Back in 1998, representatives from Halliburton and Shell met with officials from NASA to talk, practically in secret. At Los Alamos, NM, no less, home to some of the most radical and exotic US military research ever. They met over the prospects of drilling on Mars and the Moon. From that meeting, Halliburton – the oilfields technology and services corporation once ran by Dick Chaney – came away with the idea of building a drill specifically for our two closest celestial bodies. Why build a drill for the Red Planet and the Harvest Moon? And why “No-bid” Halliburton? Which still has a strong connection to one of its greatest beneficiary's, Dick Chaney, of course. Yes, that US Vice President, the one who tricked the world into thinking the US needed to invade Iraq for Weapons of Mass Destruction. Bruce Gagnon, the space weapons expert who runs The Global Network Against Weapons and Nuclear Power in Space, asks a rhetorical question: “Why do you think Halliburton is building a drill for Mars and the Moon?” To monopolize the untold resources Mars and the Moon might offer? The question nearly answers itself, says Gagnon. “There’s going to be a scramble for the moon by the Chinese, the Russians and the Americans. This is real. There’s going to be a conflict over it,” he says. “Who controls the moon is going to be rich by unimaginable amounts.” Perhaps those cards are in the future for mankind. But certainly mankind has history on its side as a warning. History in the form of an Iraqi insurgency. The Iraq insurgency erupted, in part, over Dick Chaney and his neo-con’s plans to privatize all of Iraq’s industries, including oil, which would be taken over by American oil giants such as Shell and Exxon. And while some may think that thousands of US troops and Iraqi civilians died in vain due to the Iraqi insurgency, perhaps their souls won't allow Chaney’s legacy and his offspring to trick us again. Hopefully on this planet and beyond. This doesn’t mean, however, there won’t be a future when man goes to war on the very surface and within the orbits of Mars and the Moon so to control the resources that can be mined and flown back to Earth. In fact, man has already predicted such a conflict will take place. In 1995, in a New York Times op-ed written by science writer Lawrence Joseph, he asks the question, “Will the Moon become the Persian Gulf of the 21st Century? And if the US does not take action in regards to the Moon, the nation could slip behind in the race for control of the global economy, and our destiny beyond.” Coincidently, late in 2009, a US Air Force recruiting commercial claiming their technology isn't “science fiction”, shows US troops tactically moving across a red and barren landscape that looks too much like Mars. Resource wars will either end when the human race becomes extinct, or rage on forever and ever as humans migrate across the universe. A migration Carl Sagan predicted will undoubtedly occur because of man’s unwaivering desire to survive, he theorized. But Sagan also conceded that our collective stupidity might do us in before we even migrate off the planet. The irony is, it might just be a resource war that ends the human race.

He3 Good--- Energy

He3 Mining Programs are Key to Future Energy Plans and Wining the New Lunar Space Race

**Shimkus 11** (John Shimkus, Expert in Global Mining at Energy Digital, “Mining Helium-3 will Transform the Dark Side of the Moon”, <http://www.energydigital.com/global_mining/mining-helium-3-will-transform-dark-side-of-the-moon>, 5/9/2011) SV

Most people are unaware that our Moon holds countless resources. Some are familiar: titanium, platinum, silicon, ammonia, mercury, and even water (yes, H20 has been confirmed to be present on the moon). But a more elusive substance, which is a rarity here on Earth, is also found on the Moon: helium-3. Helium-3 is a non-radioactive hydrogen isotope with one neutron and two protons. It is carried through space via the Sun’s solar winds, but burns up as it enters Earth’s atmosphere, making it almost non-existent here on our planet. However, an abundance of helium-3 has built up on the Moon’s surface over the millennia as confirmed in soil samples collected by the Apollo 17 lunar mission, and it is just waiting to be mined. Why you ask? Because, helium-3 can fuel non-radioactive nuclear fusion reactions to produce safe, clean, abundant energy, and can completely transform our energy future. Helium-3 nuclear fusion reactions release non-radioactive protons that can be harnessed to create electricity directly. This type of nuclear fusion is safer and far more efficient than the nuclear fission reactions used in nuclear plants today, which use heat to run steam turbines, losing energy in the conversion process and creating radioactive waste as a byproduct. Projections estimate that on a commercial basis helium-3 would be worth around $40,000 per ounce. Roughly 100 tons of Helium-3 could power the entire population of Earth for a year and scientists estimate that the Moon could contain approximately 1 million tons—10,000 years worth of energy. But is mining the Moon realistic, and who would spearhead such a risky endeavor? Google announced the “Google Lunar X PRIZE” competition in 2007, in which the Internet giant challenged privately funded spaceflight teams from across the globe to send a robot to the moon’s surface. The first successful team will win $30 million in prizes. As of February 2011, 29 teams from various nations are officially competing for the prize, and several will be launching within the next two years. The US state of Florida is also offering a $2 million prize to the first private spaceflight launched from its soil. NASA is even willing to pay $10 million or more for data collected from private lunar missions. Caterpillar—a top name in mining machinery and equipment—has invested in Carnegie Mellon University’s Astrobotic Technology, a company vying for the Google Lunar X PRIZE. Already having experience in automated machinery, Caterpillar will use the partnership with Astrobotic to propel its own lunar program. Caterpillar Automation Systems Manager Eric Reiners says,“Caterpillar makes sustainable progress possible by enabling infrastructure development and resource utilization on every continent on Earth. It only makes sense we would be involved in expanding our efforts to the 8th continent: the Moon.” Richard Branson—the man, the myth, the legend—has started up Virgin Galactic. With his own private fleet of spaceships and a spaceport in New Mexico (USA), Branson is already booking spaceflights for those who can afford the $200,000 ticket price. Initial flights will be sub-orbital, with the goal of eventually setting up a lunar resort, in which the elite can take a vacation to the Moon. While no official statements have confirmed Branson’s intentions to mine the Moon, media contacts from Virgin Galactic have hinted that it is not out of the realm of possibility. The governments of Russia, China and India have all made public comments on exploiting the Moon’s resources, and the Russian space company RSC Energia has proposed a permanent lunar base to be completed by 2025 as a hub for helium-3 mining operations. According to the Outer Space Treaty of 1967, Moon mining does not seem to violate any international agreements. However, there is debate over who would own the rights to the materials mined.

He3 Good---Power for Space Colonization

He3 mining and moon control is key to establish US Space Hegemony

**Kazan 10** (Casey Kazan, Daily Galaxy Editor, “China Launches Second Moon Mission: Is Helium 3 an Ultimate Goal”, <http://www.dailygalaxy.com/my_weblog/2010/10/china-launches-second-moon-mission-is-mining-helium-3-an-ultimate-goal.html>, 10/3/2010) SV

In 2007, shortly after Russia claimed a vast portion of the Arctic sea floor, accelerating an international race for the natural resources as global warming opens polar access, China announced plans to map "every inch" of the surface of the Moon and exploit the vast quantities of Helium-3 thought to lie buried in lunar rocks as part of its ambitious space-exploration program. Ouyang Ziyuan, head of the first phase of lunar exploration, was quoted on government-sanctioned news site ChinaNews.com describing plans to collect three dimensional images of the Moon for future mining of Helium 3: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of Helium-3 can reach one to five million tons." "Helium-3 is considered as a long-term, stable, safe, clean and cheap material for human beings to get nuclear energy through controllable nuclear fusion experiments," Ziyuan added. "If we human beings can finally use such energy material to generate electricity, then China might need 10 tons of helium-3 every year and in the world, about 100 tons of helium-3 will be needed every year." Helium 3 fusion energy - classic Buck Rogers propulsion system- may be the key to future space exploration and settlement, requiring less radioactive shielding, lightening the load. Scientists estimate there are about one million tons of helium 3 on the moon, enough to power the world for thousands of years. The equivalent of a single space shuttle load or roughly 25 tons could supply the entire United States' energy needs for a year. Thermonuclear reactors capable of processing Helium-3 would have to be built, along with major transport system to get various equipment to the Moon to process huge amounts of lunar soil and get the minerals back to Earth. **With China's announcement, a new Moon-focused Space Race seems locked in place**. China made its first steps in space just a few years ago, and is in the process of establishing a lunar base by 2024. Russia, the first to put a probe on the moon, plans to deploy a lunar base in 2015. A new, reusable spacecraft, called Kliper, has been earmarked for lunar flights, with the International Space Station being an essential galactic pit stop.

He3 Good---Resolves Peak Oil

Gerald L. Kulcinski 1996

**[**Associate Dean for Research Grainger Professor of Nuclear Engineering Director, Fusion Technology Institute]

[learning.hccs.edu/faculty/kristine.ervin/engl1302/resources/...of.../file]

Some people think that by using Helium 3 will ruin the economy of the country and the world, perhaps they are individuals that have no idea of this subject or even care to know that **scientists have been doing studies on this gas for several years.** Its existence was first proposed by the Australian nuclear physicist Mark Oliphant while working at Cambridge University's Cavendish Laboratory. Helium 3 is one of the best industrial gases there is out there, it consist on one neutron and two protons, it is rarely found on earth but it is very common to be found in abundance on the moon.

Helium 3 is proposed as a future generation of fuel but not only for cars and planes but also on any type of machinery currently using gasoline, which is mentioned in details on the first category during the body part of the reading. Over the past ten years helium 3 is becoming more attractive to big corporations due to increase in oil prices and also because we are starting to run out of oil; therefore they are investing money and time on doing several research’s and studies on helium 3. Eventually, this gas will generate more jobs and also will keep people employed by their existing employers.

\*\*\* Commercialization Adv \*\*\*

Commercial Space Travel Adv---Solvency

Government development of a new orbital vehicle jump-starts the commercial space travel industry.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

Costs for the development of low-cost orbital passenger transportation systems are of the order of 10 billion Euros [7–9]. Even 10 times this amount would be less than 5 years of space agencies' current budgets. The economic benefits seem sure to greatly outweigh the cost, due to the much larger commercial markets that would be created as a result, in contrast to the very small markets created with 1 trillion Euro-equivalents invested in satellite and launch vehicle manufacturing to date. That is, there seem to be no technical reasons why rapid growth of space travel services could not be realised: the technology has existed for decades, and companies wishing to develop vehicles are hampered by only one obstacle, which is the easiest for governments to solve—lack of funds. Hence the rest of this paper assumes that over coming decades households will start to purchase space ﬂight services, which will grow to reach 5 million passengers/year, out of a worldwide middle-class population of more than 2 billion people, a few decades from now. Starting from today, in order to achieve the scale of activity shown in Fig. 1 over the next 30 years, government funding equivalent to about 10% of space agencies' budgets, or some 2 billion Euros/year would probably suffice to stimulate private investment in reusable orbital passenger vehicle manufacturing and operations. Thereafter most of the funding would come from private companies, just as airline and hotel companies finance their own growth today.

Commercial Space Travel Adv---Gov’t Funding Key

Government funding is critical to the aerospace industry’s space ventures.

Rosenberg 11 (Zach, spaceflight editor of Flight International Magazine, NASA funding crucial to commercial spaceflight, Flight International, April 5, http://www.flightglobal.com/articles/2011/05/04/356207/nasa-funding-crucial-to-commercial-spaceflight.html)

NASA's role as the provider of pump priming funding for the commercial spaceflight industry is set to come under further scrutiny despite the recent award of the latest Commercial Crew Development (CCDev) contracts. The latest beneficiaries of NASA's largesse are SpaceX, Blue Origin, Sierra Nevada and Boeing in the CCDev 2 competition. It is no surprise that many potential competitors are reliant on NASA funding to put their products into orbit; experienced spacefarers Orbital Science are rumoured to have dropped building plans after losing both CCDev awards. Despite what is billed to be the strongly corporate nature of the programme - in that the aerospace industry provides the bulk of the capital - some companies are reliant on government funding. If CCDev's third round is cancelled, what programmes will survive? Government funding has traditionally been a strong stimulus for aerospace programmes, from classified technology development to pre-launch loan funding for commercial aircraft. Private spaceflight is a nascent and potentially very lucrative industry - however, the massive upfront development costs required may not be met by similar revenue streams: only a few people on Earth can afford to pay their way. Space tourists to date have launched on Soyuz for $20 million per flight; only seven tourists have flown, with a single repeat customer. Therefore, outside NASA, interest has come from countries seeking a way to launch their own missions without needing to develop the resources. Bigelow Aerospace, which is developing a space station of sorts, has signed agreements with organisations in six countries: Japan, Singapore, UK, Sweden, Australia and the Netherlands. Bigelow has also signed an agreement with Boeing - Bigelow will provide the destination and Boeing will provide transport in the form of its CST-100 capsule. But Boeing maintains that NASA funding is crucial; the aerospace behemoth won two rounds of CCDev money, including the largest single award of CCDev 2 with $92.3 million. "If for some reason we weren't selected to continue in the next phase then it would be a very difficult decision for us to continue on our own," said John Elbon, CST-100 programme manager, "and most likely we would not." "The foundation of our business case is transporting NASA astronauts to the space station, and if that's the only part of the business that comes to be, that would be ok," said Elbon. "Certainly our business case is much more attractive if there's additional business beyond that." NASA's direct support through CCDev is not the only avenue. CCDev remains wholly disconnected from a widely anticipated request for proposals for resupply flights to the International Space Station - or wherever else NASA decides to fly (manned landings on Mars or an asteroid are frequently discussed). Yet CCDev money gives the recipients a massive head start against non-funded rivals, and while few companies have given up completely after failing to win a CCDev award, the near future almost certainly belongs to the winners. Publicly traded Boeing is the exception among CCDev awardees. Blue Origin, Sierra Nevada and SpaceX are privately owned companies and thus under no particular obligation to earn profit to translate into shareholder dividends. SpaceX founder Elon Musk has maintained that, while profit would be nice, his primary goal is to hurl things into orbit as cheaply as possible. Late in April, Blue Origin programme manager Rob Myerson made it clear that he expects its spacecraft to fly, NASA or no. Sierra Nevada programme manager Mark Sirangelo could not confirm continued development without CCDev, but said: "NASA's a co-investor in the project, we're putting up a significant amount of our capital, and at the end of the day it's one of many markets we hope to service." Additional NASA funding is sure to be at stake in future budget negotiations as the 2012 US presidential election nears. NASA employees breathed a sign of relief when only a small portion of its budget was cut in the contentious continuing resolution that funds the government, over which a dramatic stand-off ensued. But as the budget tightens and political battles loom, competitors for CCDev3 money will need to examine just how stable NASA is as an anchor customer and plan for the worst.

Commercial Space Travel Adv---Solves Growth

Commercial space travel key to economic growth.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

The continuation of human civilisation requires a growing world economy, with access to increasing resources. This is because competing groups in society can all improve their situation and reasonable fairness can be achieved, enabling social ethics to survive, only if the overall "economic pie" is growing. Unfortunately, societies are much less robust if the "pie" is shrinking, when ethical growth becomes nearly impossible, as competing groups try to improve their own situation at the expense of other groups. Continued growth of civilisation requires continual ethical evolution, but this will probably be possible only if resources are sufficient to assure health, comfort, education and fair employment for all members of society. The world economy is under great stress recently for a number of reasons, a fundamental one being the lack of opportunities for profitable investment—as exemplified by Japan's unprecedented decade of zero interest-rates. This lack of productive investment opportunities has led a large amount of funds in the rich countries to "churn" around in the world economy in such forms as risky "hedge funds", causing ever greater financial instability, thereby further weakening economic growth, and widening the gap between rich and poor. Increasing the opportunities for profitable, stable investment requires continual creation of new industries [16]. Governments today typically express expectations for employment growth in such fields as information technology, energy, robotics, medical services, tourism and leisure. However, there are also sceptical voices pointing out that many of these activities too are already being outsourced to low-cost countries which are catching up technologically in many fields [20]. Most of the new jobs created in the USA during the 21st century so far have been low-paid service work, while the number of US manufacturing jobs has shrunk rapidly [21]. It is thus highly relevant that aerospace engineering is a field in which the most technically advanced countries still have a substantial competitive advantage over later developing countries. Hence, if a commercial space travel industry had already been booming in the 1980s, the shrinkage in aerospace employment after the end of the "cold war" would have been far less. Consequently it seems fair to conclude that the decades long delay in developing space travel has contributed to the lack of new industries in the richer countries, which is constraining economic growth and causing the highest levels of unemployment for decades. The rapid economic development of China and India offers great promise but creates a serious challenge for the already rich countries, which need to accelerate the growth of new industries if they are to benefit from these countries' lower costs without creating an impoverished under-class in their own societies. The long-term cost of such a socially divisive policy would greatly outweigh the short-term benefits of low-cost imports. The development of India and China also creates dangers because the demands of 6 billion people are now approaching the limits of the resources of planet Earth. As these limits are approached, governments become increasingly repressive, thereby adding major social costs to the direct costs of environmental damage [22]. Consequently, as discussed further below, it seems that the decades-long delay in starting to use the resources of the solar system has already caused heavy, self inﬂicted damage to humans' economic development, and must be urgently overcome, for which a range of policies have been proposed in [23,24].

A viable Commercial Space Travel industry would eliminate poverty.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

In most countries, most of the population do not have economically significant land holdings, and so employment is the economic basis of social life, providing income and enabling people to have stable family lives. The high level of unemployment in most countries today is therefore not only wasteful, it also causes widespread poverty and unhappiness, and is socially damaging, creating further problems for the future. One reason for investing in the development of passenger space travel, therefore, is that it could create major new fields of employment, capable of growing as far into the future as we can see. As of 2001, the hotel, catering and tourism sector was estimated to employ 60 million people world-wide, or 3% of the global workforce, and 6% of Europeans [15]. Hence we can estimate that the passenger air travel industry, including airlines, airports, hotels and other tourism related work, indirectly employs 10–20 times the number of people employed in aircraft manufacturing alone. Likewise, passenger space travel services could presumably create employment many times that in launch vehicle manufacturing—in vehicle operations and maintenance, at spaceports, in orbiting hotels, in many companies supplying these, in services such as staff training, certification and insurance, and in a growing range of related businesses. This possibility is particularly valuable because high unemployment, both in richer and poorer countries, has been the major economic problem throughout the world for decades. Consequently the growth of such a major new market for advanced aerospace technology and services seems highly desirable, as discussed further in [16].

Commercial Space Travel Adv---Solves Environment

Commercial space industry key to make space solar power economically viable- solves environmental problems.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

4. Environmental protection Economic development in space based on low launch costs could contribute greatly, even definitively, to solving world environmental problems. As a first step, substantially reducing the cost of space travel will reduce the cost of environment-monitoring satellites, thereby improving climate research and environmental policy-making. 4.1. Space-based solar power supply A second possibility, which has been researched for several decades but has not yet received funding to enable testing in orbit, is the delivery of continuous solargenerated power from space to Earth. Researchers believe that such space-based solar power ( SSP) could supply clean, low-cost energy on a large scale, which is a prerequisite for economic development of poorer countries, while avoiding damaging pollution. However, realisation of SSP requires much lower launch costs, which apparently only the development of a passenger space travel industry could achieve. Hence the development of orbital tourism could provide the key to realising SSP economically [14]. 4.2. Carbon-neutral space travel Clean energy produced by SSP could eliminate the environmental impact of space travel, and even make it "carbon neutral" if this is considered desirable [25]. Moreover, SSP has a much shorter energy pay-back time than terrestrial solar energy, due to the almost continuous supply of power which it can generate, rather than only in day-time during clear weather. Some critics claim that space travel will become a significant environmental burden [26]. However, while superficially correct in the short term, this is the opposite of the truth over the longer term. It would be a dangerous error to prevent the growth of space tourism in order to avoid its initial, minor environmental impact, since this would prevent a range of major benefits in the future, including the supply of lowcost, carbon-neutral SSP, and other space-based industry. 4.3. Space-based industry If orbital travel grows to a scale of millions of passengers/year -- as it could by the 2030s, with vigorous investment -- it will stimulate the spontaneous growth of numerous businesses in space. These will grow progressively from simple activities such as maintenance of orbiting hotels, to in-space manufacturing using asteroidal minerals. For example, the development of SSP would enable a range of industrial processes using the advantages of space, including high vacuum, weightlessness, low-cost electricity and sources of both minerals and volatile chemicals in shallow gravitational wells. If SSP grows to supply a significant share of the terrestrial energy market, more and more industry would operate outside the Earth's ecological system. While most industries cause growing damage to the Earth's environment as they grow in scale, industrial activities which are outside the Earth's ecosystem need not cause any such damage. Hence the growth of space-based industry to large scale offers the longer-term possibility of decoupling economic growth from the limits of the terrestrial environment. Indeed, it has been convincingly argued that only the use of space resources, including especially SSP, offers the possibility of protecting the Earth's environment while enabling sufficient economic growth to preserve civilised society [22,27].

Commercial Space Travel Adv---Solves Ice Age

SSP key to weather mod- solves the coming ice age.

Collins and Autino 08 (Patrick, econ professor-Azabu University (Japan) and a Collaborating Researcher with the Institute for Space & Astronautical Science, and Adriano, President of the Space Renaissance International, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace, “http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml)

4.4. Severe weather amelioration and climate stabilisation The use of solar power satellites for reducing the severity of hurricanes and typhoons, and/or ameliorating severe snow conditions has been discussed for some years. In the extreme case this application of SSP might even include a role in the stabilisation of climate. Earth's climate system is extremely complex, and is the subject of a great deal of ongoing scientific research, including collection of an ever-wider range of data, and ever-more detailed analysis of climate change in the past. A positive-feedback cycle causing sudden onset of the cooling phase of the long-term cycle of "ice ages" has been hypothesized, whereby a winter with unusually low temperatures and/or unusually widespread and/or longlasting snow cover would increase the probability of the following winter being even more severe [28,29]. The beginning of such a trend would be similar to the sharply more severe winters seen over the two last years in North America (as well as the unusually cool 2009 summer). Consequently, although such a possibility may seem remote, and although there are thorny legal problems concerning deliberate weather modification, it is nevertheless noteworthy that satellite power stations may be the only practical means of selectively melting snow over areas of thousands of square kilometres, possibly sufficient to prevent such a vicious circle, even in the event of terrestrial energy shortages.

\*\*\*Space-Based Solar Power Advantage\*\*\*

SBSP Advantage---Colonization Key

Space Exploration key to SBSP

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

The other major factor preventing SBSP development is high launch costs and the lack of

easy access to space. According to the SBSP Phase 0 Architecture Feasibility Study by (NSSO),

construction of a single SBSP satellite would require at least 120 launches. In general, launch

costs are the only major factor limiting the development and use of space, and SBSP will

encourage companies to develop technology to decrease these costs. SBSP will catalyze the

development of commercial access to space, and in the same way, development of commercial

access to space will catalyze the use of SBSP.

SBSP Advantage---Impact---War

Space based solar power solves great power conflict from inevitable energy competition.

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

FINDING: The SBSP Study Group found that SBSP offers a long‐term route to alleviate the security challenges of energy scarcity, and a hopeful path to avert possible wars and conflicts. If traditional fossil fuel production of peaks sometime this century as the Department of Energy’s own Energy Information Agency has predicted, a first order effect would be some type of energy scarcity. If alternatives do not come on‐line fast enough, then prices and resource tensions will increase with a negative effect on the global economy, possibly even pricing some nations out of the competition for minimum requirements. This could increase the potential for failed states, particularly among the less developed and poor nations. It could also increase the chances for great power conflict. To the extent SBSP is successful in tapping an energy source with tremendous growth potential, it offers an “alternative in the third dimension” to lessen the chance of such conflicts.

SBSP Advantage---Impact---Aerospace

Space based solar power key to US aerospace dominance.

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

FINDING: The SBSP Study Group found that SBSP directly addresses the concerns of the Presidential Aerospace Commission which called on the US to become a true spacefaring civilization and to pay closer attention to our aerospace technical and industrial base, our “national jewel” which has enhanced our security, wealth, travel, and lifestyle. An SBSP program as outlined in this report is remarkably consonant with the findings of this commission, which stated: The United States must maintain its preeminence in aerospace research and innovation to be the global aerospace leader in the 21st century. This can only be achieved through proactive government policies and sustained public investments in long‐term research and RDT&E infrastructure that will result in new breakthrough aerospace capabilities. Over the last several decades, the U.S. aerospace sector has been living off the research investments made primarily for defense during the Cold War…Government policies and investments in long‐term research have not kept pace with the changing world. Our nation does not have bold national aerospace technology goals to focus and sustain federal research and related infrastructure investments. The nation needs to capitalize on these opportunities, and the federal government needs to lead the effort. Specifically, it needs to invest in long‐term enabling research and related RDT&E infrastructure, establish national aerospace technology demonstration goals, and create an environment that fosters innovation and provide the incentives necessary to encourage risk taking and rapid introduction of new products and services. The Aerospace Commission recognized that Global U.S. aerospace leadership can only be achieved through investments in our future, including our industrial base, workforce, long term research and national infrastructure, and that government must commit to increased and sustained investment and must facilitate private investment in our national aerospace sector. The Commission concluded that the nation will have to be a space‐faring nation in order to be the global leader in the 21st century—that our freedom, mobility, and quality of life will depend on it, and therefore, recommended that the United States boldly pioneer new frontiers in aerospace technology, commerce and exploration. They explicitly recommended hat the United States create a space imperative and that NASA and DoD need to make the investments necessary for developing and supporting future launch capabilities to revitalize U.S. space launch infrastructure, as well as provide Incentives to Commercial Space. The report called on government and the investment community must become more sensitive to commercial opportunities and problems in space. Recognizing the new realities of a highly dynamic, competitive and global marketplace, the report noted that the federal government is dysfunctional when addressing 21st century issues from a long term, national and global perspective. It suggested an increase in public funding for long term research and supporting infrastructure and an acceleration of transition of government research to the aerospace sector, recognizing that government must assist industry by providing insight into its long‐term research programs, and industry needs to provide to government on its research priorities. It urged the federal government must remove unnecessary barriers to international sales of defense products, and implement other initiatives that strengthen transnational partnerships to enhance national security, noting that U.S. national security and procurement policies represent some of the most burdensome restrictions affecting U.S. industry competitiveness. Private‐public partnerships were also to be encouraged. It also noted that without constant vigilance and investment, vital capabilities in our defense industrial base will be lost, and so recommended a fenced amount of research and development budget, and significantly increase in the investment in basic aerospace research to increase opportunities to gain experience in the workforce by enabling breakthrough aerospace capabilities through continuous development of new experimental systems with or without a requirement for production. Such experimentation was deemed to be essential to sustain the critical skills to conceive, develop, manufacture and maintain advanced systems and potentially provide expanded capability to the warfighter. A top priority was increased investment in basic aerospace research which fosters an efficient, secure, and safe aerospace transportation system, and suggested the establishment of national technology demonstration goals, which included reducing the cost and time to space by 50%. It concluded that, “America must exploit and explore space to assure national and planetary security, economic benefit and scientific discovery. At the same time, the United States must overcome the obstacles that jeopardize its ability to sustain leadership in space.” An SBSP program would be a powerful expression of this imperative.

SBSP Advantage---Impact---Competitiveness

Space based solar boosts declining US competitiveness.

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

FINDING: The SBSP Study Group found that SBSP offers a path to address the concerns over US intellectual competitiveness in math and the physical sciences expressed by the Rising Above the Gathering Storm report by providing a true “Manhattan or Apollo project for energy.” In absolute scale and implications, it is likely that SBSP would ultimately exceed both the Manhattan and Apollo projects which established significant workforces and helped the US maintain its technical and competitive lead. The committee expressed it was “deeply concerned that the scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength.” SBSP would require a substantial technical workforce of high‐paying jobs. It would require expanded technical education opportunities, and directly support the underlying aims of the American Competitiveness Initiative.

SBSP Advantage---Impact---Climate Change

Solves climate change

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

FINDING: The SBSP Study Group found that to the extent the United States decides it wishes to limit its carbon emissions, SBSP offers a potential path for long‐term carbon mitigation. This study does not take a position on anthropogenic climate change, which at this time still provoked significant debate among participants, but there is undeniable interest in options that limit carbon emission. Studies by Asakura et al in 2000 suggest that SBSP lifetime carbon emissions (chiefly in construction) are even more attractive than nuclear power, and that for the same amount of carbon emission, one could install 60 times the generating capacity, or alternately, one could replace existing generating capacity with 1/60th the lifetime carbon emission of a coal‐fired plant without CO2 sequestration.

SBSP Advantage---Solvency---Tech = feasible

SBSP is technologically feasible.

Rouge 07 (Joseph, former Director-National Security Space Office, Space‐Based Solar Power As an Opportunity for Strategic Security Phase, October 9, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf)

This study revealed that while the business case for SBSP cannot be closed for construction to begin in 2007, the technical feasibility of the concept has never been better and all science and technology development vectors appear to indicate that there is credible potential for SBSP to be built within a strategically relevant period of time. This review also uncovered surprisingly significant interest and evaluation within academia, the aerospace industry, and energy industries that is progressing independently of DoD reviews. The United States is not the only country to observe the potential of SBSP and the improving technical state‐of‐the‐art, as substantial interest and support have been witnessed in other regions of the world to include Europe, Japan, Canada, India, China, and Russia among others. This international interest can be leveraged to build or strengthen strategically stabilizing long‐term partnerships.

\*\*\*Overview Effect Advantage\*\*\*

Overview Effect---Solves War

**Experiencing the “Overview Effect” solves war- shifts to a more peaceful mindset.**

**White, 98**

[Frank White 1998 “The overview effect: space exploration and human evolution” page 48 http://books.google.com/books?id=3a2rz-s3JJsC&pg=PA48&lpg=PA48&dq=overview+effect%2Bpeace&source=bl&ots=3oKMszma8Z&sig=fJG4vFAUf-ulYYi7i5MgRXXQPSw&hl=en&ei=E1MDTraBCsutgQeInNyXDg&sa=X&oi=book\_result&ct=result&resnum=1&ved=0CBoQ6AEwAA#v=onepage&q=overview%20effect%2Bpeace&f=false]

**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 Pro-gram,** 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 substantia**l, 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.”

**Experiencing the “Overview Effect” brings us closer to world peace- sense of interconnectedness.**

**Newberg, No date**

[Andrew Newberg, Associate Professor in the Department of Radiology and Psychiatry at the Hospital of the University of Pennsylvania, http://www.overviewinstitute.org/AndrewNewberg-bio.htm]

T**he Overview Effect may be one of the most important experiences we can try to bring to people**. This experience needs to be made available for all people. **It is also crucial to bring this experience to leaders around the world, regardless of whether they are political, corporate or academic leaders. All of us can benefit from this experience. The experience itself is deeply rooted in our biology.** As a neuroscientist studying a broad variety of human experiences, it appears that the brain itself is capable of taking in the Overview Experience and converting such an overwhelming concept into our behaviors and thoughts. In**dividuals who have had the Overview Experience feel a breaking down of boundaries and a sense of the interconnectedness and preciousness of the Earth and all those who live on it**. It is a testament to how our brain is wired to enable us to transcend our often petty goals and seek to become something greater than we already are. **By encouraging others to have the Overview Experience, we have the opportunity to move humanity closer to world peace by deepening our understanding of those around us and committing ourselves to improving the lives of all human beings.**

**The “overview effect” describes an alteration in a person’s understanding of the universe- deep sense of connection to other beings.**

**O’Neill, 8**

[IAN O'NEILL “The Human Brain in Space: Euphoria and the “Overview Effect” Experienced by Astronauts” MAY 22, 2008 http://www.universetoday.com/14455/the-human-brain-in-space-euphoria-and-the-overview-effect-experienced-by-astronauts/]

Could be the best example yet of being “spaced out”? **When in space, astronauts have repeatedly reported inexplicable euphoria, a “cosmic connection” or an increased sensitivity to their place in the Universe. The experience sounds like the ultimate high, or the ultimate enlightening; it would appear that without trying, astronauts are able to attain a similar mental state as meditating Buddhist monks.** So what is happening when the human body is in space? Does zero-gravity create new connections in the brain? Or is it a natural human response to the vastness of space and realizing just how small we are in comparison? What ever the reason, it looks like even **when astronauts are back on solid ground, they have changed profoundly…** On March 6th, 1969, Rusty Schweikart experienced a feeling that the whole universe was profoundly connected. At the time, he was on a postponed space walk outside his Apollo 9 Lunar Module, carrying out tests for the forthcoming Moon landings. Already having suffered from space sickness (hence delaying the EVA) he felt a euphoric sensation: “When you go around the Earth in an hour and a half, you begin to recognize that your identity is with that whole thing. That makes a change… it comes through to you so powerfully that you’re the sensing element for Man.” – Russell “Rusty” Schweikart. Two years later, **Apollo 14 astronaut, Edgar Mitchell** (joint record holder with Alan Shepard for longest ever Moon walk of 9 hours and 17 minutes) **reported experiencing an “Overview Effect”. He described the sensation gave him a profound sense of connectedness, with a feeling of bliss and timelessness.** He was overwhelmed by the experience. **He became profoundly aware that each and every atom in the Universe was connected in some way, and on seeing Earth from space he had an understanding that all the humans, animals and systems were a part of the same thing, a synergistic whole. It was an interconnected euphoria.** Schweikart and Mitchell’s experiences are not isolated anomalies**, many other astronauts since the 1970′s have reported this Overview Effect. Andy Newberg, a neuroscientist**/physician with experience in space medicine, **hopes to find out whether this is an actual psychological phenomenon**. Perhaps there is a medical reason for an actual change in an astronaut’s brain function when in space. What’s more, he’s noticed a psychological change in the men and women that have come back from space: “**You can often tell when you’re with someone who has flown in space,** its palpable.” – Andy Newberg Newberg **has scanned many brains to try to understand how humans reach this euphoric state on Earth. The religious communities, transcendental mediators and others around the world are able to experience similar states and have been the focus of interest to neuroscientists. In some cases, the meditation leads some people to view the whole cosmos as an interconnected quantum web, where consciousness is not separate, but a part of the Universe.** Now Newberg hopes to monitor the brain of one of the first space tourists so a better grasp of the brain function of a human in zero-G can be understood. Edgar Mitchell has said that his personal event has changed his life, revealing a Universe that had remained hidden until he experienced the Overview Effect on that Apollo 14 mission in 1971. **Whether this effect is a physical change in the brain, or a deeper, yet to be discovered event, Newberg hopes to find some answers.**

The “overview effect” creates a peaceful mid-set shift- moves from identification with fractions of the world, to the entire system.

Krukin, 8

[jeff krukin, Executive Director of the Space Frontier Foundation 2008 “the healing power of space” http://www.jeffkrukin.com/index2.php?option=com\_content&do\_pdf=1&id=27]

If you aren't familiar with "The Overview Effect," it is "... **the experience of seeing the Earth from a distance, especially from orbit or the Moon, and realizing the inherent unity and oneness of everything on the planet. The Effect represents a shift in perception wherein the viewer moves from identification with parts of the Earth to identification with the whole system."** (Frank White, author of The Overview Effect: Space Exploration and Human Evolution) We are so inundated with news of conflict and other challenges across our planet that it's difficult to see how the new year can be better than the last. Well, if we can't see it, then **we must create that which we wish to see, and any hopeful and peaceful vision of humanity's future must include our stellar neighborhood.** As former space shuttle astronaut Joe Allen said, "**With all the arguments, pro and con, for going to the moon, no own suggested that we should do it to look at the Earth. But that may in fact be the most important reason.**" A wonderful event that occurred in Raleigh, NC on Dec. 1st demonstrated **the healing power of bringing space down to Earth and into our neighborhoods**.

**The “Overview Effect” is life-changing- alters view of humanity.**

Davis, 2/26

[Ned Davis Ned Davis research “Space Exploration For Everyone; The Overview Effect” February 26th, 2011http://neddavisblog.com/space-exploration-for-everyone-the-overview-effect/]

The age of space exploration for the general public is upon us. **The recent progress of private space companies to send Regular Joe’s into space has reached a critical stage.** **No longer is space exploration the realm of large governments and secret military projects**. No firm dates have been set, however many companies are serious about the venture and the first few space tourists could enter L.O.E. (Low Earth Orbit) as soon as late 2012. You can book a seat on Virgin Galactic for $200,000 right now. These select few will witness first hand the wonders of outer space and low earth orbit. **Astronauts and space scientists, known for their steel eyed calm and cool, have often gushed and praised the experience of being in space as ‘life changing’ and awe inspiring. This phenomena is now known as the “Overview Effect” and occurs when astronauts look down upon the Earth and, for the first time, witness the fragile and seemingly razor thin atmosphere everyone on our planet lives beneath. One sees no country boundaries and the world looks as it should; a singular beautifully balanced planet suspended in the blackness of the universe. Many have said it has a profound impact and deeply effects their view of Humanity. Many say the experience is even difficult to articulate to others into words. The Overview Effect can be life altering and long lasting.**

The “Overview Effect” creates a more peaceful Earth- Psychological changes from viewing Earth.

Cox, 9 [Ken Cox Ph. D. Founder and Director Aerospace Technology Working Group 2009“Sustainable Space Exploration and Space Development A Unified Strategic Vision” http://www.spacerenaissance.org/papers/A-UnifiedSpaceVision-Hsu-Cox.pdf]

In addition to the economic and resource dimensions inherent in the space effort, there is also an important psychological dimension to consider. It seems to be a universal Sustainable Space Exploration and Space Development: A Unified Strategic Vision experience among astronauts that when they look back at our blue home planet from the depths of space that they feel what has been called the “overview effect,” a profound natural bond for humanity accompanied by a desire to cherish one another. While humans, currently limited to a single-planet civilization, often feel threatened or compelled to fight for resources and living space on the surface of the Earth, we may anticipate that our psychological attitude may change as more people experience the overview effect as a result of expanding the human horizon outward into space. Hence, we should not underestimate the benefit to be achieved by expanding human habitats outside the Earth as a contributing factor to the acceleration of human conscious evolution, leading perhaps to sustainable and peaceful human development on Earth.

Overview Effect---Solves Environment

The “Overview Effect” triggers “green” initiative- Environmental movement of the 70’s proves.

Malik, 9[Tariq Malik, Senior Editor 22 April 2009 “Planet Earth a Fragile Oasis, Astronauts Say” http://www.space.com/6603-planet-earth-fragile-oasis-astronauts.html]

The first astronauts ever to see the entire planet as a distant orb in a sea of black space were the three Apollo 8 astronauts, who took the iconic image of Earth rising over the limb of the moon in December 1968. “The amazing public perception of that stunning photo gave everybody an awareness that the Earth was an oasis out there in a very barren, harsh cosmos,” said former astronaut Thomas Jones, a planetary scientist and co-author of the book “Planetology.” “I think those images became the icon of the environmental movement in its earliest phase.”

**The perception of Earths fragile nature caused by viewing from space triggers civil engagement in Earth Day.**

Malik, 9[Tariq Malik, Senior Editor 22 April 2009 “Planet Earth a Fragile Oasis, Astronauts Say” http://www.space.com/6603-planet-earth-fragile-oasis-astronauts.html]

Astronauts looking down on Earth from space have long said the view is tremendous, but it is also comes with the revelation that of all the planets in the cosmos, there is only one world that humanity calls home. “Our planet is our spaceship,” said NASA astronaut Sandra Magnus, who recently returned to Earth after spending about 4 1/2 months in space. “It looks very fragile from here, and it’s very easy to take it for granted when we’re living on it, when it seems so big and so massive. But it’s not. It’s very small and very fragile.” Magnus returned home in late March with a new perspective of her home planet, one that came just in time for Earth Day today.

The Earth’s unified appearance from space causes one to feel the need to “care” for the planet.

Malik, 9[Tariq Malik, Senior Editor 22 April 2009 “Planet Earth a Fragile Oasis, Astronauts Say” http://www.space.com/6603-planet-earth-fragile-oasis-astronauts.html]

“There’s no doubt, when you look down at the Earth from here, you’re just overwhelmed by how beautiful it is,” Barratt said this week, adding that two things immediately jump out. “One is how much you miss it, and two, is how much you really want to take care of it as best you can.” Magnus said that when a person gazes at the Earth, there is a sense that humanity and all life as we know it are completely dependent on a single planet and its thin atmosphere. “It makes you think about our planet as a whole system,” Magnus said. “We’re all there together living together as human beings and other organisms and we have to take care of each other.”

Viewing Earth from space gives momentum to environmental movements- Empirics prove.

Exopsyhchology, 8[exopsychology 2008 “Human Readiness for Extraterrestrial Relationships” http://www.exopsychology.net/?page\_id=561]

The evolution of consciousness is increasingly a matter of conscious evolution, an evolution that takes place not in genetic or even cultural time frames, but in daily life, as a matter of conscious choice. If in fact aliens are not visiting Earth, exopsychology is still important, because there is a cultural phenomenon taking place, one that increasingly fosters a global perspective. If people of Earth truly adopted a global identity and consciousness, institutions and concepts such as Nationalism, racism, consumerism, orthodox religions and science would all be challenged to accept and adapt to a new perspective. Climate change and overpopulation will increasingly pressure us to adopt a global perspective, even if alien contact does not. The very idea of alien, intelligent life encourages us to think differently, and prods us towards a Cosmic perspective, at which point the global perspective truly sinks in. The Cosmic perspective first hit Western culture when astronauts went to the moon, and millions of people saw the Earth from space. The ecology movement gained new momentum at that time, to everybody’s benefit. This is also known as the Overview Effect, the subject of growing interest. Abductees typically carry messages concerning environmental issues. This may be a reflection of a growing unease about our environment, and it may also be something more than that, namely, a manifestation of the Collective Unconscious. Or, maybe aliens are making their concerns known, in a non-threatening way, through the intermediary of ordinary people. Let the data speak.

Overview Effect---AT: Humans Bring Problems to Space

Colonist will not destroy mars

Zubrin ’95 (Robert, masters degree in Aeronautics and Astronautics, member of Lockheed Martin's team for space exploration , The Case for Colonizing Mars, National Space Society,http://www.nss.org/settlement/mars/zubrin-colonize.html) JL

The primary **analogy** I **wish to draw is that Mars is to the new age of exploration as North America was to the last**. The Earth's Moon, close to the metropolitan planet but impoverished in resources, compares to Greenland. Other destinations, such as the Main Belt asteroids, may be rich in potential future exports to Earth but lack the preconditions for the creation of a fully developed indigenous society; these compare to the West Indies. Only Mars has the full set of resources required to develop a native civilization, and only Mars is a viable target for true colonization. Like America in its relationship to Britain and the West Indies, Mars has a positional advantage that will allow it to participate in a useful way to support extractive activities on behalf of Earth in the asteroid belt and elsewher**e.** But despite the shortsighted calculations of eighteenth-century European statesmen and financiers, the true value of America never was as a logistical support base for West Indies sugar and spice trade, inland fur trade, or as a potential market for manufactured goods. The true value of America was as the future home for a new branch of human civilization, one that as a combined result of its humanistic antecedents and its frontier conditions was able to develop into the most powerful engine for human progress and economic growth the world had ever seen. **The wealth of America was** in fact that shecould support people**,** and that the **right kind of people** chose to go to her. People create wealth. People are wealth and power**. Every feature of Frontier American life that acted to create a practical can-do culture of innovating people will apply to Mars a hundred-fold**. Mars is a harsher place than any on Earth. But provided one can survive the regimen, it is the toughest schools that are the best. The Martians shall do well.

No Link – Colonization wouldn’t be imperialistic

**Howerton 95** (Alexander, Business Editor for Countdown, “Free Space: Real Alternatives For Reaching Outer Space”, p. 38)SV

True, many evils were perpetrated in the over-zealous spirit of discovery, and whole civilizations were wiped out in the process**,** but there are two main differences between that era of discovery and this one: first, there are no lives or civilizations to destroy in our solar system (the question of life on Mars has not been totally resolved; I therefore advocate we learn as much as possible about the Martian geography and ecosystem before we engage in any grand plans of terraforming). Secondly, we have the benefit of advanced historical knowledge and appreciation to guide us. We know more about our world and our past than our great exploring forefathers, thanks in part, already, to the increased communications provided by the economic exploitation of space, in the form of communications satellites.

Overview Effect---Diplomacy/Geopolitics Impact

Colonization has huge diplomatic potential—increases international cooperation.

Red Colony, 10(A group of professionals who are frontrunners in mars development, Why Colonize Mars?, <http://www.redcolony.com/features.php?name=whycolonizemars>, JG)

From a geological standpoint alone, Mars is exciting because it offers scientists a view of how planets develop. Mars is billions of years older than the Earth, and its features are much more exaggerated. The largest canyons, volcanoes, and craters in the solar system are available for our study. 3. Its Diplomatic Potential It is obvious that the world isn't perfect, but we've been trying for the entirety of our civilized existence. We've reached a point now where the majority of the world's superpowers are on good enough terms to begin an international joint-project to colonize Mars. This was much the theory with the International Space Station, but dirty politics proved how immature the world's superpowers are. Ending the quarrelling and going to space might sound like ignorant idealism, but imagine the diplomatic potential. When we become united in a goal, not just as Americans or as Russians but as mankind, all of humanity puts aside its differences. Even if the initial trip to Mars is sponsored by one nation or one space agency, in the end Mars will be for everyone. The Old World's boundaries will not be able to restrain the emigration. Who knows, the concept of countries might remain a thing of the Earth, an archaic reminder of castles and kings and the battle for power. Mars could be the beginning of a new era in human diplomacy.

Colonization fosters international cooperation and world peace.

Cox, 9 [Ken Cox Ph. D. Founder and Director Aerospace Technology Working Group 2009“Sustainable Space Exploration and Space Development A Unified Strategic Vision” http://www.spacerenaissance.org/papers/A-UnifiedSpaceVision-Hsu-Cox.pdf]

The commercial development of space promises to provide extraordinary opportunities to develop new economic capabilities that will most likely help overcome global challenges and crises in energy, climate change and resource shortages. Such efforts could also be transformative to all nations that participate. Human development and economic expansion into space could even help accelerate the evolution of human civilization, and also help inspire human collaborative and effective diplomacy, thus enhancing bonds between nations and fostering an enduring world peace.

\*\*\* Space Elevator \*\*\*

Space Elevator---Solvency---Colonization

The Space Elevator rewrites the rules for colonization economics- it’s the best way to facilitate future efforts.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p.161-162)

A paradigm shift The reason, then, to use a Space Elevator to go into space, is that it changes the roles dramatically and reduces the cost to an economic level. The Space Elevator is a disruptive technology. Disruptive technologies are not gradual change. They rewrite the ground rules. If you are playing the old game of "rockets" you are out of it when an elevator offers launch capacity with a "98% off” sale tag. Disruptive technologies are the key to changes in nation strengths. Steam engines gave Britain its power in the Industrial Revolution and turned it from an average European country into a world power for a time. Cars and airplanes were the disruptive technologies at the start of the 20th Century. Cell phones mean newly developing countries can leapfrog landline phone systems. By the end of the 21st Century the Space Elevator will have transformed our society and space travel. The cost of implementation, at around S10 Billion to S20 Billion is within reach of dozens of countries, Fortune 50 corporations and even wealthy individuals. Once a determined country (or entity) decides to go ahead with implementing the technology and building the first Space Elevator, it would be difficult to stop it. The first country or entity to successfully implement the technology will quickly gain economic and political power in the form of controlling the primary access to space: telecommunications, energy, the moon, Mars, asteroids and a myriad of new markets. This will drive the history of the 21st century.

Current rocket based craft options are inherently risky- the space elevator is the only method to get off the rock.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 153-4)

So why do it with a Space Elevator? Our current rocket launch technology depends on a handful of launch sites. It is not widely understood that our hold on space travel is tenuous. The much-trumpeted ISS depends on servicing from Russian craft and from the Space Shuttle. The Challenger and Columbia disasters shut down the Shuttle program for years. A similar failure for the alternative remaining service option, Russian craft, could mean the end of the ISS. When Hurricane Frances passed through Florida in September 2004, there were real fears that it could wreck Cape Canaveral, America's prime launch base. James Kennedy of NASA was reported to say after the storm: "…the initial feeling of the 200 employees inside the space center Monday was "that we had dodged a big bullet," Kennedy said. "I was significantly worried about the future of human space flight based upon that doomsday scenario" of a direct hit by a hurricane with at least Category 4 force-"xvii What about SpaceShipOne? Does that show the way? We very much applaud the efforts of Rutan and others to develop private space planes. However, the general public lacks appreciation of the gap between such planes, and traveling to the Moon. SpaceShipOne is only capable of a brief suborbital flight at a height of 100 km or so above Earth. It only spends a few minutes at that height, which is where space officially "starts". Why only a few minutes? That word sub-orbital is the clue. It is not going fast enough to stay in orbit SpaceShipOne cannot orbit the Earth, even at that low height. Like a firecracker, it goes up, hovers in space for a moment, and then falls down again, eventually flying back to Earth. As its' designers acknowledge, there is a big gap between achieving a sub-orbital flight, and going into orbit, or even visiting the ISS which is 386 km up. It is the same equation that bugs all rockets. The extra fuel required to reach orbit would call for a vastly larger craft. In turn, the weight of the larger craft requires more fuel still, and so on. While it is possible that, based on the design experience of such craft, future rocket design might result in rockets that bring the cost of space launches down, we are talking of reductions of only a few percent off present day costs. Even then, we are still talking about low orbit (LEO) launches-Admirable as it is, SpaccShipOne is never going to hike anyone to the Moon. We currently only have a multi-billion dollar rocket-based program that is an expensive high-risk technology. We need something better if we are to stay in space. To the best of our knowledge today, we can only envisage two ways of getting into space, by rockets, or by climbing up an endless ladder. So, that is where our Space Elevator comes in. It is the only alternative.

Space Elevator---Solvency---Quick Colonization

Space elevator key to rapid colonization- and lunar bases will be a stepping-stone for further colonization.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 158-9)

Let's start with a fun one: building lunar colonies. Each Space Elevator will be able to deliver 1500 tons of material to the Moon or Mars every year. The mass of a lunar base with a population of roughly 450 people is around 4000 tons with an annual resupply rate of about 1,800 tons. So, using part of the capacity of the first few Elevators it would be practical to have a lunar base (or Mars base) with a thousand people up and operating for much less than the current NASA budget. At this level we could have a full infrastructure on the Moon, a self-sustaining society, producing products and resources for use back on Earth. People would be born and live their lives there. Now what happens when we build this infrastructure and have valuable activities occurring like mining, power production, launch facilities, astronomy, Earth observations, and manufacturing? Private enterprise sets up shop and expands the population and infrastructure. Private enterprise has much more financial power than the government in this situation and will quickly drive development. The Space Elevator effectively collects a toll on all this activity, since it is the conduit by which all materials and personnel must travel. Compare this to the European ocean-going ships that crossed the Atlantic to North America or the transcontinental railroad. Both end points grew and profited- Boston competed with New York, Liverpool competed with London, to the benefit of all. If we speculate on what will happen, we have a lot of confidence in stating that after the first several Elevators are built expansion will be rapid and within two decades we will have substantial cities on the Moon and Mars with thousands of people. Imagine that thousands of people living, going to school, socializing, and producing products and services. A new "frontier" is a reality, the first new colony in hundreds of years. Colonization will start with the Moon but it will quickly spread once the techniques and value are demonstrated. Mars and the asteroids will be colonized next followed by the moons of the larger planets. Brads' grandmother once stated that in her life the world had gone from covered wagons to men on the Moon. That was a time span of 86 years. Our children will say they saw human society expand from a single world to dozens, from a time when a few people a year might venture into space to one where die corporate IT technician might get assigned to a job on Mars. In another 86 years, there will be dozens of major cities on the Moon and Mars, a large number of asteroids will be under development and there could be human outposts floating in the atmosphere of Venus and on several of the moons of Jupiter. The first stepping-stone to this impressive future will be the establishment of a lunar base, and with the Space Elevator this is totally feasible for less than we are currently paying to NASA to maintain our existing rocket-based space technology.

Space Elevator---Solvency---Mars

Space elevator key to colonize and mine Mars

Weinstein, 03(Leonard, Advanced Measurement and Diagnostics Branch, NASA Langley Research Center, AIP, Space Colonization Using Space-Elevators from Phobos, http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=APCPCS000654000001001227000001&idtype=cvips&gifs=yes&ref=no, JG)

A novel approach is examined for creating an industrial civilization beyond Earth. The approach would take advantage of the unique configuration of Mars and its moon Phobos to make a transportation system capable of raising mass from the surface of Mars to space at a low cost. Mars would be used as the primary location for support personnel and infrastructure. Phobos would be used as a source of raw materials for space-based activity, and as an anchor for tethered carbon-nanotube-based space-elevators. One space-elevator would terminate at the upper edge of Mars' atmosphere. Small craft would be launched from Mars' surface to rendezvous with the moving elevator tip and their payloads detached and raised with solar powered loop elevators to Phobos. Another space-elevator would be extended outward from Phobos to launch craft toward the Earth/Moon system or the asteroid belt. The outward tip would also be used to catch arriving craft. This approach would allow Mars to be colonized, and allow transportation of people and supplies from Mars to support the space industry. In addition, large quantities of material obtained from Phobos could be used to construct space habitats and also supply propellant and material for space industry in the Earth/Moon system as well as around Mars. ©2003 American Institute of Physics

Space Elevator---Solvency---Now key time

Now is the key time- Japan is poised to beat us to building the elevator

Colony Worlds, 09 (Colony Worlds is a group of people who seek to highlight the innovation in technology, medicine and science that will help our species discover new homes upon new worlds, Awesome: Japan May Commit $10 Billion Towards Space Elevator, <http://www.colonyworlds.com/2008/10/awesome-japan-may-commit-10-billion-towards-space-elevator.html>, JG)

With both the US and China relying upon rockets to secure their solar future beyond the heavens, it looks as if the nation of the rising sun is placing its bets on the [space elevator](http://en.wikipedia.org/wiki/Space_elevator). ([RIA Novosti](http://en.rian.ru/analysis/20081006/117469160.html)) Japanese engineers intend to build an elevator to deliver cargo into space. Japanese authorities are prepared to allocate $10 billion for the project. The space elevator is expected to cut the cost of delivering cargo into space and is considered one of the most ambitious projects of the 21st century. The Japanese plan to unveil a schedule for the elevator’s assembly and commissioning this November. While the space elevator has its share of engineering problems, its successful construction would pretty much guarentee Japan’s space dominance over its rivals, as Japan would be able to launch cargo at [much lower prices](http://science.howstuffworks.com/space-elevator.htm) than either China or the US could via rockets. A space elevator would enable Japan to establish large colonies fairly quickly on both the Moon and Mars–not to mention help the nation generate billions of Yen by renting it out to half the planet. Note: The first [Japanese Space Elevator](http://www.jsea.jp/en) conference is coming up, so be sure to check out the [Space Elevator Blog](http://www.spaceelevatorblog.com/) for highlights from Tokyo! Description: img

Space Elevator---Solvency---Funding Key

Funding key- the space elevator will quickly become viable.

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: Given proper funding, when is the earliest that you could see the space elevator becoming operational? Answer: Given sufficient funding, I am confident that the space elevator could be up and running within 15 years. There are no insurmountable technical issues to the concept. The show stoppers at this point are funding and support. This is unfortunate given that the space elevator has the potential to reduce the cost of getting to orbit to perhaps $20 per pound, including human passengers. The space elevator, more than any other project or concept, has the capacity to quickly open up the field of space and create a massive space-based industry.

Carbon nanotubes will be quickly viable with sufficient funding.

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: Current nanotubes are not sufficiently strong to be used in a space elevator. How much progress do you anticipate in nanotube technology during the next decade? Answer: Small quantities of some nanotubes have been made that are sufficiently strong to be used in a space elevator. We would obviously need to produce hundreds of tons of such nanotubes to build a space elevator. With sufficient funding, we could create a nanotube-based material appropriate for a space elevator within a couple of years.

Funding is the only issue.

Edwards 07 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Space Elevator: Expert Q&A, Jan 16, http://www.pbs.org/wgbh/nova/space/edwards-elevator.html)

Q: What is harder, getting $10 billion to start, or solving the technical problem of spinning carbon nanotubes into a ribbon? Tony, Issaquah, Washington Edwards: No question—getting $10 billion. We are almost done with the second.

Space Elevator---US Key/Leadership IL

The US must be the first to build a space elevator- key to US space dominance.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 126-127)

Will America win the race? In various discussions, individuals have told us definitively that the United States will build the first Space Elevator. Others have stated just as definitively that a private entity will build the first Elevator. As we will see, there is little that is certain about the future. It is true that a country such as the United States might build the Space Elevator but when the cost and technological difficulty is reduced sufficiently it will open the way for a number of entities to consider undertaking the endeavor. A clear example is seen in rocket technology. The United States and Russia both perfected rocket technology in the 1960s and conducted extensive space programs. In addition, China, Japan, France, India, Pakistan, England, Germany and a handful of other countries have various levels of rocket technology. The United States rockets have been built by a set of large aerospace companies. Since 2004, individuals have built and flown rockets to carry people to space. Rocket technology has matured and spread across the globe. The technology for the Space Elevator is much less complex than that for rockets. Technology in our current society is now chased, developed and distributed with vigor. The process that took rockets from a national level to the hands of individuals will be short circuited for the Space Elevator, the cost and technology are well within reach of countries, corporations, and individuals. The question is which entity is most likely to overcome the political hurdles, the capital costs and the technical challenges to succeed first. Americans will of course assume that their country will be the builder, hut at this stage nothing is certain. Perhaps "which country?" is not even the right question: with the levels of wealth of the 21st century is it within the reach of the worlds’ richest individuals and the largest companies? The prospect of a Microsoft Space Elevator is nor inconceivable, as is a Shell or Exxon Elevator. Today's space enabled nations include the USA, Russia, China, Europe Japan and India. In 20 years time the list may have expanded to include other countries, Private venture space operators are already beginning plans for their first flights and by then may be in a position to fight for market share. Well before then, it will be apparent that the country launching the first Elevator will take control of space. This is the reverse of today’s technology, where it is often die case that the first-in company bears all the costs of development while others rake the idea and build on it. For the Space Elevator, it is, to use an Australian expression, "first-in-best-dressed". Whoever owns the first Elevator will have a 95% cost advantage over competitors who still depend on rocket launches, and that advantage translates into the cost of constructing second and subsequent Elevators. So there is a clear economic imperative to win the race and be first. It is not just construction and launch costs: the economic and territorial benefits of expansion into space will accrue to the owner of the Elevator and the owning Country or Company may become the dominant power of the late 21" century.

Space Elevator---China Adv IL

The US will cede control of space to China if it doesn’t immediately begin building a space elevator.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 130)

The most obvious candidate country must be China. It already has a launch capability and has put men into orbit. China has hinted at ambitions to land on the Moon -and maybe even beat the USA in returning people to the Moon. The construction of a Space Elevator would be a logical progression for China, and put it far ahead of the USA in its ability to conquer space. The United States government with its complacency and current commitments will likely not begin construction on the Space Elevator until 2020. On the other hand, in the next couple years a 'wild card' country could conceivably face the political challenges and step up to build the first Space Elevator.

Failure to build the space elevator will cause the US to lose the space race with China.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p.163-4)

For all we know, a misstep similar to that of ancient China could easily occur or may have already occurred in the United States. Consider that because of the declining space program in the United States and the growing one in China, books written on the Moon or Mars may be written in Chinese. Chinese success in space in the 21st Century could wipe out the legacy of that 600-year-old strategic mistake. We are not seeking to create another version of the arms race, or inter-nation rivalry. It would be nice to learn from our mistakes and, this time, advance into space in a cooperative spirit instead. However, it seems an unfortunate fact of our modern life that fear is a big driver of national advancement Bear in mind that the entity that builds the elevators will be the one that controls the supply of energy from space, and the revenue from space - a real good reason to be the one who builds the elevator. We can see the level of influence and attention a few small countries in the Middle East have garnered due to their energy resources as compared to similar countries in Africa or South America. Imagine if a country such as Australia were to build the first elevators and control construction of the solar power satellites. It already has the most accessible Earth Port location just off the coast of Perth. It would combine a developed economy with energy resources beyond what is held in the Middle East Australia would wield considerable clout and could become a dominant world power! In die same respect consider what other entities may be in a position to control these resources: China, Japan, Europe, Microsoft, Boeing, Honda, Wal-Mart, or any other that can bring together the financing and technology. Here we will boldly claim that we are at a critical juncture in time. In the next twenty years, a paradigm shift will occur. An entity will grab the reigns and step on the path to become the dominant global leader for the coming century- The United States could continue in the dominant role but the reigns could just as easily be picked up by Europe, Japan, Russia, China, and Australia or even by a corporate entity. What we are confident of is that the next few years will determine how the history of the next century will be written.

China seeking the elevator- whoever gets the first will control space.

Flight, 06 (Georgia, Journalist for CNN, The 62,000 mile elevator ride, http://money.cnn.com/magazines/business2/business2\_archive/2006/03/01/8370588/index.htm,JG)

Who will bite first? The Chinese government has made no secret of its ambitious space program and carbon nanotube research. **Nor has Japan**. "Whoever builds the first elevator will have a virtual monopoly on all future ones,**" Edwards says. "**The political and economic structure of the world could be completely different 50 years from now." Risk to the infrastructure would be minimal. The floating platform will ideally be anchored on the equator, Earth's calmest area with the fewest lightning strikes and storms. The ribbon will have the highest melting point of any material ever produced and be flexible enough to withstand high winds.

Whoever gets the elevator first will dominate future space commerce.

Flight, 06 (Georgia, Journalist for CNN, Gizmodo, The Great Space Elevator, <http://gizmodo.com/158665/the-great-space-elevator>, JG)

There are startups and then there are startups. Web 2.0 is all fine and dandy and I love AJAX as much as the next person but let's face it, as amazing as Flickr, del.icio.us and MeasureMap are, they and the rest of the new web apps combined and taken to the tenth power aren't even half as sexy as the Space Elevator. The what? Business 2.0's Georgia Flight explains: Earth is constantly spinning. So if you attach a counterweight to it with a cable, and put it far enough away—62,000 miles—the cable will be held taut by the force of the planet's rotation, just as if you spun around while holding a ball on a string. And if you've got a taut cable, you've got the makings of an elevator. As strange as that sounds—push the "Up" button, climb in, and soar off into weightless bliss—don't be surprised if it happens. The space elevator is where the PC was in the 1960s: The theory is solid, the materials exist, and people in garages are starting to tinker with the next step. Two Seattle startups are competing to build the elevator. Both believe they can do it within 15 years at a cost of $10 billion. NASA and China's space agency are eager to help make it happen. And no wonder: A working elevator would reduce the cost of launching anything into space by roughly 98 percent. 98 percent! Biggest discount EVER? So of course the US wants it, China wants it and so does Japan. If and when it does become reality, the country that gets a Space Elevator first will likely have a stranglehold on space commerce for a long time.

Space Elevator---Aerospace

Space elevator would be contracted out to the aerospace industry.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 122)

An obvious possibility is that the United States government constructs the first Space Elevator, The United States has led in many areas such as technology and space and is economically the dominant country in the world with a Gross Domestic Product approaching 9 trillion dollars. However, the country and the government are separate. If the United States government were to construct the first Space Elevator it would be done either through NASA or the Air Force. In cither case it would be subcontracted out to one of die major aerospace companies due to the long-standing relationships and strong political lobby. But we contend that where the subcontract goes is not critical but the operation of the funding agency is.

Space Elevator---Space Solar Power Solvency

Space elevator critical to making space solar power economically viable- solves oil dependence.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p.159)

Solar power transmission What about services for Earth? We will eventually run short of oil but energy is all around us. We are starring to use solar arrays here on Earth for power bur things like night clouds, and the atmosphere limit their efficiency. Well, in space there is no night, no clouds and no atmosphere. Solar arrays work much better in space. Now think about putting square kilometers of solar arrays in space to collect the limitless power of the sun and sending this power down to Earth on a laser beam or microwave. No pollution and it won't run out. The electricity generated can run cars, factories, homes, everything. Great idea, so why aren't we doing it? We would if we could; people have been working on the idea for 30 years. The problem has been that the initial launch costs are too high for putting the solar arrays in space. The Space Elevator will lower the costs to an economic level. So we dedicate a few Elevators to building solar power satellites and put up these huge arrays. The dependence on oil disappears. Pollution dwindles. Our children and their children will have a consistent source of energy for all their needs, and it benefits the environment too. Everybody wins!

Space Elevator- Satellite Market Solvency

Space elevator boosts the satellite launch market.

Van Pelt 09 (Michel, engineer at ESTEC, the technical centre of the European Space Agency, *Space tethers and space elevators*, p. 191 google books)

The satellite launch market situation represents a vicious circle: the launch market will remain small without breakthroughs such as a space elevator, and for such a small market it does not economically make sense to develop expensive new launch systems. As mentioned before, government investment is probably needed to break this loop and develop the first space elevator. Once it is operational and the launch market increases because of its availability, the construction and operation of additional and improved space elevators may become a purely commercial business. At Earth this stage will be difficult to reach, but for space elevators on the Moon and Mars it will be even harder to find an economical balance between costs and benefits.

Space Elevator- Asteroid Deflection Solvency

The space elevator is necessary for implementing any asteroid deflection strategy- key to avoid a catastrophic strike.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,,* p.159-160)

Protection from asteroids Have you seen the movies Armageddon or Deep Impact? In spite of the artistic license that these movies adopt, they highlight a critical issue. There arc asteroids that could impact Earth causing global destruction. The likelihood of an impact is believed to be low in the short-term but it is clear what will happen if a large object does hit Earth. These large objects are extremely difficult to deflect and to do so will require extensive assets in space. If an asteroid were headed for Earth right now we would have little chance of protecting ourselves. With a large detector array in space we could detect dangerous objects on prior orbits giving months or years of warning. With extensive spaceship systems at geosynchronous orbit and the Elevator to support them, a system could be put in place to meet a dangerous object early, when the minimum energy is required to deflect it. Even in this case, to deflect an object a kilometer across could require thousands of tons of fuel and hardware. This would be challenging for the Elevator but much more viable than with any current system in place today.

Space Elevator- Tech = Feasible

Already technically viable- funding and commitment are key.

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: How much of an improvement is needed from nanotubes? Answer: Nanotubes of lengths up to an inch can already be created. These materials can be bundled together to form arbitrarily long lengths of cable that would be appropriate for a space elevator. So the primary problems at this point are not technical but rather economic and political.

AT: Space junk/other damage

The elevator absorbs damage- space junk and other impacts are irrelevant

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: Some critics have claimed that microscopic cracks will propagate through any ribbon at the speed of sound. Answer: The ribbon isn't solid, but rather is composed of 10-40 thousand strands of nanotube fibers. Individual fibers will get broken and recoil, so the ribbon needs to be designed to recoil only short distances. So short lengths of fibers will get broken, but the breaks won't propagate in such way as to destroy the ribbon. The ribbon will unquestionably be hit by micro meteors, and these will damage small areas. But the ribbon will be designed to absorb these areas and still remain fully functional. Question: How difficult will it be for a space elevator to avoid satellites and space debris? Answer: Any debris that is a centimeter or smaller will hit and damage the ribbon. Objects larger than a centimeter will be tracked continuously monitored. The elevator, which will be located in the ocean, will need to be moved approximately once every 14 hours in order to avoid hitting larger debris. So these issues are by no means intractable.

AT: Radiation

Radiation is a non-issue.

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: What about radiation issues? Answer: The space elevator would employ both active and passive radiation shields. I did research on using a large toroid and that would eliminate most of the charged particles. A small amount of additional shield would absorb the remaining radiation. The weight penalty issues would be rather modest - only a few tons. Four tons of extra weight on a twenty ton satellite is not prohibitive.

Cost = $10 billion

Cost of deploying the elevator = $10 billion.

Edwards 09 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, Interview of Brad Edwards - Space Elevator Expert by Sander Olson, Dec 1, http://nextbigfuture.com/2009/12/interview-of-brad-edwards-space.html)

Question: How long would it take and how much would it cost to develop and assemble the space station? Answer: The entire process of building and deploying could be done within a decade. Initial estimates are that it would cost $10 billion to build. Even assuming cost overruns and delays, the project could be built in a dozen years for not more than $20 billion

\*\*\*Solvency---Moon Colonies\*\*\*

Moon Colonization---Solvency---General

Moon colonization is feasible---laundry list

Murphy / 6:13 pm June 14th, 2008 25, Good Reasons to Go to the Moon, Ken Murphy, member of the Board of Directors of the National Space Society http://www.outofthecradle.net/archives/2008/06/25-good-reasons-to-go-to-the-moon-2/

1) Hydrogen Whether in water form or not, we do know that there is hydrogen at the Lunar poles. This can serve a minumum of two ends: water for a base, fuel for rockets. 2) Oxygen The heavy part of the LH/LOX fuel mix is the oxygen, about 7/8ths of the weight. Instead of launching all the fuel for cislunar maneuvering from Earth, launch 8x the hydrogen from Earth and mix it with the Lunox. 3) 1/6th gravity This will provide engineering fun and challenges for future generations of engineers. How does one design an extensible tower for a solar mirror with 1/6th the force of gravity? 4) No weather This goes hand-in-hand with #3. Engineering design will be significantly different in a vacuum environment with no water, wind, rain, hurricanes, or tornadoes. Corrosion takes a different form. 5) Vacuum A critical part of many of the engineering processes used here on Earth, requiring the expenditure of large amounts of energy to create a vacuum. The Moon has about 15,000,000 square miles of it. 6) Glass A good proportion of the Lunar soil returned by astronauts was in the form of glass. Lunar glass has the distinct characteristic of having formed in a water-free environment, making it anhydrous. What advantages this may offer in the field of optics is largely Luna Incognito. Then there’s fiberglass, composites, etc. 7) Human factors Having 1/6th of Earth’s gravity, the heart doesn’t have to pump as hard to supply oxygen to the brain. While for a youth this would have an atrophy-type effect, for those advanced in years it can serve a rejuvenative effect, as the heart is suddenly relatively stronger. This allows for longer productive lives for our citizens. And you can fly in a large enough space. 8 ) Crater history The Moon is the best record in our local neighborhood of the history of bombardments from space. Earth is too dynamic to sustain a record, but the Moon is perfect. By establishing an impact history in size and time we can look for any cyclicality in the timing of impacts, and if so, where are we in the cycle? Addendum: Dr. Paul Spudis has pointed out that the Moon also provides a historical record of the Solar System’s journey around the galactic core as well. 9) Cold-traps At the Lunar poles, there are places the sun never shines. These everdark craters seem to hold the bulk of the hydrogen detected at the poles. Excavations outside the craters can create additional cold-traps for later industrial use. 10) Solar mirrors Mounted on extensible towers, mirrors can be placed in perpetual sunlight to illuminate selected areas. This requires the high-technology capability to turn the mirror. No batteries required. 11) Solar power towers Extensible towers at the poles will allow the placement of solar cells or films in constant sunlight. It doesn’t matter so much hitting the perfect peak for one’s ground-based system as making the tower high enough to peek over the horizon, which on the Moon is very short. 12) Radio silence While not a perfectly radio-silent environment, the far side of the Moon is far better than anything on Earth or even in orbit. Large arrays can allow for a leap in precision for radio astronomy and SETI. 13) Solar cathedral A number of religions and cultures around the world still use the Lunar calendar in the conduct of their affairs. Part of this involves determining the beginning of each lunar month. Building a Solar cathedral on the Moon will allow an unprecedented degree of precision in making that determination. It’s also a good way of getting different faiths to work together. 14) Neighborhood watch The orbital scopes like Hubble get all of the credit for cool deep-space discoveries, but no one’s keeping an eye on our local neighborhood. That’s why we’re finding more and more asteroids after they’ve passed the Earth. The Moon provides the kind of dull, stable platform for the astronomy that no one else wants to do. 15) Greenhouses Lunar regolith can’t really grow plants by itself, but the addition of humus (not hummus), other nutrients, and careful recycling does allow for plant growth. Plants grown in Lunar soil may provide new fragrances, flavors, and vintages. Spices were one of the early high-value, low mass/volume goods that helped create the trade routes of old. 16) Metals Vacuum-processed ultra-pure aluminum. Vacuum-processed ultra-pure titanium. Vacuum-processed ultra-pure iron. Vacuum-processed ultra-pure magnesium. You want it? We’ve got it. 17) Volatiles The Sun has been burying light elements in the Lunar soil for aeons. All it takes is a little baking at about 1100 K, a little shaking to agitate the particles, and a place to liquefy the output. Cold-traps are particularly useful for this. 18)Extreme sports Imagine bicycle races at 250 kph. Imagine regoboarding the southside of Copernicus. Imagine flying in a large underground cavern. Imagine high-jumping in 1/6th G. Or long-jumping. 19) Spaceships Some items, like advanced electronics, will be shipped from Earth for a very long time. But things like spacecraft structural elements (and fuel) can easily be done on the Moon, obviating the need to waste the lift mass from Earth’s gravity well. 20) EML-1 Having such a large neighbor so close by creates a warp in Earth’s gravity well. There are certain areas of relative stability, and one lies on the line connecting the center of the Earth and Moon. Putting a station at that point (or rather in a halo orbit around it) allows for all kinds of unexpected benefits. 21) GEO assets We have billions of dollars of orbital assets in geosynchronous orbit. It’s cheaper in fuel to go from EML-1 to GEO and back, than to go just from LEO to GEO. Over time, this will allow for a huge decrease in the cost of refueling, repairing, and upgrading, as well as building larger and more capable platforms. 22) Solar power satellites Placement of large solar arrays in GEO orbit allows for the collection and transmission of energy to fixed points on Earth, such as military bases. This will also provide a long-term source of energy, as the Sun is not expected to expire for another 4.5 billion years or so. Besides, most of the energy we use here on Earth is second or third-hand solar power anyway. Pieces of the solar power satellites, like PV cells and structural elements, can come from the Moon. 23) Free-flyer platforms Another consequence of the warping of Earth’s gravity well is that trajectories can be created that sort of wander out from EML-1, and then wander back (like the Genesis mission which went via EML-1 to SEL-1 and back). This affords materials scientists and companies the opportunity to send free-flyer platforms on long-term, jitter-free production runs. Results can be studied on the station and new production runs undertaken quickly. 24) Constant access The entire Lunar surface is accessible 24-hours a day from EML-1 for about the same delta-V (~2.5km/s). From EML-1 most inclinations of LEO are accessible for less than 1.0 km/s (with aerobraking and time, ~3.77km/s for a direct burn). GEO is constantly accessible, as is deep space. 25) b The Moon is the ideal location to get our feet wet, and getting there can lay the foundation for a civilization that can go beyond the Moon to Mars and the asteroids and other destinations of interest.

**Moon Colonization Key-Multiple Warrants**

A. Scientific Exploration

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

Scientific exploration is probably the most obvious of the six themes. It takes little imagination to envision planetary geologists in spacesuits, loping across the lunar terrain, studying rocks and regolith: it is, after all, to first approximation what the Apollo astronauts did. In addition to studies of the lunar surface, the Moon itself could serve as a platform for telescopes and other space science experiments, including some human-tended ones. The problem with relying on science as the primary reason for human lunar exploration is that, in the eyes of many, science can be done for far less money by robotic missions—which also don’t put human lives at risk. “Manned moon flight may appeal to baby boomers, but it makes little scientific sense for most space missions these days,” the Los Angeles Times concluded in an editorial Sunday. “Robots can now perform, or be developed to perform, most of the tasks people would do at a moon station.” Similarly, an editorial Saturday in the Minneapolis Star Tribune stated, “Today’s best investments in space exploration lie in extending the reach of uncrewed probes like the Mars Global Surveyor.” Human spaceflight advocates typically counter that humans are much more capable than robots. That’s certainly true, but they’re also much more expensive, and for many missions the general public would be perfectly satisfied with the lower, but less expensive, scientific output provided by robots. In some cases where the scientific stakes are particularly high—such as Mars and the search for past or present life—there may be more support for human exploration, but that’s less likely to be the case on the Moon.

B. Exploration Preparation

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

The exploration preparation theme makes the case of using the Moon as a proving ground for the technologies and techniques that would be used on missions to Mars and other destinations. On the face of it, this seems to make some sense: better to learn that a particular system doesn’t work as expected when you’re only a few days from Earth, rather than six months or more. However, there’s an open question about how useful the Moon is as an analogue for Mars: what works on the Moon won’t necessarily work on Mars, and vice versa. This rationale also suggests that the Moon is only a means to a more distant end, and once we’ve learned all that we can about exploration there we’ll pack up and leave (something that would probably suit some Mars exploration advocates just fine.) Some might conclude that the “permanent” Moon base wouldn’t be so permanent after all.

C. Global Partneriships

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

The idea behind the global partnerships theme, as the NASA poster states, is to “provide a challenging, shared and peaceful activity that united nations in pursuit of common objectives.” Sort of like, say, the International Space Station? We’ve seen how well that’s worked, both in space and in foreign relations. The idea of having countries work together to explore the universe is certainly an honorable cause, but it should be a side benefit of the exploration, rather than one of the primary justifications itself.

D. Public Engagement

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

Similarly, the public engagement theme argues that human lunar exploration program will “encourage students and help develop the high-tech workforce”, another familiar argument for those who have followed the various justifications for the space program over the years. Like international cooperation, encouraging students to study math and science is important and a nice side benefit of any exploration program, but hardly a justification for the program itself.

E. Economic Expansion

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

Under economic expansion, NASA makes the argument that a Moon base and ancillary activities will provide “benefits to life on the home planet”. That phrase sounds perilously close to the old, tired spinoff justification for the space program, and, in fact, in the brief video associated with this theme the narrator mentions that lunar exploration “also fosters innovations that benefit our society and economy.” Fortunately, though, NASA’s vision here is broader than spinoffs: the agency is pitching the Moon as a new economic frontier, a place for companies to do business and develop products and services. There are certainly proposals for businesses based on lunar resources, from searching from platinum-group metals deposited by impacting meteorites to beaming solar power back to Earth (and, of course, everyone’s favorite lunar resource, helium-3, ready for the taking on the Moon once we get around to developing fusion reactors.) However, many of these ideas are many years, if not decades, away from fruition, if they are even feasible in the first place. Moreover, these potential new industries will have to struggle with the high costs of space transportation, something the Vision does little, if anything, to address. “The human inhabitation of space in any significant numbers won’t happen until someone can tackle the costs of getting astronauts the first hundred miles up,” an editorial in USA Today last week noted.

F. Human Civilization

Foust ’06( Jeff, senior analyst of Futron Corp-dedicated to aspects of space industry, Moonbase why, Space Review, http://www.thespacereview.com/article/764/1) JL

That leaves us with one final theme, boldly titled human civilization. It is, as NASA puts it, to “extend human presence to the Moon to enable eventual settlement.” That’s a theme that current NASA administrator Mike Griffin has pushed since taking office, talking about the need for humanity to become a “multiplanet species”. It’s also a theme that appeals to many die-hard space activists, who were sold on the idea thanks to decades of science fiction tales or through the efforts of Gerard O’Neill and his space colony concepts. (Nevermind that terms like “colony” and “colonization”, while used in some media accounts of NASA’s plans, have a somewhat negative, or at least politically incorrect, connotation these days because of their association with European colonial era on Earth.) The importance of expanding humanity beyond the Earth is undeniable: if humans remain solely on the Earth, the species is vulnerable to a natural or artificial catastrophe. Yet there’s a danger here of looking a bit too escapist. Some will wonder why NASA is spending so much to provide a second home for humanity (one that will only support a handful of people, and won’t be self-sufficient for years, if ever) when that money could be spent to improve life on Earth.

Moon Colonization---Solvency---General

Moon Craters are suitable for life

CNN Tech Moon hole might be suitable for colony January 01, 2010 <http://articles.cnn.com/2010-01-01/tech/moon.lava.hole_1_lunar-base-lava-flows-lunar-surface?_s=PM:TECH>

Building a home near a moon crater or a lunar sea may sound nice, but moon colonists might have a much better chance of survival if they just lived in a hole. That's the message sent by an international team of scientists who say they've discovered a protected lunar "lava tube" -- a deep, giant hole -- that might be well suited for a moon colony or a lunar base. The vertical hole, in the volcanic Marius Hills region on the moon's near side, is 213 feet wide and is estimated to be more than 260 feet deep, according to findings published in Geophysical Research Letters, a journal of the American Geophysical Union. More important, the scientists say, the hole is protected from the moon's harsh temperatures and meteorite strikes by a thin sheet of lava. That makes the tube a good candidate for further exploration or possible inhabitation, the article says. "Lunar lava tubes are a potentially important location for a future lunar base, whether for local exploration and development, or as an outpost to serve exploration beyond the Moon," writes the team, led by Junichi Haruyama, a senior researcher with the Japanese space agency JAXA. "Any intact lava tube could serve as a shelter from the severe environment of the lunar surface, with its meteorite impacts, high-energy UV radiation and energetic particles, and extreme diurnal temperature variations." Lava tubes have previously been discovered on the moon, but the scientists say the new hole is notable because of its lava shield and because it does not appear to be prone to collapse. Lave tubes exist on Earth and also have been found on Mars. The cylinder-shaped caverns can be carved out by lava flows, volcanic eruptions, seismic activity or ground collapse resulting from meteoroid strikes. The scientists used high-resolution images from a Japanese moon orbiter called SELENE to discover this lunar lava tube. The findings were published November 12, but they grabbed the attention of the public this week. NASA is reportedly working on plans to return to the moon by 2020 and to set up a temporary lunar colony by 2025 as part of the Constellation Program. Funding for the program, however, remains somewhat in question. The American space agency could not be reached for comment.

Regolith has enough minerals and water sustain human life

Schrunk Space: beyond 1999 Chemistry & Industry, 20 December 1999 The Moon: resources, future development and colonization David Schrunk, Burton Sharpe, Bonnie Cooper & Madhu Thangavelu Chichester: John Wiley & Sons Ppxv+432, £34.95, ISBN 0 471 97635 0

Data returned by the 1996 Clementine mission indicated that the regolith in the shadows of the lunar poles included a substantial fraction of ice. The subsequent Lunar Prospector mission confirmed this and, even more significantly, suggested the presence of vast seams of ice below the regolith. This ice probably fell in a shower of meteorites, most of which contain some H2O. The permanently shadowed craters of the lunar poles provided ideal deep-frozen storage for this key resource, which Clementine team member Paul Spudis described as 'the most valuable piece of real estate in the solar system'. This book presents a comprehensive overview of the peculiar challenges and opportunities presented by the industrial colonisation of the Moon. It covers a range of topics from power generation Ñ fusion reactors, photovoltaic cells or, most intriguingly, heat engines exploiting the 300K temperature difference between the lunar day and night - to lunar governance, including a less convincing advocacy of an 'engineering discipline of laws'. The pharmaceutical and biotech industries get a relatively brief look-in with the observation that lunar laboratories would be ideal secluded environments for working with biohazardous materials. The authors also note that, once a colony had been well established, the Moon would be an ideal home for the physically disabled and elderly: one-sixth Earth gravity offers greater mobility and less chance of a bad fall. All we need to return to the Moon is the will, and this book is designed to build that will. It is certainly an inspiring read, and would be enjoyed by fans of Stephen Baxter and Kim Stanley Robinson at least as much as by its target audience of students and space industry professionals. The more evangelical passages tend to be somewhat gushing, and the authors show rather too much faith in the willingness of the private sector to commit resources to long-term, high-risk ventures, but their case is persuasive and, perhaps most importantly, visionary. As John F Kennedy declared nearly 40 years ago when he committed the US to the first lunar landing: we do these things not because they are easy, but because they are hard. People have never been willing to remain in one place given the means to travel further afield, and it is, after all, a big universe out there. The question is, if not now, then when?

Method to colonizing the moon

Michael Cooney NASA gathering Moon colonization ideas By Layer 8 on Fri, 12/05/08 - 12:05pm.

NASA today put out a call for proposals on how to best develop space settlement technology. Each proposal is expected to offer innovative, meaningful, and enduring research and technology development activities that could enable space colonization or space settlement by providing a sustained human presence on the Moon as a stepping stone to future exploration of Mars, NASA stated. The space agency is offering about $1 million grants under the Ralph Steckler/Space Grant Space Colonization Research and Technology Development program that has been established to help support a broad range of human activity in space that, for the most part, is not reliant on Earth's resources NASA said. The late Ralph Steckler, a successful assistant film director, maintained a lifelong interest in space colonization and left NASA a portion of his estate "for the colonization of space because [he believed] this is for the betterment of mankind." NASA has defined three aims for the Steckler/Space Grant: To make a meaningful contribution to enabling the colonization or the settlement of space; To leverage activities, where appropriate, through teaming and resource sharing; and To support space colonization efforts in innovative and enduring ways based on Mr. Steckler's vision. Building a successful lunar facility is no small task as you might well imagine. NASA has outlined a number of items to consider including the development of system exploration elements such as: transportation vehicles (Launch Vehicle, Landers), habitation, rovers, power - solar vs. nuclear), and proper communication technology. The architecture challenge is to assemble the best mix of elements so they work synergistically, NASA said. That includes how the facility would be built and delivered. For example, should it be one big item or many smaller, modular containers that could be strapped together as needed? The grants facilitate a small part of the NASA Authorization Act of 2005 that includes the following goals: Return Americans to the Moon no later than 2020; Launch the Crew Exploration Vehicle, Orion, no later than 2015; Increase knowledge of the impacts of long-duration stays in space on the human body using the most appropriate facilities available, including the International Space Station. NASA in June said it was looking for a few good lunar research ideas and is willing to pay $8 to $10 million for the effort. NASA's Lunar Science Institute will handle the research proposals which should address the institute's core interests: science of the moon including objectives that meet NASA's future lunar exploration needs. NASA anticipates making five to seven awards, including one focused on exploration objectives. In August, NASA said it wanted help designing the outer space network it will use to back up future trips to the moon and perhaps beyond. The space agency issued a broad Request for Information or RFI to solicit ideas from private companies and researchers interested in potentially providing communications and navigation services that would support the development of exploration, scientific and commercial capabilities on the moon over the next 25 years. Such spending is challenging as the space agency faces a number of critical budget and technical decisions that could impact the long-term progress of its next generation space exploration technologies.

Moon colonization’s feasible---laundry list

Murphy / 6:13 pm June 14th, 2008 25, Good Reasons to Go to the Moon, Ken Murphy, member of the Board of Directors of the National Space Society http://www.outofthecradle.net/archives/2008/06/25-good-reasons-to-go-to-the-moon-2/

1) Hydrogen Whether in water form or not, we do know that there is hydrogen at the Lunar poles. This can serve a minumum of two ends: water for a base, fuel for rockets.

2) Oxygen The heavy part of the LH/LOX fuel mix is the oxygen, about 7/8ths of the weight. Instead of launching all the fuel for cislunar maneuvering from Earth, launch 8x the hydrogen from Earth and mix it with the Lunox.

3) 1/6th gravity This will provide engineering fun and challenges for future generations of engineers. How does one design an extensible tower for a solar mirror with 1/6th the force of gravity?

4) No weather This goes hand-in-hand with #3. Engineering design will be significantly different in a vacuum environment with no water, wind, rain, hurricanes, or tornadoes. Corrosion takes a different form.

5) Vacuum A critical part of many of the engineering processes used here on Earth, requiring the expenditure of large amounts of energy to create a vacuum. The Moon has about 15,000,000 square miles of it.

6) Glass A good proportion of the Lunar soil returned by astronauts was in the form of glass. Lunar glass has the distinct characteristic of having formed in a water-free environment, making it anhydrous. What advantages this may offer in the field of optics is largely Luna Incognito. Then there’s fiberglass, composites, etc.

7) [Human factors](http://www.outofthecradle.net/categories/lunar-library/high-frontier/high-frontier-biologics/) Having 1/6th of Earth’s gravity, the heart doesn’t have to pump as hard to supply oxygen to

the brain. While for a youth this would have an atrophy-type effect, for those advanced in years it can serve a rejuvenative effect, as the heart is suddenly relatively stronger. This allows for longer productive lives for our citizens. And you can fly in a large enough space.

8 ) Crater history The Moon is the best record in our local neighborhood of the history of bombardments from space. Earth is too dynamic to sustain a record, but the Moon is perfect. By establishing an impact history in size and time we can look for any cyclicality in the timing of impacts, and if so, where are we in the cycle?

Addendum: [Dr. Paul Spudis](http://www.spudislunarresources.com/) has pointed out that the Moon also provides a historical record of the Solar System’s journey around the galactic core as well.

9) Cold-traps At the Lunar poles, there are places the sun never shines. These everdark craters seem to hold the bulk of the hydrogen detected at the poles. Excavations outside the craters can create additional cold-traps for later industrial use.

10) Solar mirrors Mounted on extensible towers, mirrors can be placed in perpetual sunlight to illuminate selected areas. This requires the high-technology capability to turn the mirror. No batteries required.

11) Solar power towers Extensible towers at the poles will allow the placement of solar cells or films in constant sunlight. It doesn’t matter so much hitting the perfect peak for one’s ground-based system as making the tower high enough to peek over the horizon, which on the Moon is very short.

12) Radio silence While not a perfectly radio-silent environment, the far side of the Moon is far better than anything on Earth or even in orbit. Large arrays can allow for a leap in precision for radio astronomy and SETI.

13) Solar cathedral A number of religions and cultures around the world still use the Lunar calendar in the conduct of their affairs. Part of this involves determining the beginning of each lunar month. Building a Solar cathedral on the Moon will allow an unprecedented degree of precision in making that determination. It’s also a good way of getting different faiths to work together.

14) [Neighborhood watch](http://www.outofthecradle.net/categories/lunar-library/big-rocks-from-space/) The orbital scopes like Hubble get all of the credit for cool deep-space discoveries, but no one’s keeping an eye on our local neighborhood. That’s why we’re finding more and more asteroids after they’ve passed the Earth. The Moon provides the kind of dull, stable platform for the astronomy that no one else wants to do.

15) [Greenhouses](http://www.outofthecradle.net/archives/2008/04/of-a-garden-on-the-moon-part-i/) Lunar regolith can’t really grow plants by itself, but the addition of humus (not hummus), other nutrients, and careful recycling does allow for plant growth. Plants grown in Lunar soil may provide new fragrances, flavors, and vintages. Spices were one of the early high-value, low mass/volume goods that helped create the trade routes of old.

16) Metals Vacuum-processed ultra-pure aluminum. Vacuum-processed ultra-pure titanium. Vacuum-processed ultra-pure iron. Vacuum-processed ultra-pure magnesium. You want it? We’ve got it.

17) Volatiles The Sun has been burying light elements in the Lunar soil for aeons. All it takes is a little baking at about 1100 K, a little shaking to agitate the particles, and a place to liquefy the output. Cold-traps are particularly useful for this.

18) [Extreme sports](http://www.outofthecradle.net/archives/2008/05/rollerblading-on-the-moon/) Imagine bicycle races at 250 kph. Imagine regoboarding the southside of Copernicus. Imagine flying in a large underground cavern. Imagine high-jumping in 1/6th G. Or long-jumping.

19) Spaceships Some items, like advanced electronics, will be shipped from Earth for a very long time. But things like spacecraft structural elements (and fuel) can easily be done on the Moon, obviating the need to waste the lift mass from Earth’s gravity well.

20) [EML-1](http://www.outofthecradle.net/categories/lunar-library/high-frontier/high-frontier-eml-1/) Having such a large neighbor so close by creates a warp in Earth’s gravity well. There are certain areas of relative stability, and one lies on the line connecting the center of the Earth and Moon. Putting a station at that point (or rather in a halo orbit around it) allows for all kinds of unexpected benefits.

21) GEO assets We have billions of dollars of orbital assets in geosynchronous orbit. It’s cheaper in fuel to go from EML-1 to GEO and back, than to go just from LEO to GEO. Over time, this will allow for a huge decrease in the cost of refueling, repairing, and upgrading, as well as building larger and more capable platforms.

22) [Solar power satellites](http://www.outofthecradle.net/archives/2007/10/space-based-solar-power-as-an-opportunity-for-strategic-security/) Placement of large solar arrays in GEO orbit allows for the collection and transmission of energy to fixed points on Earth, such as military bases. This will also provide a long-term source of energy, as the Sun is not expected to expire for another 4.5 billion years or so. Besides, most of the energy we use here on Earth is second or third-hand solar power anyway. Pieces of the solar power satellites, like PV cells and structural elements, can come from the Moon.

23) Free-flyer platforms Another consequence of the warping of Earth’s gravity well is that trajectories can be created that sort of wander out from EML-1, and then wander back (like the Genesis mission which went via EML-1 to SEL-1 and back). This affords materials scientists and companies the opportunity to send free-flyer platforms on long-term, jitter-free production runs. Results can be studied on the station and new production runs undertaken quickly.

24) Constant access The entire Lunar surface is accessible 24-hours a day from EML-1 for about the same delta-V (~2.5km/s). From EML-1 most inclinations of LEO are accessible for less than 1.0 km/s (with aerobraking and time, ~3.77km/s for a direct burn). GEO is constantly accessible, as is deep space.

25) b The Moon is the ideal location to get our feet wet, and getting there can lay the foundation for a civilization that can go beyond the Moon to Mars and the asteroids and other destinations of interest.

Moon colony can support earth in case of natural disaster

Shapiro. "Why the Moon? Human survival!" The Space Review. March 19, 2007, Robert Shapiro, Professor Emeritus and Senior Research Scientist in the Chemistry Department of New York University, <http://www.thespacereview.com/article/832/1>

Physicist Stephen Hawking, and a number of others, have called for humanity to spread out to distant planets of our Solar System. But there is no need to go so far to protect ourselves. After a few decades—centuries at worst—dust and ash will settle, radioactive materials will decay, and viruses will perish. Earth will once again become the best home for humanity in the Solar System. Return would be easiest if a safe sanctuary were nearby. In the more probable instance that only a limited disaster took place, that nearby sanctuary could also play a valuable role in restoring lost data and cultural materials, and coordinating the recovery. And of course, construction of the rescue base will be much easier if it is only days, rather than months or years, away. We do not have to build the base from scratch, in an environment of emptiness, as we are attempting to do with the space station. A suitable platform has been orbiting our planet ever since its formation. On most clear nights, we need only look up to see it. If I employ the same arithmetic that I use when I insure my home, the cost of the lunar base can easily be justified. My house has not burned down, and the disasters I described may not occur. A host of other benefits, described on the NASA web site, will result from human presence on the Moon. But we do not need to invoke them to provide reasons for our investment.

Not colonizing the moon is a recipe for disaster on Earth and Extinction

Shapiro. "Why the Moon? Human survival!" The Space Review. March 19, 2007, Robert Shapiro, Professor Emeritus and Senior Research Scientist in the Chemistry Department of New York University, <http://www.thespacereview.com/article/832/1>

Suppose we wanted to conjure up a recipe for human disaster. Here is my suggestion about steps that we might take: (1) Let the population swell up to seven billion or more. Then we will need vast and complex systems to ensure the production of food, materials, and energy sources, as well as transportation to deliver the goods. By increasing our numbers, we will also increase the playing field in which new viruses can develop, increase pollution and the probability of dramatic climate change, and hasten the day when important natural resources are exhausted. (2) Computerize the operation of the food, energy, and transportation systems, and store all of the instruction manuals and needed references within the computers. Similarly, place all of our scientific, technical and medical knowledge within computers. Make the computers more and more complicated, so that only a handful of experts are prepared to deal with a massive failure. (3) Arrange to have the computers, and most other functions of society, dependent upon the operations of an intricate power grid that is subject to massive and unexplained failure. We have already had a rehearsal of such an event. For example, on August 14, 2003, 50 million people in the northeast United States were deprived of power for many hours. The main cause of the blackout, according to the task force charged with its investigation, was the failure of an Ohio power company to trim trees in part of its service area. In September of that year, a similar blackout shut off power to almost all of Italy and part of Switzerland. Unintended causes might of course be eclipsed by the deliberate actions of terrorists. Gregory McNeal estimated in the *New York Times* that “a coordinated attack on four or five critical sites could send much of the nation into darkness for weeks.” (4) Streamline the production of nuclear and biological weapons so that they become available not only to most heads of state, but also to groups of religious zealots and of extreme nationalists. Encourage both the exchange of information about such weapons, and their availability on the international black market. Individuals who are technically competent but mentally unbalanced will then also have access to such weapons, enriching their current arsenal of computer viruses, bombs, and hijacked airplanes. All of the above events have already taken place or are likely to occur in the near future. We may also expect that single disasters may trigger a cascade of others. For example, my local power company has circulated a card advising its customers to assemble “at least a three-day supply of water and non-perishable food” as part of a “family emergency preparedness plan”. But what would we do, in urban centers, when that supply was exhausted but power and transportation had not been restored? Looting of stores and warehouses might be expected, together with an attempt by residents to flee to less populated areas where conditions might be better. Famine and civic disorder will inevitably produce casualties; unburied bodies could then lead to disease epidemics.

Moon colonies would not need earth resources

Tapping the Wealth of the Moon Klaus P Heiss. The Journal of Social, Political, and Economic Studies. Washington: Spring 2004. Vol. 29, Iss. 1; pg. 3, 62 pgs

The 'locational' advantages of "Space Station Moon" include that: \* It is a massive, 'airless', stable platform. \* It has an unlimited supply of solar energy hitting its surface and immediate surrounds -an energy potential of about 1.3 KW per square meter (!) at an average of 1 AU. More 'impressive' is that in but ten days more solar energy 'hits' the surface of the Moon than all the known global fossil fuel resources accumulated over eons past on Earth! Without an atmosphere the energy is there for the taking. \* It can serve as an ideal platform for emplacing nuclear reactors and missions using these power sources in a variety of novel Space missions. Use of any number of Prometheus size reactor modules will allow any level of foreseeable power supplies as an alternative to or complement to solar power plants. \* It could also serve potentially as an ideal testbed for 'clean' fusion RDT&E using the 'captured' 3He in Lunar soils 'clean' insofar as fusion processes using 3He generate as their major byproduct deuterium rather than the exceedingly volatile contaminating byproduct tritium associated with 'conventional' fusion processes.'' \* It has only a sixth of Earth's gravity enabling major reductions in transport energy required (and associated delta-V) for many important operations. \* It has most material resources needed for Space and Lunar structures and operations, including some of the direly needed water resources (hydrogen in particular). \* Last but not least, it is only a very short distance from Earth (in 'time' and 'delta V), indeed the Moon is part of 'Earth Space' and an ideal platform to observe all of Cis-Lunar space across the full electromagnetic spectrum.

Moon Colonization---Solvency---Short-Term

Moon colonization is feasible now and would succeed in the short term

Dinkin 4 – Sam Dinkin, columnist for the Space Review, September 7, 2004, “Colonize the Moon before Mars,” online: http://www.thespacereview.com/article/221/1

The Moon has many relative advantages. The first is capital utilization. A Lunar cycler can make hundreds of round trips in the time that a Mars cycler can make. Second, there is much less fuel required to get from the Earth to the Moon than to Mars. Existing technology can be used to get to the Moon (see “Soyuz to the Moon?”, The Space Review, August 2, 2004). A lunar landing mission might cost $120 million for an Ariane 5 booster. If each mission cost another $120 million for the Soyuz, service module and everything else, then that would be $240 million per flight instead of $5 billion per flight. That means that a $50-billion level of commitment from Earth can afford over 400 flights every two years. Of course, that level of commitment could be optimally spent in much better ways. By creating a lunar cycler, a station at L-1, an orbital fuel depot, in situ utilization of lunar oxygen and possibly lunar water, there could be a vibrant community on the Moon.

While a single Ariane 5 could not heft as much as a Mars Direct flight, it may still transfer a comparable amount of resources and people as a Mars Direct flight would to Mars. Since life support and consumables are much less onerous for a short trip than a long trip, there is a lower mass requirement for crew transfer flights to the Moon and much less depreciation of capital in transit. Having new heavy lift that would enable Mars Direct would also enable more sensible lunar colonization missions.

Moon Colonization---Solvency---Springboard

Moon colonization’s a key springboard to Mars and other colonization missions

Schmitt et al 9 – Harrison H. Schmitt, geologist, Apollo 17 astronaut, Former Chair NASA Advisory Council, Andy Daga, Lunar surface architecture and technology consultant, and Jeff Plescia, Applied Physics Laboratory, The Johns Hopkins University, 2009, “Geopolitical Context of Lunar Exploration and Settlement,” online: http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf

What, then, should be the focus of national space policy in order to maintain leadership in deep space? Some propose that we concentrate only on Mars. This would be naïve and self-defeating. The country is simply not technically ready to go to Mars at present, and it will be a long time until we are ready to do so. Returning to the Moon, however, provides the fastest path for humans to go to Mars. Without the experience of returning to the Moon, we will not have the engineering or physiological insight for many decades to either fly to Mars or land there. Without lunar water resources, radiation protection for the long voyage to Mars may not be possible. Without the development of lunar helium-3 fusion technology applied to interplanetary propulsion, we may not be able to reduce the transit time to Mars to an acceptable duration. Without lunar operational experience, including learning to operate outside of communications with Earth, we vastly increase the risk of early Martian flights. Without lunar oxygen and water, Earth launch payloads to Mars may be prohibitively large and expensive, not to mention the continued uncertainties about sustainable resources on Mars. Without lunar rocket fuel resources, that is, hydrogen, oxygen and/or methane, we may not be able to land on Mars because of complicating presence of just some atmosphere and not a lot. Indeed, without returning to the Moon, future opportunities of leadership, including a much greater potential for international cooperation in scientific endeavors related to the Moon and beyond, cannot be realized.

Colonizing the moon would be the first step in colonizing other Celestial Bodies

(Colonize the Moon before Mars by Sam Dinkin Tuesday, September 7, 2004 http://www.thespacereview.com/article/221/1)

There are a number of reasons that the Moon is the best place to start space colonization, but the basis of most of them are its proximity to the Earth. Most of these stem from the lower cost of access to the Moon. There are also important engineering, economic and political advantages to starting colonization with the Moon. Before discussing the advantages of the Moon, let’s analyze what a full-court press for Mars colonization looks like. Mars Robert Zubrin constantly beats the drum for exploring Mars first. It is disingenuous to say that the goal of space exploration is the colonization of Mars. Even colonization advocates would be happy with colonization of the Moon, the asteroids, and many other destinations. The discovery of life on Mars would not matter much one way or the other. Suppose there is Earth-like life on Mars. That might point to a common origin or a similar bootstrap method. What is that worth commercially? If you knew the answer, how much could you sell it for? Ten billion? vWhat follow on activities would that news generate? None. Life may be an exciting discovery perhaps the most exciting in all history, but it does not amount to a large inducement to go to Mars. Mars would be an excellent idea to get started if this were the only space colonization option. There is a much better option, however, teasing us as it hangs in the sky. Mars is an excellent colonization spot and should be colonized because it is a great place to live. If we are going places as a species, we have to start somewhere. Right now, the level of space commitment by all actors on Earth is about $50 billion a year. This level of commitment would pay for about twenty Mars Direct-style missions every two years. This is a feasible budget for the colonization of Mars. Many technologies can be optimized if the focus of Earth space efforts was colonization. Cyclers could be placed in permanent Earth-Mars transfer orbit. In situ resource utilization could eliminate the need for hydrogen shipment from Earth. Better crew selection could eliminate the need for humans to take a return trip. If the goal of human presence on Mars is to colonize it, $50 billion a year can do it well. It will probably take decades of subsidy before a Mars colony could sustain itself. A twenty-year program of $50-billion-a-year subsidies would hit a trillion dollars. This is an affordable sum for a rich planet. It would be an excellent idea to get started if this were the only space colonization option. There is a much better option, however, teasing us as it hangs in the sky. The Moon The Moon has many relative advantages. The first is capital utilization. A Lunar cycler can make hundreds of round trips in the time that a Mars cycler can make. Second, there is much less fuel required to get from the Earth to the Moon than to Mars. Existing technology can be used to get to the Moon (see “Soyuz to the Moon?”, The Space Review, August 2, 2004). A lunar landing mission might cost $120 million for an Ariane 5 booster. If each mission cost another $120 million for the Soyuz, service module and everything else, then that would be $240 million per flight instead of $5 billion per flight. That means that a $50-billion level of commitment from Earth can afford over 400 flights every two years. Of course, that level of commitment could be optimally spent in much better ways. By creating a lunar cycler, a station at L-1, an orbital fuel depot, in situ utilization of lunar oxygen and possibly lunar water, there could be a vibrant community on the Moon. While a single Ariane 5 could not heft as much as a Mars Direct flight, it may still transfer a comparable amount of resources and people as a Mars Direct flight would to Mars. Since life support and consumables are much less onerous for a short trip than a long trip, there is a lower mass requirement for crew transfer flights to the Moon and much less depreciation of capital in transit. Having new heavy lift that would enable Mars Direct would also enable more sensible lunar colonization missions. There are many supporting reasons to go to the Moon. Consider three categories of justification: engineering, economics, and politics.

Moon Colonization---Solvency---Tech

Colonization is Possible-We have the tech

**O’Neill 74 (**Gerard K O’Neill Ph.D, Physics Professor at Princeton, “The Colonization of Space”, http://mike-combs.com/space/TCoS.html, September 1974) SV

There are several key problems involved here, each of which appears to yield to an efficient solution in principle: reducing freight-shipment cost from the Earth to L5, the colony site; minimizing the mass needed from Earth; designing a device for low-cost transfer of materials from the Moon to L5. The first problem was considered by Robert Wilson (NASA), Eric Hannah and George Hazelrigg (Princeton) at a meeting held 9 and 10 May at Princeton (A Proceedings of this meeting will be published). Their conclusion was that the best method during the 1980's will probably be conventional chemical rockets-specifically, the high-quality engines already being developed for the space shuttle. Among several variations possible, the common feature was reusability, and the cost estimates for shipment varied from $190 to $400 per pound, in 1972 dollars. The cost summary table (Table 4) therefore assumes $425 per pound. To reduce the mass needed from Earth, most of the repetitive structural members (aluminum) and window panels (glass) must be produced at L5 from lunar material. A further, important saving is made by getting 89% of the mass of needed water from oxygen in the plentiful lunar-surface oxides, bringing only 11% of the water mass as liquid hydrogen from Earth. Of the 500,000-ton total mass (see Table 2) for the Model 1 colony, 98% can be obtained from the Moon. The elements most needed are aluminum, titanium, silicon and oxygen. Lunar surface soil is usable for agriculture, with the addition of nitrates and small amounts of trace elements. The remaining 10000 tons must come from the Earth. To bring the total cost within practical limits, we must develop a low-cost method for transporting raw materials from the Moon to the construction site. The discussion of transport methods should be taken as an existerice proof rather than as a detailed design. There may very well be better methods than those I have considered; however, it is enough to show two solutions that appear to be workable. Both use the two great advantages of the lunar environment: an excellent vacuum and a very low escape velocity, about 1.5 miles per sec, less than one quarter of the escape velocity from Earth. To bring a kilogram to L5 from the Moon takes less than 5% of the energy needed to take a kilogram from Earth. Both methods assume electric power from a conventional steam-electric power plant that uses solar energy, and both assume that the system runs only during the lunar day, the night being used for scheduled maintenance, crew rest and possibly materials processing. I have also assumed another factor of two lost to system breakdowns. Overall then, each system is assumed to be running only one week in four. The first method, called "RPL" for rotary pellet launcher, is a symmetric, two-arm propeller-like device, running at constant speed. (See box on page 38 for description). To transfer 500 tons in six years, about 26 such RPL's would be needed, for a total power of 32 MW. Precise steering is carried out by a linear electromagnetic deflection-plate system after the launching, to hold down the pellet dispersion and permit easy collection. The alternative method, called "TLA" for transport linear accelerator, uses the technology of dynamic magnetic levitation and the linear synchronous motor. The TLA is a recirculating system of small, passive vehicles (buckets), each having no moving parts but containing superconducting. coils. The bucket accelerates a 9-kg payload to escape speed along a magnetic-levitation, linear-synchronous track. Deceleration then releases the payload, the bucket slows to a moderate speed, and is recirculated to receive another payload. Table 3 shows some guideline pararneters. The mass estimate is 1500 tons, Of which about 80% is in power-generation and power-handling equipment. In six years, running 25% of the time, the TLA can transport over 300 times its own weight. (For a short bibliography of early work on the possibilities of electromagnetic launching, before the development of dynamic magnetic levitation see reference 13.) Both RPL and TLA may have eventual applications as high-throughput energetically efficient reaction motors running on solar power and able to use any kind of asteroidal debris as reaction mass. They could propel very large payloads in the million-ton range or higher, between the asteroid belt and the L5 site.

NASA has technology for colonization of the moon

Schrunk Space: beyond 1999 Chemistry & Industry, 20 December 1999 The Moon: resources, future development and colonization David Schrunk, Burton Sharpe, Bonnie Cooper & Madhu Thangavelu Chichester: John Wiley & Sons Ppxv+432, £34.95, ISBN 0 471 97635 0

If only we'd listened to Gerry Anderson, we'd be living there by now. His Space:1999 television series was based in Moonbase Alpha, the first permanent lunar colony, staffed by a multinational team of scientists and military personnel in space-age fashions. Or, to take a slightly more high-brow example from science fiction, Arthur C Clarke and Stanley Kubrick's 2001: a space odyssey showed industry taking its first steps into space, with Pan-Am flying to orbiting hotels and the mineralogical exploration of the lunar surface. What these visions of the near future assumed was that the impetus of the US Apollo programme would continue past the initial goal of sending a couple of test pilots for a lunar walkabout and round of golf, into serious long-term colonisation and exploitation of the near extraterrestrial environment. What they didn't count on was the collective failure of nerve that saw funding slashed and the grand project abandoned. Once the glory was won, this government-driven project fell to fundamentally political pressures, from a Congress jealous of the billions of dollars sequestered by NASA and from a disillusioned public, who, at a time of social turmoil at home and unpopular military intervention overseas, came to view the space programme as a grotesquely grandiose extension of US foreign policy. But is the time now right to return to the Moon - not, this time, in a politically driven, publicly funded national gala, but in a long-term multilateral industrial venture based on solid commercial and scientific returns? David Schrunk, Burton Sharpe, Bonnie Cooper and Madhu Thangavelu believe it is, and this book is their manifesto. A multidisciplinary team who met by chance at a 1994 conference on lunar exploration, the authors have a vision of the Moon as the ultimate out-of-town science park. Virtually all of the raw materials needed by any lunar colony are already there, they argue. And the technology needed to exploit them is available today. All that appears to be missing is the will. Chemistry and the chemical industry would inevitably play a leading role in the colonisation and exploitation of the moon. Importing materials from Earth is prohibitively expensive, thanks to the $10,000/lb cost of carrying mass away from the home planet's gravitational clutches. But all the elements needed for colonisation are available hidden in the regolith - the rubble of rock fragments and dust that covers the lunar surface. The challenge is the universal challenge of chemistry: how to manipulate those elements into useful molecular forms. The need to live off the land would fuel the development of a uniquely lunar chemical industry. The regolith contains metals, minerals and oxygen, and inert elements such as helium and neon, useful for compressed gas and other applications. And a high concentration of helium-3 promises plentiful fuel for fusion reactors. While few of the organic feedstocks of the terrestrial industry are available on the Moon, trace elements including carbon, nitrogen and hydrogen are constantly delivered by the solar wind. As earlier researchers noted, one cubic metre of regolith contains the chemical equivalent of lunch for two, with plenty of carbon and nitrogen left over. The regolith can therefore provide the building blocks for the fatty acids, amino acids, vitamins, sugars, water and oxygen needed to support life, and for the whole portfolio of polymers and plastics. A series of inorganic reactions can create simple organic molecules such as ethene and formaldehyde, which can then be built into basic foodstuffs and plastics. A small-scale industry encompassing organic chemistry, biochemistry and plastics could be founded in the first stages of colonisation - perhaps with automated production units landed on the surface to ensure a supply of these chemicals for the first human settlers. Water is another basic requirement of any colony, and recent studies indicating the presence of up to six billion tonnes of ice bode well for colonisation plans.

Moon Colonization can be accomplished easily, especially with assistance from the private sector

Potter. "Back to the Moon: What's the Point." LA Times. July 24, 2009, Michael Potter, <http://www.latimes.com/news/opinion/opinionla/la-oew-potter-nye24-2009jul24,0,1961674.story>

NASA continues to pursue the [George W. Bush](http://www.latimes.com/topic/politics/government/presidents-of-the-united-states/george-bush-PEPLT000857.topic)-initiated "Vision for Space Exploration," which calls for a return to the moon and an eventual human presence on Mars. If these goals of returning to the moon and going on to Mars can be accomplished in a coherent, sustainable and efficient fashion, they should be robustly supported. Supporters of this plan view the moon as a logical stepping stone to Mars, arguing that a sustainable moon base would provide fuel for space vehicles and help us move up the critical learning curve of enabling humans to live beyond low-Earth orbit.In this climate of budgetary pressures and domestic distractions, it is possible that either NASA or a weak-willed Congress may choose a planet destination and skip returning to the moon. If NASA intends to be serious about these ambitious goals, the agency has to immediately tighten its controls on plans, logistics and cost. If the agency is unable to demonstrate this ability to focus, Congress is likely to impose its own will, which would likely result in a scaled-down vision.There are two positive effects that could come from this budgetary crunch. The first is an opportunity for a more focused and disciplined NASA. The second is an opportunity for the private sector to play a more important role in the future of space exploration. The better that NASA can leverage the private sector (and vice versa), the greater the opportunity for achieving a big impact in space with a smaller overall investment.

Building Technology on the moon would be easier than on Earth

Tapping the Wealth of the Moon Klaus P Heiss. The Journal of Social, Political, and Economic Studies. Washington: Spring 2004. Vol. 29, Iss. 1; pg. 3, 62 pgs

The Moon opens entirely novel perspectives and opportunities: what if one were to take all the proposed observing instruments and deploy them in an "astronomy/observations" co-operative (or condominium), with common energy, thermal management, absolutely 'stable' deployment, without atmospheric interferrences and comprehensive protection against solar and cosmic 'weather', common or shared data processing and communication systems and command and control infrastructure as well as the ability for "on-site" maintenance (preventive and repairs), updating and replacements? Rather than the 'current' life cycle of large astronomy observatories of a decade of "sale", followed by a decade of "construction and deployment" to finally a decade of use (if all goes well) to be followed by a decadal 'discontinuity through the 'next' observatory' one would here finally establish a continuous astronomy/observation facility of enormous flexibility - applicable to instruments across the electromagnetic spectrum, with distributed apertures of stable geometry of hithcrtoo unimaginable dimension and resolution - all for a fraction of the cost of individually handcrafted and built observatories of accidental functionality.

Moon Colonization---Solvency---Resources/Energy

Abundance of Earth minerals is dwindling; moon mining is vital for rare and useful resources

by Leonard David, SPACE.com's Space Insider Columnist Date: 04 October 2010 Time: 08:10 AM ET <http://www.space.com/9250-mining-rare-minerals-moon-vital-national-security.html>

The seemingly barren moon may actually be a treasure-trove of priceless resources: a potentially bountiful, mineral-rich, yet untapped, cosmic quarry. Still, few see the moon as an alluring mining site, ripe for the picking of rare elements of strategic and national security importance. Here on Earth, China recently blocked the export of rare earth elements to Japan for use in an array of products; from wind turbines and glass for solar panels to use in hybrid cars, and even guided missiles and other defense-oriented creations. China is increasingly putting the pinch on quotas of such elements out of their country. And as the scarcity of these valuable minerals grows, so too does the concern in other nations regarding the availability of this limited resource. For instance, a recent report from the Congressional Research Service, a study arm of the U.S. Congress, reviewed the worldly use of rare earth elements for national defense. The report looked at the production of elements such as europium and tantalum, among others, outside the United States and flagged the important issue of supply vulnerability. The study pointed out that rare earth elements are used for new energy technologies and national security applications and asked: Is the United States vulnerable to supply disruptions of these elements’ Are they essential to U.S. national security and economic well-being’ Among the policy options flagged in the Congressional Research Service assessment is establishing a government-run economic stockpile and/or private-sector stockpiles. Doing so "may be a prudent investment," the study noted, and would contain supplies of specific rare earth elements broadly needed for "green initiatives" and defense applications. Local concentrations Given all the mineral mischief here on Earth, the moon could become a wellspring of essential resources, but at what quality, quantity and outlay to extract’ [10 Coolest New Moon Discoveries] Providing a lunar look-see is Carle Pieters, a leading planetary scientist in the Department of Geological Sciences at Brown University in Providence, R.I. "Yes, we know **there are local concentrations of REE on the moon**," Pieters told SPACE.com, referring to rare earth elements by their acronym REE. "We also know from the returned samples that we have not sampled these REE concentrations directly, but can readily detect them along a mixing line with many of the samples we do have." Pieters is also principal investigator for NASA’s Moon Mineralogy Mapper, known as M3, which was carried on India’s Chandrayaan-1 lunar-orbiting spacecraft. That probe was lofted by the Indian Space Research Organization in October 2008 and operated around the moon until late August 2009. Among other findings, the M3 gear found a whole new range of processes for mineral concentrations on the moon, unappreciated until now. For example, the M3 experiment detected a new lunar rock, a unique mixture of plain-old plagioclase ‘ plentiful in the Earth’s crust and the moon’s highlands ‘ and pink spinel, an especially beautiful arrangement of magnesium, aluminum and oxygen that, in its purest forms, is prized as a gemstone here on Earth. What about the whereabouts of precious elements sitting there on our celestial neighbor in gravitational lock’ Pieters said **lunar scientists have a good idea how lunar rare earth elements became concentrated**, it occurred as part of the moon's magma ocean differentiation sequence. But it is now also recognized that "early events disrupted and substantially reorganized that process in ways we are still trying to decipher," she added. With the recent, but limited, new data for the moon from the international fleet of lunar orbiters with remote sensing instruments ‘‘ from Europe, Japan, China, India and now the United States, "we are beginning to see direct evidence for the activity of geologic processes that separate and concentrate different minerals," Pieters said. On the moon, these areas and outcrops are local and small. Exposure is largely dependent on using impact craters as probes to the interior. Current data are only sufficient to indicate the presence of some concentrations of minerals, but are inadequate to survey and map their character and distribution, Pieters observed. Lunar KREEP creep Also working in the lunar mineral fray is Leslie Gertsch, a space mining expert and deputy director of the Rock Mechanics and Explosives Research Center at the Missouri University of Science and Technology in Rolla. She’s got the low-down on KREEP. KREEP is an acronym based on element symbols for the geochemical component in lunar rocks rich in potassium (K), rare-earth elements (REE), phosphorus (P), thorium, and other incompatible elements, Gertsch explained. "These elements are not incorporated into common rock-forming minerals during magma crystallization ‘ hence they become enriched in the residual magma and in the rocks that finally do form from it. This is especially so on the moon," Gertsch said. One popular model for the moon’s formation is that it solidified from a global magma ocean formed from material that aggregated after the young Earth impacted a Mars-sized planet, she explained. KREEP is exposed on the lunar surface in certain areas, Gertsch said. Although rare earth elements are not themselves presently detectable by remote instruments, spotting thorium sharpens the ability to spot associated rare-earth elements on the moon's surface due to similar geochemical properties that caused them to crystallize under the same conditions, she added. "However, separating rare earth elements from each other is difficult," Gertsch noted, "because there are few properties where they differ significantly enough to permit efficient sorting of ore particles ‘ at least by standard methods." Gertsch said that rare earth elements do sometimes occur in the ores of other metals. "Presumably **REE mixtures could be produced on the moon and shipped to Earth for more specific separation**. Neither potential mining methods nor the economics of this particular approach have been studied, to my knowledge," Gertsch concluded. Finding and refining So let's say that the moon is rife with rare earth elements ‘what now’ "I think that the economies of production hold sway here," said Dale Boucher, director of innovation at the Canada-based Northern Center for Advanced Technology Inc., in Sudbury, Ontario. Boucher said that the presence of rare earth elements on the moon can only be truly determined by a dedicated lunar exploration program. That would entail not just orbital sensing techniques, but actual drill cores and sampling in a fashion similar to standard mining and mineral exploration practices here on Earth. This will only provide gradation data -- but settle the issue of valuable rare elements on the moon ‘ "which can then be used to determine expected returned value and information on the viability of extraction of any particular element," Boucher explained. Boucher said that another issue is not about just digging them up, but rather the entire process of finding and refining. "It seems that there is significant quantity of REE's in North America, [it’s] just not profitable to refine them ... yet. What value is the strategic element in this’ Can one put a price on this’ If so, it may be economically viable to explore the moon and extract the REEs," Boucher said. In the end, the Boucher said, the whole premise revolves on a cost per pound at the user's front door. "A very tough problem and well suited to a mining economist," he concluded. Distant prospect While lunar rare earth elements may or may not be up for grabs, there's still another resource on the moon of high-value, argues one expert. "For rare earths, they are called rare for their low abundance, not economic value. However, some do have practical use in manufacturing, as in superconducting magnets," said Paul Spudis, a planetary scientist and leading advocate for exploring the moon at the Lunar and Planetary Institute in Houston. Spudis said that moon-situated rare earth elements are in very low abundance, except in the KREEP terrain of the western near side. "The only possible use of such I have heard of is the possibility of mining lunar thorium ‘ not a rare earth, strictly speaking, but associated with them ‘ to fuel nuclear reactors for power generation at a lunar base. Quite a distant prospect, I suspect," Spudis advised. For Spudis, **the real strategic lunar commodity is water**. "It's **useful for life support, energy storage, and propellant. It can be extracted on the moon and exported to cislunar space to create a permanent transportation system**," Spudis said. "That’s strategy for you!" All this being said, a question: On the 20- to 50-year timeframe, are there valuable or strategic resources on the moon’ "It is not possible to fully predict what will be important in the future, but I expect the answer is yes," Pieters said. "Resource knowledge is one aspect of lunar exploration that certainly drives the non-US space-faring nations. It is disappointing that planners in our [U.S.] space program have not invested in that scope or time scale," Pieters added. "Other than the flurry over looking for water in lunar polar shadows, no serious effort has been taken to document and evaluate the mineral resources that occur on Earth’s nearest neighbor. Frustrating!"

Moon colonization would provide low-cost, un-polluted solar energy to underdeveloped nations, but now is key

J. Peter Vajk[\*](http://www.sciencedirect.com/science/article/pii/0040162576900196" \l "fn1) Available online 12 April 2002. (received his doctorate in physics from Princeton University in 1968 to devote his efforts to further research on satellite solar power and space colonization)

The Forrester world dynamics model (as extended to a two-sector model by D. R. Tuerpe) has been used to investigate the impact of space colonization on the predicament of mankind in general and on the plight of the underdeveloped nations in particular. If a space colonization program is undertaken as early as 1982, then **low-cost, pollution-free solar energy, beamed down to earth in microwave form, can be provided in abundant quantities soon enough to help raise the underdeveloped nations toward parity with the developed nations**. If space colonization is postponed by twenty years, however, most of the benefits to the underdeveloped world are lost. Several aspects of space colonization which have not been included in the model are also discussed, which suggest that the model and its results are highly conservative.

Moon Colonization--- Rare Earth Metals

The Moon Has Abundant He3 and Other Key Rare Earth Elements

**Ouellette 11** (Jennifer Oullette, Science Writer at Discovery, “This Moon Was Made for Mining (Helium-3)”, <http://news.discovery.com/space/this-moon-was-made-for-mining-helium-3.html>, 2/21/2011) SV

And that's where the moon comes in. The moon's lunar soil is chock-full of helium reserves, thanks to the solar wind. In fact, every star emits helium constantly, suggesting that one day, spaceships will carry on a brisk import and export trade to harvest this critical element -- assuming we can figure out how to make such a process economically viable. But helium-3 isn't the only resource the moon might have to offer. It could also be a source for rare earth elements, such as europium and tantalum, which are in high demand on Earth for electronics and green energy applications (solar panels, hybrid cars), as well as being used in the space and defense industries. China is the largest exporter of rare earth elements, but there are growing concerns over supply vulnerability as China drastically reduces its rare earth exports. Scientists know that there are pockets or rare earth deposits on the moon, but as yet they don't have detailed maps of those areas. Potassium, phosphorus and thorium are other elements that lunar rocks have to offer a potential mining venture.

Moon Colonization---Solvency---Environment

Colonizing the moon allows us to escape environmental problems on Earth.

[Gerard K. O'Neill](http://ssi.org/?page_id=11) (Gerard K. O'Neill was professor of physics at [Princeton University](http://www.princeton.edu/).)  
[Physics Today](http://www.aip.org/pt/), 27(9):32-40 (September, 1974)

New ideas are controversial when they challenge orthodoxy, but orthodoxy changes with time, often surprisingly fast. It is orthodox, for example, to believe that Earth is the only practical habitat for Man, and that the human race is close to its ultimate size limits. But I believe we have now reached the point where we can, if we so choose, build new habitats far more comfortable, productive and attractive than is most of Earth. Although thoughts about migration into space are as old as science fiction, the technical basis for serious calculation did not exist until the late 1960's. In addition, a mental "hangup"-the fixed idea of planets as colony sites appears to have trapped nearly everyone who has considered the problem, including, curiously enough, almost all science-fiction writers. In recent months I learned that the space pioneer Konstantin Tsiolkowsky, in his dreams of the future, was one of the first to escape that hangup. By chance, and initially almost as a joke, I began some calculations on the problem in 1969, at first as an exercise for the most ambitious students in an introductory physics course. As sometimes happens in the hard sciences, what began as a joke had to be taken more seriously when the numbers began to come out right. There followed several years of frustrating attempts to get these studies published. Friends advised that I take my ideas "to the people" in the form of physics lectures at universities. The positive response (especially from students) encouraged me to dig harder for the answers to questions about meteoroid damage, agricultural productivity, materials sources, economics and other topics. The results of that study indicate that We can colonize space, and do so without robbing or harming anyone and without polluting anything. If work is begun soon, **nearly all our industrial activity could be moved away from Earth's fragile biosphere within less than a century from now**. The technical imperatives of this kind of migration of people and industry into space are likely to encourage self-sufficiency, small-scale governmental units, cultural diversity and a high degree of independence. The ultimate size limit for the human race on the newly available frontier is at least 20,000 times its present value. How can colonization take place? It is possible even with existing technology, if done in the most efficient ways. New methods are needed, but none goes beyond the range of present-day knowledge. The challenge is to bring the goal of space colonization into economic feasibility now, and the key is to treat the region beyond Earth not as a void but as a culture medium, rich in matter and energy. To live normally, people need energy, air, water, land and gravity. In space, solar energy is dependable and convenient to use; the Moon and asteroid belt can supply the needed materials, and rotational acceleration can substitute for Earth's gravity. Space exploration so far, like Antarctic exploration before it, has consisted of short-term scientific expeditions, wholly dependent for survival on supplies brought from home. If, in contrast, we use the matter and energy available in space to colonize and build, we can achieve great productivity of food and material goods. Then, in a time short enough to be useful, the **exponential growth of colonies can reach the point at which the colonies can be of great benefit to the entire human race**.

Moon Colonization---Solvency--- Sustainability

Moon colonization would become self-sustainable

Orbitec -- ORBITAL TECHNOLOGIES CORPORATION December 2006 <http://www.orbitec.com/documents/SSLC_2006.pdf>

The first purpose of the SSLC is to establish a permanent human presence on the Moon with a minimum need for supplies from Earth. The second purpose would be to serve as a test-bed for technologies that would be in common between the SSLC and an eventual Mars base. The SSLC is intended to fully utilize lunar resources. The colony would be considered “self-sustaining” when it can achieve the goal of surviving without any supplies from Earth for 52 months. This represents the period a Mars colony would need to survive between supplies missions from Earth, assuming one missed re-supply mission opportunity. The SSLC would need to produce and recycle all of the consumables required over that time. It must also maintain all of the modules, facilities, and equipment. We have assumed that the SSLC would have a steady-state population of 100. The Lunar colonists are considered to be permanent residents for a minimum period of 52 months. The colony could become self-sustaining without becoming completely isolated from the Earth. For example, scientific and technical equipment needed for further science, exploration, and extension of operations could be supplied. Communications and electronic data transfer with Earth would be extensive. The SSLC would be located at the southern pole of the Moon. There are several reasons to choose this location. First, data from the Lunar Prospector indicated significant amounts of frozen water ice, or at least bound hydrogen, at both of the Lunar poles in cold traps where the Sunlight is severely limited or non-existent (bottoms of craters and depressions). This resource will provide a valuable feedstock for H2O, O2, and fuel to support lunar surface activities, provide life support consumables, and allow transportation back to the Earth. Second, there are several areas at the South Pole that receive near-constant Sunlight. Two locations near the Shackleton crater at the lunar South Pole have been identified that collectively receive sunlight for ~98% of the time, making those excellent sites for the SSLC and the associated solar power systems. The availability of near continuous power eliminates the need for long-term energy storage. Third, the temperature environment is much more consistent than other non-polar lunar sites, with few dramatic temperature shifts. Surface temperatures at the South Pole remain close to –53 +/- 10 C. Other places on the Moon, outside of the poles, can see temperature swings over 400 C during Lunar day to night cycle. The small changes in temperature will simplify the thermal control system requirements of the SSLC and reduce cyclical thermal stresses. Electrical and thermal energy for the colony is proposed to be initially supplied by a combination of nuclear power plants (two ≥ 1 MW plants) and solar energy. The CELSS, Closed Ecological Life Support System, would provide all the atmospheric requirements for living on the Moon. The food acreage is sized to support 100 people. Dust has been identified as a significant problem during the Apollo missions. All attempts will be made to prevent the entry of dust into the habitat volume. Robotics and automated processes would be extensively used for surface construction and maintenance of the SSLC facilities. Telecommunications, navigation and information management are other important requirements. For a more complete description, see the NIAC website for the final report.

\*\*\*Solvency---Mars Colonies\*\*\*

Mars Colonization---Solvency---General

New commitment to Mars jumpstarts a large-scale colonization effort---resources and tech are feasible soon

Dinkin 4 – Sam Dinkin, columnist for the Space Review, September 7, 2004, “Colonize the Moon before Mars,” online: http://www.thespacereview.com/article/221/1

Mars is an excellent colonization spot and should be colonized because it is a great place to live. If we are going places as a species, we have to start somewhere. Right now, the level of space commitment by all actors on Earth is about $50 billion a year. This level of commitment would pay for about twenty Mars Direct-style missions every two years. This is a feasible budget for the colonization of Mars. Many technologies can be optimized if the focus of Earth space efforts was colonization. Cyclers could be placed in permanent Earth-Mars transfer orbit. In situ resource utilization could eliminate the need for hydrogen shipment from Earth. Better crew selection could eliminate the need for humans to take a return trip. If the goal of human presence on Mars is to colonize it, $50 billion a year can do it well.

Mars has sufficient resources for development and could act as a jumping off point for further exploration

**Zubrin**, **97** aerospace engineer and president of the Mars Society and Pioneer Astronautics**,** 1997 (Robert, “The Economic Viability of Mars Colonization,” http://www.aleph.se/Trans/Tech/Space/mars.html, JG)

The economic viability of colonizing Mars is examined. It is shown, that of all bodies in the solar system other than Earth, Mars is unique in that it has the resources required to support a population of sufficient size to create locally a new branch of human civilization. It is also shown that while Mars may lack any cash material directly exportable to Earth, Mars' orbital elements and other physical parameters gives a unique positional advantage that will allow it to act as a keystone supporting extractive activities in the asteroid belt and elsewhere in the solar system. The potential of relatively near-term types of interplanetary transportation systems is examined, and it is shown that with very modest advances on a historical scale, systems can be put in place that will allow individuals and families to emigrate to Mars at their own discretion. Their motives for doing so will parallel in many ways the historical motives for Europeans and others to come to America, including higher pay rates in a labor-short economy, escape from tradition and oppression, as well as freedom to exercise their drive to create in an untamed and undefined world. Under conditions of such large scale immigration, sale of real-estate will add a significant source of income to the planet's economy. Potential increases in real-estate values after terraforming will provide a sufficient financial incentive to do so. In analogy to frontier America, social conditions on Mars will make it a pressure cooker for invention. These inventions, licensed on Earth, will raise both Terrestrial and Martian living standards and contribute large amounts of income to support the development of the colony.

Mars is best option for colonization

Davies and Makuch ’10 (Paul, Ph.D from Arizona State University, Dirk Schulze, Ph.D from School of Earth and Environmental Sciences Washington State University,To Boldly Go: A One-Way Human Mission to Mars, Journal of Cosmology, <http://journalofcosmology.com/Mars108.html>) JL

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 t**he **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**.**

**Mars is the best place to colonize -- Water, Gravity, Day, temp, size, resources**

**Red Colony, 10** (A group of professionals who are frontrunners in mars development, Why Colonize Mars?, <http://www.redcolony.com/features.php?name=whycolonizemars>, JG)

Here are seven reasons why we should colonize Mars: 1. Its Similarity to Earth Mars has water, frozen underground and at the polar caps. There is evidence that this water has, in the past and present, flooded the surface in liquid form. Signs of erosion can be found on the slopes of craters and volcanoes. Geological features resembling those on Earth suggest that Mars was once a wet and hospitable planet. A day on Mars is 24.5 hours long. Mars is a third the size of Earth, but it has as much land area as the seven continents combined. Its gravity is 2.7 times less than that of Earth: enough to remain flat-footed on the surface, but a low enough escape velocity to make launching from Mars relatively simple. Remember, it was much easier for Apollo to lift off from the moon than it was to leave Earth. Construction materials would be lighter as well, facilitating labor in the early colony. The health benefits of such an environment are unknown, but it is theorized that Mars might prevent and relieve forms of arthritis and back pain. Also, Martian-born children might be taller than their Terran cousins. Both planets have seasons and similar rotational patterns. Mars is roughly in the same heat-range as Earth, being next-door in the solar system, and if it had a thicker atmosphere it is likely the two planets would share the same climate. Today, Mars's temperature varies from +1°F to -178°F, with an average global temperature of -85°F. That's cold, but still the solar system's most hospitable for humans. 2. Its Scientific Secrets With its similarity to Earth, there is a strong possibility that bacterial life (or something more?) exists on the planet. Some people believe that Viking detected it way back in 1976. Others believe that we found it in a Martian meteorite. Rovers are on their way to Mars to settle the debate, but we may only be sure if humans look for themselves. As any engineer will tell you, the ease with which a human being can cover a stretch of ground and examine specimens along the way, gathering and processing data, cannot be emulated with a machine. If we ever find life, we can begin to answer some of the biggest questions we've ever asked: "Are we alone in the universe? What else is out there? What is the basic unit of life? What does life need to survive?"

Carbon Dioxide proves Mars is Capable of maintaining human life

Whittington ’11 (Mark,. has written on space subjects for The Washington Post, USA Today,The Weekly Standard., The Discovery of More Frozen Carbon Dioxide on Mars; Implications for Terraforming, Yahoo,http://news.yahoo.com/s/ac/20110423/us\_ac/8352705\_the\_discovery\_of\_more\_frozen\_carbon\_dioxide\_on\_mars\_implications\_for\_terraforming)JL

**A recent discovery of more frozen carbon dioxide at the south pole of Mars** than previously thought by the Mars Reconnaissance Orbiter has profound implications for our understanding of that planet's past and its possible future. **So much frozen carbon dioxide rests at the Martian south pole that it constitutes almost all of what used to be that planet's atmosphere,** billions of years ago.The **discovery would** seem to **confirm the belief** of many scientists **that** at one time**, Mars was a warmer, more watery planet,** possibly **capable of supporting life.**

**Mars is the best place to colonize – Orbital Elements, Physical Parameters**

**Zubrin, 05** (Robert, Ph.D. in Nuclear Engineering Lockheed Martin's scenario development team charged with developing strategies for space exploration, The Economic Viability of Mars Colonization, <http://www.aleph.se/Trans/Tech/Space/mars.html>, JG)

The economic viability of colonizing Mars is examined. It is shown, that of all bodies in the solar system other than Earth, Mars is unique in that it has the resources required to support a population of sufficient size to create locally a new branch of human civilization. It is also shown that while Mars may lack any cash material directly exportable to Earth, Mars' orbital elements and other physical parameters gives a unique positional advantage that will allow it to act as a keystone supporting extractive activities in the asteroid belt and elsewhere in the solar system. The potential of relatively near-term types of interplanetary transportation systems is examined, and it is shown that with very modest advances on a historical scale, systems can be put in place that will allow individuals and families to emigrate to Mars at their own discretion. Their motives for doing so will parallel in many ways the historical motives for Europeans and others to come to America, including higher pay rates in a labor-short economy, escape from tradition and oppression, as well as freedom to exercise their drive to create in an untamed and undefined world. Under conditions of such large scale immigration, sale of real-estate will add a significant source of income to the planet's economy. Potential increases in real-estate values after terraforming will provide a sufficient financial incentive to do so. In analogy to frontier America, social conditions on Mars will make it a pressure cooker for invention. These inventions, licensed on Earth, will raise both Terrestrial and Martian living standards and contribute large amounts of income to support the development of the colony.

Mars Colonization---Solvency---General---Resources

**Space colonization is possible—Mars has sufficient resources for development and could act as a jumping off point for further exploration**

**Zubrin**, **97** aerospace engineer and president of the Mars Society and Pioneer Astronautics**,** 1997 (Robert, “The Economic Viability of Mars Colonization,” <http://www.aleph.se/Trans/Tech/Space/mars.html>, JG)

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Mars is self sufficient

Zubrin ’95 (Robert, masters degree in Aeronautics and Astronautics, member of Lockheed Martin's team for space exploration , The Case for Colonizing Mars, National Space Society,http://www.nss.org/settlement/mars/zubrin-colonize.html) JL

**Mars is the best target for** colonization in the solar system **because** it **has** by far the **greatest potential for self-sufficiency**. Nevertheless, even with optimistic extrapolation of robotic manufacturing techniques, Mars will not have the division of labor required to make it fully self-sufficient until its population numbers in the millions. Thus, for decades and perhaps longer, it will be necessary, and forever desirable, for Mars to be able to import specialized manufactured goods from Earth. These goods can be fairly limited in mass, as only small portions (by weight) of even very high-tech goods are actually complex. Nevertheless, these smaller sophisticated items will have to be paid for, and the high costs of Earth-launch and interplanetary transport will greatly increase their price. What can Mars possibly export back to Earth in return? It is this question that has caused many to incorrectly deem Mars colonization intractable, or at least inferior in prospect to the Moon.For example, **much has been made of the fact** that the **Moon has indigenous supplies of helium-3,** an isotope not found on Earth and which could be of considerable value as a fuel for second generation thermonuclear fusion reactors**.** Mars has no known helium-3 resources. On the other hand, because of its complex geologic history, **Mars** may **have concentrated mineral ores, with much greater concentrations of** precious **metal ores** readily **available** than is currently the case on Earth — because the terrestrial ores have been heavily scavenged by humans for the past 5,000 years. **If concentrated supplies of metals of equal or greater value than silver** (such as germanium, hafnium, lanthanum, cerium, rhenium, samarium, gallium, gadolinium, gold, palladium, iridium, rubidium, platinum, rhodium, europium, and a host of others) **were available on Mars,** they could potentially **be transported back to Earth for a substantial profit.** Reusable Mars-surface based single-stage-to-orbit vehicles would haul cargoes to Mars orbit for transportation to Earth via either cheap expendable chemical stages manufactured on Mars or reusable cycling solar or magnetic sail-powered interplanetary spacecraft. The existence of such Martian precious metal ores, however, is still hypothetical. But there is one commercial resource that is known to exist ubiquitously on Mars in large amount — deuterium. Deuterium, the heavy isotope of hydrogen, occurs as 166 out of every million hydrogen atoms on Earth, but comprises 833 out of every million hydrogen atoms on Mars. Deuterium **is the key fuel** not only **for** both first and second generation **fusion reactors, but it is also an essential material needed by the nuclear power industry** today**.** Even with cheap power, deuterium is very expensive; its current market value on Earth is about $10,000 per kilogram, roughly fifty times as valuable as silver or 70% as valuable as gold. This is in today's pre-fusion economy. Once fusion reactors go into widespread use **deuterium prices will increase**. All the in-situ chemical processes required to produce the fuel, oxygen, and plastics necessary to run a Mars settlement require water electrolysis as an intermediate step. As a by product of **these operations,** millions, perhaps **billions, of dollars worth of deuterium will be produced**. Ideas may be another possible export for Martian colonists. Just as the labor shortage prevalent in colonial and nineteenth century America drove the creation of "Yankee ingenuity's" flood of inventions, so the conditions of extreme labor shortage combined with a technological culture that shuns impractical legislative constraints against innovation will tend to drive Martian ingenuity to produce wave after wave of invention in energy production, automation and robotics, biotechnology, and other areas. These inventions, licensed on Earth, could finance Mars even as they revolutionize and advance terrestrial living standards as forcefully as nineteenth century American invention changed Europe and ultimately the rest of the world as well. Inventions produced as a matter of necessity by a practical intellectual culture stressed by frontier conditions can make Mars rich, but invention and direct export to Earth are not the only ways that Martians will be able to make a fortune. The other route is via **trade to the asteroid belt,** the band of small, mineral-rich bodies lying between the orbits of Mars and Jupiter.There are about 5,000 asteroids known today, of which about 98% are in the "Main Belt" lying between Mars and Jupiter, with an average distance from the Sun of about 2.7 astronomical units, or AU. (The Earth is 1.0 AU from the Sun.) **Of the remaining two percent known as the near-Earth asteroids, about 90% orbit closer to Mars than to the Earth.** Collectively, these **asteroids represent an enormous stockpile of mineral wealth** in the form of platinum group and other valuable metals. Miners operating among the asteroids will be unable to produce their necessary supplies locally. There will thus be a need to export food and other necessary goods from either Earth or Mars to the Main Belt**. Mars has an overwhelming positional advantage as a location from which to conduct such trade.**

Mars is Abundant on Natural minerals

BIS ’98 (British Interplanery Society, Space Journal, Survival and prosperity using regolith resources on Mars, The smithsonian, http://adsabs.harvard.edu/abs/1989JBIS...42..161C)JL

Although still imperfectly known, the surface material of Mars contains chemical resources which can be converted to commodities such as water, food, metals, and fuels. Chemicals needed for manufacturing processes are also readily produced from the soil. Superimposed on a globally uniform fine-grained material may be concentrations of valuable resources. The types of 'ores' could range from ice to gold.

Mars Colonization---Solvency---General---Rare Earth Metals

Mars colonization = tons of rare earth metals.

Red Colony, 10(A group of professionals who are frontrunners in mars development, Why Colonize Mars?, <http://www.redcolony.com/features.php?name=whycolonizemars>)

There is an abundance of rare metals on Mars such as platinum, gold, silver, and others. Shipping from Mars to Earth, as mentioned above, is much easier than the other way around. Even more promising is the proximity of the asteroid belt to Mars. Dactyl, the moon orbiting the asteroid Ida shown in this picture, is 1.4 kilometers in diameter, yet it contains more iron that the human race has used in its entire existence. These asteroids could be mined near Mars and shipped from the planet for little cost. What we could see develop is a triangle trade route, much like the one in the 18th century between Britain, the West Indies, and America. The economic potential is colossal.

Mars Colonization---Solvency---General---Water

Water is Abundant on Mars

O’Neil ’08(Ian, writer for universe today quoting interview with Dr. Adrian Brown, Searching for Water and Minerals on Mars – Implications for Colonization, Universe today,http://www.universetoday.com/14037/searching-for-water-and-minerals-on-mars-implications-for-colonization/)JL

In a timely news release, the CRISM mission site has announced new results to come from the analysis of the mineral distribution at the bottom of Candor Chasma (pictured), part of the vast Valles Marineris. Candor Chasma is a deep, long and steep-sided valley about 813 km (505 miles) long and has been cited as a possible location for the Hillside Settlement concept as conceived by the Mars Foundation. In fact, this settlement concept was the inspiration behind the first permanent settlement aptly called “Underhill” in Kim Stanley Robinson’s epic novel Red Mars. So, there is obvious interest as to what Candor Chasma can offer the colonists inhabiting the Hillside Settlement with easy access to locally mined minerals. The CRISM instrument has discovered **quantities of sulfate and pyroxene rich deposits in the region, useful for many industrial processes**. In our interview, Dr Brown outlined other important minerals **that CRISM has found and some of their common uses here on Earth: “**These [minerals] include kaolinite (chinaware is made of this mineral), talc (the main constituent of many soaps) and hydrated silica (perhaps like chert, which Indian knives were carved out from). The small amounts of these minerals means it has been impossible to discover them before CRISM, and previously they were discounted in all our modelling of Mars.” – Dr Adrian Brown, SETI Institute principal investigator and CRISM scientist. For me, the most revealing part of our conversation was Brown’s estimate on the sheer quantity of water held as ice in the north polar cap. **The north pole hides under a 1000 km (**620 mile) diameter disk **of near-pure water ice** (with some impurities like sand and dust, giving a pink hue). This disk is 3 km (1.9 miles) high, holding staggering 2.35 million cubic kilometers of water**.** That’s **enough water to cover the continental US to a depth of 200 meters**! Throw in the water that is held at the south pole (a carbon dioxide/water ice disk 300 km in diameter and 2 km high) and we’re looking at the equivalent volume of water ice held in the Greenland ice sheet (or 500 times less than the amount of water in our oceans**)**. It’s not that hard to imagine that if a permanent Mars colony is established, mining operations for water ice would be common. But it doesn’t stop there; **water could also be extracted from the atmosphere.** One of Dr Brown’s studies focus on measuring the variation of water ice crystals in the clouds throughout the seasons. There should also be quantities of water vapour in the warmer equatorial regions. **There is also the possibility of extracting water from the permafrost layers below the Martian regolith**. The Phoenix Mars lander (set to arrive at the Red Planet on May 25th) will be able to investigate the possibility of sources of frozen water below the surface. Dr Brown also indicated that the observations by the Mars Orbital Camera (on board NASA’s Mars Global Surveyor, lost in November 2006) of apparent gullies may reveal the location of possible sub-surface aquifers (after gushing across the surface) for future colonists to “tap” into (pictured). However, there have been studies that dispute this in favour of dry debris flows creating the gullies, but a definitive answer will not be arrived at until the gullies are analysed in-situ. And if he had the chance, I think Dr Brown would be the first to look into this exciting possibility after I asked him the question: Would you like to go to Mars?

**Mars has the right resources for colonization especially water**

**Portree, 01** (David, NASA History Division Office of Policy and Plans NASA Headquarters, Humans to Mars: 50 years of Mission Planning 1950-2000, <http://history.nasa.gov/monograph21.pdf>, JG)

The giant dust storm subsided during December, theatrically unveiling a surprising world. Mars was neither the dying red Earth espoused by Percival Lowell nor the dead red moon glimpsed by the flyby Mariners.3 From its long-term orbital vantage point, Mariner 9 found Mars to be two-faced, with smooth northern lowlands and cratered southern highlands. The missions to the Moon confirmed that a relationship exists between crater density and age—the more densely cratered a region, the older it is. Hence, Mars has an ancient hemisphere and a relatively young hemisphere. Mars is a small world—half Earth’s diameter—with large features. The Valles Marineris canyons, for example, span more than 4,000 kilometers along Mars’ equator. Nix Olympica, imaged by Mariner 6 and Mariner 7 from afar and widely interpreted as a bright crater, turned out to be a shield volcano 25 kilometers tall and 600 kilometers wide at its base. Renamed Olympus Mons (“Mount Olympus”), it stands at one edge of the Tharsis Plateau, a continentsized tectonic bulge dominating half the planet. Three other shield volcanoes on the scale of Olympus Mons form a line across Tharsis’ center. Most exciting for those interested in Martian life were signs of water. Mariner 9 charted channels tens of kilometers wide. Some contain streamlined “islands” apparently carved by enormous rushing floods. Many of the giant channels originate in the southern highlands and open out onto the smooth northern plains. The northern plains preserve rampart craters—also called “splosh” craters—which scientists believe were formed by asteroid impacts in permafrost. The heat of impact apparently melted subsurface ice, which flowed outward from the impact as a slurry of red mud, then refroze.4 Humans

Mars Colonization---Solvency---General/AT: Moon Better

Mars better than the moon-minerals, water, ag

Zubrin ’95 (Robert, masters degree in Aeronautics and Astronautics, member of Lockheed Martin's team for space exploration , The Case for Colonizing Mars, National Space Society,http://www.nss.org/settlement/mars/zubrin-colonize.html) JL

Among extraterrestrial bodies in our solar system, **Mars is singular** in **that** it **possesses all the raw materials required to support** not only **life,** but a new branch of human civilization. This uniqueness **is illustrated** most **clearly if** we **contrast Mars with** theEarth's **Moon,** the most frequently cited alternative location for extraterrestrial human colonization. **In contrast to** the **Moon, Mars is rich** in **carbon, nitrogen, hydrogen and oxygen,** all in biologically readily accessible forms such as carbon dioxide gas, nitrogen gas, and **water ice** and permafrost**.** **Carbon, nitrogen, and hydrogen are only present on** the **Moon in parts per million quantities,** much like gold in seawater. Oxygen is abundant on the Moon, but only in tightly bound oxides such as silicon dioxide (SiO2), ferrous oxide (Fe2O3), magnesium oxide (MgO), and aluminum oxide (Al2O3), which require very high energy processes to reduce. Current knowledge indicates that if **Mars** were smooth and all its ice and permafrost melted into liquid water, the **entire planet would be covered with** an **ocean over 100 meters deep.** **This contrasts** strongly **with the Moon, which is** so **dry** that if concrete were found there, Lunar colonists would mine it to get the water out. Thus, if plants could be grown in greenhouses on the Moon (an unlikely proposition, as we've seen) most of their biomass material would have to be imported**. The Moon is also deficient in** about **half the metals of interest to industrial society (**copper, for example**), as well as many other elements of interest s**uch as sulfur and phosphorus. **Mars has every required element in abundance**. Moreover, on Mars, as on Earth, hydrologic and volcanic processes have occurred that are likely to have consolidated various elements into local concentrations of high-grade mineral ore. Indeed, the geologic history of Mars has been compared to that of Africa, with very optimistic inferences as to its mineral wealth implied as a corollary. In contrast, the **Moon has** had virtually **no history of water** or volcanic action, with the result that it is basically composed of trash rocks with very little differentiation into ores that represent useful concentrations of anything interesting. You can generate power on either the Moon or Mars with solar panels, and here the advantages of the Moon's clearer skies and closer proximity to the Sun than Mars roughly balances the disadvantage of large energy storage requirements created by the Moon's 28-day light-dark cycle. But if you wish to manufacture solar panels, so as to create a self-expanding power base**, Mars holds an enormous advantage,** as only Mars **possesses the large supplies of carbon and hydrogen needed to produce the pure silicon** required for producing photovoltaic panels and other electronics**.** In addition, **Mars has** the **potential for wind-generated power while** the **Moon** clearly **does not.** But both solar and wind offer relatively modest power potential — tens or at most hundreds of kilowatts here or there. To create a vibrant civilization you need a richer power base, and this Mars has both in the short and medium term in the form of its geothermal power resources, which offer potential for large numbers of locally created electricity generating stations in the 10 MW (10,000 kilowatt) class. In the long-term, **Mars will enjoy a** power**-rich economy** based **upon exploitation of its large domestic resources of deuterium** fuel for fusion reactors. **Deuterium is five times more common** on Mars **than it is on Earth,** and tens of thousands of times more common on Mars than on the Moon**.** But the **biggest problem with the Moon,** as with all other airless planetary bodies and proposed artificial free-space colonies, is that **sunlight is not available in a form** useful **for growing crops**. A single acre of plants on Earth requires four megawatts of sunlight power, a square kilometer needs 1,000 MW. The entire world put together does not produce enough electrical power to illuminate the farms of the state of Rhode Island, that agricultural giant. Growing crops with electrically generated light is just economically hopeless. But you can't use natural sunlight on the Moon or any other airless body in space unless you put walls on the greenhouse thick enough to shield out solar flares, a requirement that enormously increases the expense of creating cropland. Even if you did that, it wouldn't do you any good on the Moon, because plants won't grow in a light/dark cycle lasting 28 days.But **on Mars** there **is an atmosphere thick enough to protect** crops grown on the surface from solar flare. Therefore, thin-walled inflatable plastic greenhouses protected by unpressurized UV-resistant hard-plastic shield domes can be used to rapidly create cropland on the surface. Even without the problems of solar flares and month-long diurnal cycle, such simple greenhouses would be impractical on the Moon as they would create unbearably high temperatures. On Mars, in contrast, the strong greenhouse effect created by such domes would be precisely what is necessary to produce a temperate climate inside. Such domes up to 50 meters in diameter are light enough to be transported from Earth initially, and later on they can be manufactured on Mars out of indigenous materials. Because **all** the **resources to make plastics exist on Mars**, networks of such 50- to 100-meter domes couldbe rapidly manufactured and deployed, opening up large areas of the surface to both shirtsleeve human habitation and agriculture. That's just the beginning, because it will eventually be possible for humans to substantially thicken Mars' atmosphere by forcing the regolith to outgas its contents through a deliberate program of artificially induced global warming. Once that has been accomplished, the habitation domes could be virtually any size, as they would not have to sustain a pressure differential between their interior and exterior. In fact, once that has been done, it will be possible to raise specially bred crops outside the domes. The point to be made is that unlike colonists on any known extraterrestrial body, Martian colonists will be able to live on the surface, not in tunnels, and move about freely and grow crops in the light of day. **Mars is** a **place where humans can live and** multiply to large numbers**, supporting themselves with products** of every description **made out of indigenous materials. Mars is thus a place where an actual civilization**, not just a mining or scientific outpost**, can be developed**. And significantly for interplanetary commerce, Mars and Earth are the only two locations in the solar system where humans will be able to grow crops for export.

Mars Colonization---Solvency---General---Replicates Earth

**Mars has same qualities as earth**

David ’05(Leonard, senior staff writer for SPACE.com also has written over 7 space tourism books,

Space Colonization: The Quiet Revolution, SPACE.com, http://www.space.com/813-space-colonization-quiet-revolution.html)JL

Why put Mars in the colonization crosshairs? "Mars is a planet that has many unusual and spectacular features that will draw people to it**,**" McCullough told the STAIF gathering. "Being a planet rather than a moon, **it has undergone many of the geological processes which have caused the formation of minerals on Earth**," he said**.** That being the case**, Mars is a user-friendly world, rife with many industrially useful minerals for construction and manufacturing purposes.** It has a suite of "ates", "ites" and "ides" of common metals with common non metals**,** McCullough pointed out. The red planet is **also wrapped in abundant carbon dioxide** which will be fairly easy to condense, he said**. Water availability on Mars is another huge plus.** There is abundant **evidence of past water activity on Mars.** It should be present in permafrost at higher latitudes on the planet. It may also be present in hydrated minerals, McCullough stated. "**The availability of water on Mars in significant quantities would once again simplify our projected industrial activities**. This makes extensive bases leading to colonies more likely," McCullough concluded.

Mars is Exactly like the Earth

Snyder ’09( Sam,Major in Biology, Mars Colonization: Our Soon to Be Home, Yahoo, <http://www.associatedcontent.com/article/1615587/mars_colonization_our_soon_to_be_home.html>)JL

Almost forty years ago we successfully put the first human on the moon. Today though we are looking further in to our solar system for new challenges that one-day we might achieve. In the future we might have flying cars, really fast genius computers, or we might even live somewhere other than Earth. That's right somewhere other than Earth, somewhere like... Mars. Some people ask how this is possible? How can we successfully live on Mars? Well the answer really isn't too far from home. **Mars is in fact very much like the Earth. The days are almost the same and its axis tilts almost the same as the Earths.** However, the two planets both vary in temperature. The Earth being closer to the Sun is warmer and Mars being farther away is colder. But the question is more how would we live on Mars?

Mars Colonization---Solvency---Springboard

**Mars** Colonization key to Solar System Colonization

Ker ’05(Than, Masters Degree from NYU, The Homestead Project: Making a Mars Settlement a Reality, Space.com, <http://www.space.com/1419-homestead-project-making-mars-settlement-reality.html>) JL

One possible scenario, the group proposes is to send small gas tanks ahead that store methane and oxygen extracted from the atmosphere. When the settlers arrive, they can then use that equipment and stored gas to build things like steel production plants. Finally, **Mars** will **be an integral part of** an inter-**solar system economy** that the group believes will develop within the next century,one **based on** the convergence of four frontiers**: Earth, the Moon, asteroids, and** Mars--including its own rocky satellite**s, Phobos and Deimos.** **Mars will catalyze the development of the other frontiers**, said Homnick, acting as a supply house for vital resources like nitrogen, carbon dioxide and water for the moon and asteroids, places where such things are scarce or nonexistent. **Many of the technologies developed for use on Mars will also have applications for the other frontiers**, the group said. For example, life support systems and mining equipment developed for use on Mars could also be used on the moon. The group strongly supports President Bush's Moon, Mars and Beyond vision and said they are not trying to compete with NASA or any other space organization. "We kind of look at NASA and the European Space Agency as analogous to Lewis and Clark in the old west," Homnick said. "They blaze the trail, go out to explore and do the science. Well, we are analogous to the pioneers--we follow the trail that they blazed, and we make the new frontier home and we add value." Instead, the group believes that different agencies can benefit from one another and the colonization of space can be sped up. "We hope they succeed because they'll help us succeed," said Palai.a

Mars Colonization---Solvency---Quick Timeframe

**Mars colonization is within our grasp**

**Zubrin, 05** (Robert, Ph.D. in Nuclear Engineering Lockheed Martin's scenario development team charged with developing strategies for space exploration, The Economic Viability of Mars Colonization, <http://www.aleph.se/Trans/Tech/Space/mars.html>, JG)

The exploration phase of Mars colonization has been going on for some time now with the telescopic and robotic surveys that have been and continue to be made. It will take a quantum leap, however, when actual human expeditions to the planet's surface begin. As I and others have shown in numerous papers1,2,3, if the Martian atmosphere is exploited for the purpose of manufacturing rocket fuel and oxygen, the mass, complexity, and overall logistics requirements of such missions can be reduced to the point where affordable human missions to Mars can be launched with present day technology. Moreover, by using such "Mars Direct" type approaches, human explorers can be on Mars within 10 years of program initiation, with total expenditure not more than 20% of NASA's existing budget. The purpose of the exploration phase is to resolve the major outstanding scientific questions bearing on the history of Mars as a planet and a possible home for life in the past, to conduct a preliminary survey of the resources of Mars and determine optimum locations for future human bases and settlements, and to establish a modus operandi whereby humans can travel to, reside on, and conduct useful operations over substantial regions of the surface of Mars.

**We have everything we need to get to mars**

**Bollard, 10** (Pat, Formor Marine, The War Starts Here, Scientists Urge Immediate Colonization of Mars, <http://patdollard.com/2010/11/scientists-urge-immediate-colonization-of-mars/>, JG)

Mars is a six-month flight away, possesses surface gravity, an atmosphere, abundant water, carbon dioxide and essential minerals. They propose the missions start by sending two two-person teams, in separate ships, to Mars. More colonists and regular supply ships would follow. The technology already exists, or is within easy reach, they wrote. An official for NASA said the space agency envisions manned missions to Mars in the next few decades, but that the planning decidedly involves round trips. President Obama informed NASA last April that he “‘believed by the mid-2030s that we could send humans to orbit Mars and safely return them to Earth. And that a landing would soon follow,’” said agency spokesman Michael Braukus. No where did Obama suggest the astronauts be left behind. “We want our people back,” Braukus said. Retired Apollo 14 astronaut Ed Mitchell, who walked on the Moon, was also critical of the one-way idea. “This is premature,” Mitchell wrote in an e-mail. “We aren’t ready for this yet.” Davies and Schulze-Makuch say it’s important to realize they’re not proposing 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 wrote, while acknowledging the proposal is a tough sell for NASA, with its intense focus on safety. They think the private sector might be a better place to try their plan. “What we would need is an eccentric billionaire,” Schulze-Makuch said. “There are people who have the money to put this into reality.” Indeed, British tycoon Richard Branson, PayPal founder Elon Musk and Amazon.com Inc. CEO Jeff Bezos are among the rich who are involved in private space ventures. Isolated humans in space have long been a staple of science fiction movies, from “Robinson Crusoe on Mars” to “2001: A Space Odyssey” to a flurry of recent movies such as “Solaris” and “Moon.” In many of the plots, the lonely astronauts fall victim to computers, madness or aliens. Psychological profiling and training of the astronauts, plus constant communication with Earth, will reduce debilitating mental strains, the two scientists said. “They would in fact feel more connected to home than the early Antarctic explorers,” according to the article. But the mental health of humans who spent time in space has been extensively studied. Depression can set in, people become irritated with each other, and sleep can be disrupted, the studies have found. The knowledge that there is no quick return to Earth would likely make that worse. Davies is a physicist whose research focuses on cosmology, quantum field theory, and astrobiology. He was an early proponent of the theory that life on Earth may have come from Mars in rocks ejected by asteroid and comet impacts. Schulze-Makuch works in the Earth Sciences department at WSU and is the author of two books about life on other planets. His focus is eco-hydrogeology, which includes the study of water on planets and moons of our solar system and how those could serve as a potential habitat for microbial life. The peer-reviewed Journal of Cosmology covers astronomy, astrobiology, Earth sciences and life. Schulze-Makuch and Davies contend that Mars has abundant resources to help the colonists become self-sufficient over time. The colony should be next to a large ice cave, to provide shelter from radiation, plus water and oxygen, they wrote. They believe the one-way trips could start in two decades. “You would send a little bit older folks, around 60 or something like that,” Schulze-Makuch said, bringing to mind the aging heroes who save the day in “Space Cowboys.” That’s because the mission would undoubtedly reduce a person’s lifespan, from a lack of medical care and exposure to radiation. That radiation would also damage human reproductive organs, so sending people of childbearing age is not a good idea, he said. There have been seniors in space, including John Glenn, who was 77 when he flew on the space shuttle in 1998. Still, Schulze-Makuch believes many people would be willing to make the sacrifice. The Mars base would offer humanity a “lifeboat” in the event Earth becomes uninhabitable, they said. “We are on a vulnerable planet,” Schulze-Makuch said. “Asteroid impact can threaten us, or a supernova explosion. If we want to survive as a species, we have to expand into the solar system and likely beyond.”

**It would not be difficult to colonize mars**

**UT, 08** (Universe Today, Mars Colonization, <http://www.universetoday.com/14883/mars-colonizing/>, JG)

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.

Mars Colonization—Solvency-- Fusion

Mars key to deuterium and controlled fusion- replaces fossil fuels.

Red Colony, 10(A group of professionals who are frontrunners in mars development, Why Colonize Mars?, <http://www.redcolony.com/features.php?name=whycolonizemars>)

An important part of the fusion reaction process is deuterium, a stable isotope of hydrogen. Once we can contain a fusion reaction, the deuterium-tritium reaction has a high yield of energy for the small amount of fuel put in. Deuterium, or heavy hydrogen, is hard to obtain on Earth, but on Mars it is five times more abundant in the form of Hydrogen-Deuterium-Oxygen (See Also: Compositions). A milliliter of liquid heavy-hydrogen fuel would produce as much energy as 20 tons of coal. Deuterium is also important in chemistry because it reacts the same way as hydrogen, but can be distinguished from hydrogen by its mass. These reactions occur slower than normal hydrogen reactions.

\*\*\*Solvency---Orbital Colonies\*\*\*

Orbital Colonies Solvency---General

Orbital colonies are superior to other types of colonization and are the only way to have the capabilities to colonize other planets.

Prado 2002. (Mark Prado has had a variety of jobs in different space organizations including things like NASA, SSI, etc. He went to school majoring in physics. <http://www.permanent.com/s-orbit.htm>) hss

Colonies in orbital space are superior to colonies on other planets and moons, contrary to popular belief. "Planetary chauvenism" is the tendency for people to think that colonies in space would preferably be located on planetary surfaces like Mars or the Moon instead of in orbital space. Consider the advantages of a habitat based in orbit: A habitat based in orbit can be wheel-shaped and rotated to produce artificial gravity by the [centrifugal (centripetal)](http://www.permanent.com/s-c-forc.htm) force. Choose the healthiest gravity you want. Earth-normal gravity may be needed for good health for long-term stays. A habitat based in orbit has access to sunshine 24 hours/day. No nights. Crops can grow faster by varying sun (but not sunlit 24 hours/day since many plants need nights, but opening/closing sunshades or mirrors for optimal sunlit periods), for more economical output per unit of habitat and time. Year-round growing season. Orbit-based habitats will be very green, glassy structures with some very exciting architectural and recreational features, including areas for human flight. Products and services for selling to Earth economies will be manufactured and assembled in orbital space, and operated there. So, the suburbs in space will be located where the demand is, namely, next to the factories, like it or not. (Why the manufacturing facilities will be located in orbital space instead of on the Moon is discussed elsewhere.) There will eventually be settlements on other planets as well, as there will be all kinds of people with diverse preferences, but settlements on other planets and moons will be feasible only after we have settlements in orbital space and the economic support and physical infrastructure to support them.

Orbital Colonies use BioHomes creating good living spaces.

Prado 2002. (Mark Prado has had a variety of jobs in different space organizations including things like NASA, SSI, etc. He went to school majoring in physics. <http://www.permanent.com/s-orbit.htm>) hss

In 1989, NASA completed a small facility called BioHome, which integrated "biogenerative" components for recycling air, water and nutrients from human wastes -- into a single, integrated habitat. Maximum air closure was achieved, and experiments were begun, which continue to date. A little larger than a mobile home, the facility put living quarters in a compartment beside the crops and waste processing facilities, circulating air and water between them. Drinkable water was taken from air condensate. The facility initially focussed on wastewater treatment. Aquatic and semi-aquatic plants known for their ability to process sewage were studied. These were not edible plants, but were instead aquatic and semi-aquatic plants chosen for their history in making excellent compost material for food plants, after they grow based on the sewage. After growing to a certain size, they are harvested, cleaned and composted. This compost has been used as a complete growth media for tomatoes, sorghum, corn, potatoes, cucumbers and squash. The facility grew edible plants, though that information was not available on the web at the time of this writing. PVC pipes slowly moved sewage downstream. The pipes had holes cut in them in which the plants were emplaced. Experiments measured the effectiveness of several plants, each of which can utilize raw human sewage as a complete growth media. Samples of the water were taken at different points in the flow and studied. In the end, the effluent water flowed through an ultraviolet unit to assure complete kill of all microorganisms, especially those pathogenic to humans. This water was then suitable for use in toilets and watering plants. Drinking water came from condensate from the air (e.g., dehumidifier and air conditioner condensate), which was also disinfected by ultraviolet equipment. The plant leaves emitted quite ample supplies of water vapors. It was also found that the plants purified the air of many manmade substances such as formaldehyde, benzene, toluene and other undesirable organics. Foliage plants were placed throughout the living quarters for absorbing the gases from the newly constructed and furnished facility.

Orbital space colonies would create a better living sphere – will create better conditions than Earth

Engdahl 2008(Sylvia Engdahl has written many non-fiction books on space exploration and development. November 5, 2008. <http://www.sylviaengdahl.com/space/survival.htm>) hss

And meanwhile, the space-dwellers producing all these things cheaply for Earth would be getting rich, because they would not be citizens of Earth nations; they would be citizens of their own orbiting colonies, entitled to the full proceeds of their labor. Eventually, they would be rich enough to fund interstellar expeditions. And their living conditions would not be what you’re imagining if you’re picturing Deep Space Nine. Orbiting colonies— probably the most difficult concept to understand if you haven’t seen any of the artists’ renditions—would be little worlds built from extraterrestrial materials, with the living space on the inside of the sphere. They would be complete biospheres with trees and lakes and gardens, much less crowded and less sterile than New York City. Many of their advocates have said that having once lived that way, humans would never want to live on the surface of a planet again, and that if they traveled to a new planet, they’d go to its surface only to explore.

Orbital Colonies Solvency---Environment

Orbital Space colonies provide for solutions to our environmental problems – could be millions of separate ecosystems.

Globus 1996(Al Globus has bachelors in science and works at NASA Ames Research Center. Date isn’t in article last date on bibliography was 1996. http://space.alglobus.net/Basics/why.html)hss

Orbital space colonies can provide thousands, if not millions, of completely separate ecosystems with easy-to-control borders. Poorly run space colonies cannot easily export their environmental problems. Each colony, holding from a few hundred to perhaps as many as a million people, is a completely enclosed ecosystem separated from every other colony by a very complete vacuum. The environmental sins of one will not be visited on another. If a colony chooses to experiment, to try new things that don't work and creates some horrendous consequences, no other colony will be directly affected. There will be no need, as there is on Earth, for global treaties preventing a society from doing pretty much as it pleases. Not only is the environment of each colony separate and unique, immigration will be very easy to control.

Orbital Colonies Solvency---Resource Shortages

Orbital colonies will allow us to become self-sufficient without using the Earth’s resources.

Prado 2002. (Mark Prado has had a variety of jobs in different space organizations including things like NASA, SSI, etc. He went to school majoring in physics. <http://www.permanent.com/s-orbit.htm>) hss

In order to become self-sufficient in space -- independent from Earth -- we will need to grow our own food in space. We can use machines to recycle urine and water vapor in the air to produce drinkable water, but it will eventually become more desirable and economical to recycle our human wastes naturally rather than only by machines, and to do so naturally in conjunction with food production. Machines would be used only to sterilize and purify water that has already been cycled through the artificial biosphere. On Earth, animals breathe in oxygen (O2) from the air and breathe out carbon dioxide (CO2) as a waste. Plants absorb this carbon dioxide from the air, and using the energy of sunlight plus water and materials from the soil and air produce sugar, starch and other things -- based on a process called photosynthesis. Plants emit oxygen as a waste. That completes the animal-plant cycle. In this cyclic manner, animals and plants are mutually dependent upon each other. Plants produce both food and oxygen for animals. In turn, animals produce carbon dioxide for plants. In addition, animals produce excrement wastes which enrich the soil. Dead plants also enrich the soil and are not wasted. This natural cycle can be moved to space, in whole or in part. Early experiments in the 1950s and 1960s focussed on recycling air using algae, not food crops. Flat tanks of algae were put under artificial light in order to absorb carbon dioxide that humans had exhaled in closed chambers, and emitted the oxygen for the humans to breathe. It was found that each human required about 8 square meters of algae for equilibrium. (The algae tanks were generally stacked as shelves so that they took much less than 8 square meters of floor space.) More recent research has expanded this to include production of edible food, and recycling of human excrement wastes and dead plant wastes in the food cycle. In the early years of space colonization, we will use a combination of natural systems and machines. We can always import pure oxygen and water from asteroidal materials, as well as carbon dioxide if we wish. It's not necessary to produce a completely closed system. However, it is important to maintain healthy and highly productive crops, which requires waste management and recycling skills.

Orbital Colonies Solvency---Overpopulation

Orbital Colonization allows for a solution to overpopulation – unlimited room in space.

Globus 1996(Al Globus has bachelors in science and works at NASA Ames Research Center. Date isn’t in article last date on bibliography was 1996. http://space.alglobus.net/Basics/why.html)hss

Growing throughout our solar system will create enormous opportunities. First, since there is the equivalent of hundreds of Earth's to settle, everyone can have as many children as they like without fear of overloading the environment. Second, we will be able to try many social systems in thousands of colonies. Failure in one does not directly affect the others. Third, a much larger population will create more knowledge, more art, and more of everything people do. This will benefit not only those that go, but those that stay on Earth as well. In case you haven't noticed, Earth is getting a bit crowded. Most of the nice places have plenty of people, and more is not really a good thing. Some societies, such as China, have taken draconian measures. China limits couples to a single child in the name of population control. But children are wonderful, as any good parent knows. They are, to a great extent, what makes life truly worth living. An unhappily childless couple, or a couple with fewer children than they want, is a tragedy. We need more room and space can supply it. While most individual colonies may only hold 10-50,000 people, when one colony fills up we can build another. If a child's home colony is full up when they get to adulthood, it is perfectly reasonable to make another exactly like it (or with improvements!). The new colony can be put in a compatible orbit so that taking the babies to see grandma is a very quick trip. There will always be more land, plenty of land for as many children as humanity wants to produce.

\*\*\*Solvency---Artificial Gravity\*\*\*

Artificial Gravity---Key to Space Colonization

Developing artificial gravity is an imperative before space colonization can occur.

Young 6 (Laurence R., Apollo Program Professor of Astronautics and Professor of Health Sciences and Technology at the MIT, http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.1999.tb09198.x/full) OP

“Zero-G and I'm feeling fine,” said Mercury astronaut John Glenn when he became the first American in orbital flight in 1962. “One G and I'm feeling fine,” said Senator John Glenn when he returned from his second space flight, of nine days, in 1998. But after the last reentry, when he tried to walk around and balance himself, things were not so fine, although he eventually recovered. It is well known that about 70% of all space travelers experience a form of motion sickness soon after going weightless, and that many of them are either nauseous or have posture and gait instability after landing. The response of the body to weightlessness can lead to serious problems after return. Of particular concern are the loss of bone and muscle, cardiovascular deconditioning, loss of red blood cells and plasma, possible compromise of the immune system, and finally, an inappropriate interpretation of otolith system signals, which are so necessary to avoid falling over upon return to a gravity field. Numerous remedies for these effects have been employed, but at this time only a few seem to have any documented beneficial effect. These few are the ingestion of ionically balanced water before reentry, inflation of an anti-g suit during reentry, and the maintenance of a vigorous and time-consuming exercise regimen nearly daily while in orbit. 1 Despite the successes to date of life support for shorter missions, the space traveler coming back to Earth after a year in weightlessness would likely be unable to walk normally for a day or more. Although the returning astronauts apparently recover in time, they are not in shape for safe vigorous or coordinated activity immediately after landing. They would be poor risks for the first interplanetary exploration. Before embarking on the next major step in space exploration, human travel to Mars, it is imperative to develop safe ways of protecting astronauts from these debilitating effects. The issue of appropriate “countermeasures” to overcome the effects of weightlessness on humans ranks as one of the chief safety concerns about a Mars mission. Along with protection against radiation exposure beyond the Earth's magnetic field, these weightlessness countermeasures require urgent development before committing to the Mars exploration.

Space colonization wouldn’t be possible without artificial gravity

HALL 1999 (Theodore W. Hall is a senior member of the AIAA. “Artificial gravity and the architecture of orbital habitats”. Journal of the British Interplanetary Society, July/August 1999. <http://www.spacearchitect.org/pubs/JBIS-52-7-Hall.pdf>.) hss

Many of these changes do not pose problems as long as the crew remains in a weightless environment. Trouble ensues upon the return to life with gravity. The rapid deceleration during reentry is especially stressful as the apparent gravity grows from zero to more than one “g” in a matter of minutes. In 1984, after a 237-day mission, Soviet cosmonauts felt that if they had stayed in space much longer they might not have survived reentry [3]. In 1987, ins the later stages of his 326-day mission, Yuri Romanenko was highly fatigued, both physically and mentally. His work day was reduced to 4.5 hours while his sleep period was extended to 9 hours and daily exercise on a bicycle and treadmill consumed 2.5 hours. At the end of the mission, the Soviets implemented the unusual procedure of sending up a “safety pilot” to escort Romanenko back to Earth [22]. Soviet cosmonauts Vladimir Titov and Moussa Manarov broke the one-year barrier when they completed a 366-day mission on 21 December 1988. Subsequent Russian missions have surpassed that. These long-duration space flights are extraordinary. They are milestones of human endurance. They are not models for space commercialization.

Artificial gravity allows humans to maintain their health in space.

Astrobiology: The Living Universe 00 (Astrobiology: The Living Universe focuses on the life in space and in the universe with interviews with the foremost experts in astrobiology ensure that we have the most comprehensive and up-to-date information, http://library.thinkquest.org/

C003763/index.php?page=adapt06) OP

The manned exploration of space has so far been limited to the moon and low Earth orbit. During missions that last only a few weeks or months, the adverse effects of weightlessness on the human body are not a huge annoyance. However, once mankind ventures beyond the moon to destintations like Mars, the length of time humans would be exposed to zero-gravity increases drastically. The consequences of extended exposure to weightlessness are undesirable physiological adaptations that impede the ability of astronauts to function efficiently upon the return to an environment with gravity. Although countermeasures such as diet and exercise can be taken to fight these physiological adaptations, they are not entirely effective. The perfect solution would be to create artificial gravity, which would allow humans to maintain their health in space.

Artificial gravity solves all negative effects of prolonged weightlessness.

International Academy of Aeronautics 9 (non governmental organization recognized by the UN, founded in 1960 to foster the development of astronautics for peaceful purposes, **http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%202/sg22/sg22finalreportr.pdf**) OP

To succeed in the near-term goal of a human mission to Mars during the second quarter of this century, the human risks associated with prolonged weightlessness must be mitigated well beyond our current capabilities. Indeed, during nearly 45 years of human spaceflight experience, including numerous long-duration missions, research has not produced any single countermeasure or combination of countermeasures that is completely effective. Current operational countermeasures have not been rigorously validated and have not fully protected any long-duration (>3 month) crews in low-Earth orbit. Thus, it seems unlikely that they will adequately protect crews journeying to Mars and back over a three-year period. Although improvements in exercise protocols, changes in diet, or pharmaceutical treatments of individual systems may be of value, they are unlikely to eliminate the full range of physiologic deconditioning. Therefore, a complete research and development program aimed at substituting for the missing gravitational cues and loading in space is warranted. The urgency for exploration-class countermeasures is compounded by the limited availability of flight resources for performing the validation of a large number of system-specific countermeasure approaches. Furthermore, recent evidence of rapid degradation of pharmaceuticals flown aboard long-duration missions, putatively because of radiation effects, raises concerns regarding the viability of some promising countermeasure development research. Although the rotation of a Mars- bound spacecraft will not be a panacea for all the human risks of spaceflight (artificial gravity cannot solve the critical problems associated with radiation exposure, isolation, confinement, and environmental homeostasis), artificial gravity does offer significant promise as an effective, efficient, multi-system countermeasure against the physiologic deconditioning associated with prolonged weightlessness. Virtually all of the identified risks associated with bone loss, cardiovascular deconditioning, muscle weakening, neurovestibular disturbances, space anemia, and immune compromise might be alleviated by the appropriate application of artificial gravity.

Artificial gravity solves post-flight musculo-skeletal injury.

Jones, et al 7 (Jeffrey, Randal Reinertson, and William Paloski all of NASA Johnson Space Center, http://www.springerlink.com/content/u7474lk724054217/fulltext.pdf) OP

This is where artificial gravity may provide the largest impact to protecting functionality for the crew upon return to a gravity field after prolonged periods in microgravity. Artificial gravity may be particularly effective in preserving the capability to response to an off-nominal landing event whether it be during the landing phase, or the need for emergency response or egress of the vehicle after landing. Additional risk reduction in the area of reduced postflight musculo-skeletal injury may also be conferred by artificial gravity use during flight, especially during the return trip.

Artificial gravity needed in order to colonize space – too many effects on the body without it.

MIT News. 1995. (Novemeber 25, 1995. A website containing articles from professionals at MIT promoting their research. <http://web.mit.edu/newsoffice/1995/gravity-1129.html>) hss

The biggest problem that must be overcome for lengthy missions of that type is the harmful effects of weightlessness on the human body, Dr. Young noted. These effects include loss of bone mass and red blood cells, fluid shifting from the lower to upper body, deconditioning of circulation and muscles, and changes in the immune system. Such reactions by the body "are perfectly appropriate for zero-gravity flight but perfectly inappropriate for return to the surface of our planet or another planet," he said. Despite in-flight exercise, most astronauts experience problems with balance and orientation, fainting, and risk of muscle tears and bone fractures for the first few days after landing. The purpose of a Mars mission "is not mere survival," Dr. Young said. "We cannot afford to have astronauts in a weak physical condition on any part of the mission." Such a mission can't be seriously considered until these problems can be overcome, he said.

Only artificial gravity can solve current microgravity effects.

Czarnik 99 (Tamarack R., M.D., Resident, WSU-Aerospace Medicine, March 1999, **http://webcache.googleusercontent.com/search?q=cache:P7zKQ94qfGQJ:chapters.marssociety.org/usa/oh/aero2.htm+artificial+gravity+necessary&cd=5&hl=en&ct=clnk&gl=us&client=safari&source=www.google.com**) OP

WHY ARTIFICIAL GRAVITY? Prolonged human exposure to microgravity has been seen to contribute to numerous physiological problems, including fluid redistribution (and subsequent loss), cardiac and skeletal muscle deconditioning, loss of bone mineral density and so on. This deconditioning is currently fought (with variable success) only by 1-2 hours per day of aerobic and resistance exercises, with resultant hull vibrational stress and contamination of the cabin environment by sweat droplets. Physiologic adaptation to microgravity necessitates readaptation to Earth-normal gravity, with consequent temporary incapacitation of varying severity. Additionally, microgravity complicates materials handling, waste management, cabin environment hygiene and the like. Artificial Gravity holds the potential to resolve or ameliorate all of these problems. On-board centrifugation on Kosmos-782 in 1975 showed that 1.0 g for 24 hours a day is sufficient to stop physiological deconditioning (1). Eliminating the need to readapt to Earth’s gravity would do away with the temporary incapacitation that complicates emergency landing planning. AG would settle airborne contaminants and cancel the danger imposed by floating material, as well as freeing hours per day of valuable astronaut working time.

Artificial gravity solves otolith sensitivity loss.

Denise, et al 7 (Pierre, Professor at University of Caen (France), Hervé Normand, Professor at University of Caen (France) and Scott Wood, NASA Johnson Space Center,

http://www.springerlink.com/content/n5775024n8626622/fulltext.pdf) OP

Because the otolithic control of the cardiovascular system is supposed to compensate for head tilt coupled with the observation that otolith tilt reflexes generally vanish during adaptation to microgravity (see Chapter 4), it can be hypothesized that the otolithic control of the cardiovascular system will be altered after spaceflight. This alteration would then participate in cardiovascular deconditioning. If this hypothesis is confirmed, it could have potential consequences for the design of countermeasures preventing cardiovascular deconditioning. In this context, providing artificial gravity by using centrifugation in supine subjects with the head off-center might be an effective means for maintaining otolith sensitivity and preserving vestibulo- sympathetic reflexes.

Artificial Gravity Solvency---General/Tech Viability

We can use artificial gravity in space.

Prado 2002. (Mark Prado has had a variety of jobs in different space organizations including things like NASA, SSI, etc. He went to school majoring in physics. <http://www.permanent.com/s-orbit.htm>) hss

If a gravity of about one third Earth's is permissible, then a short radius habitat may be comfortable. The main reason for lowering radius would be simply economics in an early space habitat in that lower radius means less material needed, including designs for stress. However, in a scenario using asteroidal or lunar material whereby the costs of material in orbit is much lower, we will probably opt for larger habitats and perhaps even Earth-normal gravity. There are numerous technical designs for small spacecraft with artificial gravity, e.g., for missions to Mars. Space stations in low Earth orbit to date have not used artificial gravity for several reasons: so that they could be smaller and cheaper; many of the experiments to be conducted by the station were in microgravity (where gravity is undesirable), and docking systems are simpler when the station is not rotating. For connecting spent fuel tanks to produce a space station situated in orbit, we can just put a long cable between them and rotate the structure. People in space will start to move away from an entirely "up vs. down" sense of reference, and start to integrate the circular elements into their frame of reference as opposed to rectangular elements on Earth.

Artificial gravity has been scientifically tested.

Astrobiology: The Living Universe 00 (Astrobiology: The Living Universe focuses on the life in space and in the universe with interviews with the foremost experts in astrobiology ensure that we have the most comprehensive and up-to-date information, http://library.thinkquest.org/C003763/index.php?page=adapt06) OP

Artificial gravity has already been shown to preserve the health of organisms in space. Soviet experiments using rats in centrifuges showed that centrifuged rats were much healthier than non-centrifuged rats. Artifical gravity preserved red blood cells and bone density in the rats, two biological areas that are negatively affected by weightlessness. The same results are likely to be seen in humans, although no experimentation with artificial gravity and humans has yet been conducted in space. Although the cost of implementing an artificial gravity system in a space ship is quite high, the price is well worth an astronaut’s health.

Artificial gravity is real- previously generated by European Space Agency.

European Space Agency 6 (March 23. 2006, “Towards a new test of general relativity?”, http://www.esa.int/esaMI/GSP/SEM0L6OVGJE\_0.html) OP

Scientists funded by the European Space Agency believe they may have measured the gravitational equivalent of a magnetic field for the first time in a laboratory. Under certain special conditions the effect is much larger than expected from general relativity and could help physicists to make a significant step towards the long-sought-after quantum theory of gravity. Just as a moving electrical charge creates a magnetic field, so a moving mass generates a gravitomagnetic field. According to Einstein's Theory of General Relativity, the effect is virtually negligible. However, Martin Tajmar, ARC Seibersdorf Research GmbH, Austria, and colleagues believe they have measured the effect in a laboratory. Their experiment involves a ring of superconducting material rotating up to 6 500 times a minute. Superconductors are special materials that lose all electrical resistance at a certain temperature. Spinning superconductors produce a weak magnetic field, the so-called London moment. The new experiment tests a conjecture that explains the difference between high-precision mass measurements of Cooper-pairs (the current carriers in superconductors) and their prediction via quantum theory. They have discovered that this anomaly could be explained by the appearance of a gravitomagnetic field in the spinning superconductor (This effect has been named the Gravitomagnetic London Moment by analogy with its magnetic counterpart). Small acceleration sensors placed at different locations close to the spinning superconductor, which has to be accelerated for the effect to be noticeable, recorded an acceleration field outside the superconductor that appears to be produced by gravitomagnetism. "This experiment is the gravitational analogue of Faraday's electromagnetic induction experiment in 1831. It demonstrates that a superconductive gyroscope is capable of generating a powerful gravitomagnetic field, and is therefore the gravitational counterpart of the magnetic coil. Depending on further confirmation, this effect could form the basis for a new technological domain, which would have numerous applications in space and other high-tech sectors" says ESA study manager Clovis de Matos. Although just 100 millionths of the acceleration due to the Earth’s gravitational field, the measured field is a surprising one hundred million trillion times larger than Einstein’s General Relativity predicts. Initially, the researchers were reluctant to believe their own results. "We ran more than 250 experiments, improved the facility over 3 years and discussed the validity of the results for 8 months before making this announcement. Now we are confident about the measurement," says Tajmar, who performed the experiments and hopes that other physicists will conduct their own versions of the experiment in order to verify the findings and rule out a facility induced effect.

Artificial gravity good – saves money

Hall 2004. (Theodore W. Hall is a senior member of the AIAA. “Architectural Design to Promote Human Adaptation to Artificial Gravity”. May 2004. http://www.spacearchitect.org/pubs/NASA-RFI-04212004-Hall.pdf) hss

As NASA prepares to send humans far beyond Earth on missions lasting a year or more, it should investigate vigorously the cost and complexity of providing artificial gravity versus the cost and complexity of avoiding it through continued application of other countermeasures. Current practice does not avoid complexity but merely defers much of it from mechanical engineering to space medicine – a field of endeavor that’s less well understood and much harder to control. Meanwhile, design strategies that might mitigate the cost of artificial gravity, by aiding human adaptation to higher rates of rotation at shorter radii, have remained unexplored [Hall 1999 July; Hall 1999 Sep.; Hall 2002 July; Hall 2002 Oct.].

\*\*\*Solvency---Asteroid Colonization\*\*\*

Asteroid Colonization Solvency---General

Asteroids and comets make good places for colonization.

Globus 1996(Al Globus has bachelors in science and works at NASA Ames Research Center. Date isn’t in article last date on bibliography was 1996. http://space.alglobus.net/Basics/why.html)hss

One of the problems with orbital real estate is a distinct lack of materials. Actually, a complete and total lack of materials. Oh, there are a few atoms here and there, a stream of solar particles (the solar wind), and perhaps even a speck of dust, but no where near enough matter to make a grain of sand, much less a kilometer-scale space colony. If an asteroid is headed on a collision with Earth, the best thing to do with it is to use the materials to build space habitats! After all, the materials are already headed for Earth, it's just a matter of changing the aim point a bit and converting the materials into something we can use. In the section on growth we will see that these materials can make truly astronomical amounts of new land available. In the section on wealth we will see that these materials can make someone, maybe you, filthy rich. Thus, an asteroid that once threatened billions of lives can be turned into land and money. Not a bad deal. We have at least a chance of finding the asteroids that will hit us in time to do something about it. Asteroids almost always stay in the inner solar system and can usually, although not always, be observed decades or even centuries before they hit Earth. Not so comets. Typical comets spend most of their life far from the Sun in highly elliptical (elongated) orbits. Occasionally, one comes screaming through the inner solar system at extremely high speed before heading back out. While asteroids tend to hit Earth at about 20 km/sec (45,000 miles per hour), long period comets strike at around 50 km/sec (112,500 miles per hour) [Willoughby and McGuire 1995]. For example, Halley's comet visits us only once every 86 years, spending only a short time near enough for Earthlings to observe it and decades lolly gagging out past Pluto. Even with a truly first-rate observation system (which we don't have at the moment), if a comet is on a collision course with Earth we will have a few months warning, or less. There simply won't be enough time to deflect it, no matter how hard we try. We will be doomed. Fortunately, since comets spend much less time than near-Earth asteroids in the inner solar system, there is a much smaller chance of collision, so we probably have some time. Given the short warning times a civilization limited to Earth would have, only a solar system wide observation system can identify problem comets in time. Worse, the system has to keep functioning for millions of years. This will never work. However, comets contain vast quantities of water. They will be of great value to space colonies. The truly large-scale orbital civilization this book advocates (ten trillion or more people) will almost certainly exploit the comets as resources and, in the process, end the threat the Earth. Although this may take tens of thousands of years, the chance of cometary collision is so small that we probably have the time.

Asteroid colonization creates better living standards than Earth– creates more growth.

Globus 1996(Al Globus has bachelors in science and works at NASA Ames Research Center. Date isn’t in article last date on bibliography was 1996. http://space.alglobus.net/Basics/why.html)hss

Space colonization will enable almost unlimited growth. Growth of life, humanity, and the societies that choose to go. A single 1km (0.6 miles) diameter asteroid has enough materials to build about 800 square kilometers (~300 square miles) of orbital real estate . That's enough to house about 160,000 people quite nicely, probably in a number of separate colonies. There are about 1000 such asteroids in our neighborhood, so exploiting the near-Earth asteroids can provide housing for perhaps 160 million people, but it gets much better. Ceres, the largest asteroid, has enough material to build orbital colonies with a livable surface area about 200 times greater than the entire Earth. That's a lot of elbow room. In fact, that one asteroid there's enough space for at least one trillion people, assuming the same density as Earth. Of course most of the Earth is essentially unpopulated - the oceans cover 2/3 of the Earth and most deserts and mountains are pretty empty. But just in case my calculations are optimistic, lets say there's only room for ten trillion folks. Ten trillion is a nice round number and will do for now. While growth is its one reward, there are others. One immediate Earthly benefit of this growth potential is less war. Specifically, wars motivated by the desire for territorial won't make sense any more. Of course, some people think territorial wars don't make sense now and they have a point. However, if a country wants more land there's only one way to get it: force.

\*\*\*Solvency---Terraforming\*\*\*

Terraforming Solvency

Warming Mars is easier than it seems via the runaway effect.

Miller 10 (Cole, Astronomy prof-U Maryland, Terraforming and the Future of Humans in Space, http://www.astro.umd.edu/~miller/teaching/astr380f09/lecture27

.pdf)

Clearly the two main challenges to terraforming Mars are to warm it up and thicken its atmosphere. Given enough time and effort we could do this, but how much would really be required with forseeable technology? A decade? A century? A million years? We also need to estimate the energy and resources needed. Fortunately, Robert Zubrin and Christopher McKay wrote a 1993 article that goes into some depth on these issues, so we will follow them closely. A key point that will make terraforming Mars much easier is the principle of a runaway greenhouse effect. Suppose that we were to warm Mars up by a few degrees Celsius. This would release some of the carbon dioxide in the permafrost, but since CO2 is a greenhouse gas this would increase the temperature further, releasing more gas, and so on. Therefore, even though the current average surface temperature on Mars is −60◦C, we would not have to heat it by 60◦C to give life a fighting chance. The true temperature increase needed is much less. Probably all we need to do is provide the first 5◦C warming and then let the runaway take care of the rest.

It’s possible to alter the orbits of asteroids to release ammonia, which is better than CO2.

Miller 10 (Cole, Astronomy prof-U Maryland, Terraforming and the Future of Humans in Space, http://www.astro.umd.edu/~miller/teaching/astr380f09/lecture27

.pdf)

We therefore explore the second suggestion, which is that if ammonia-rich asteroids exist in the outer solar system, then altering their orbits to hit Mars would release ammonia, which is a better greenhouse gas than CO2. We say outer solar system because, counterintuitively, it would take less energy to divert such an object to Mars than it would take for one in a closer orbit. The basic reason is that objects farther away orbit more slowly. Therefore, only a slight change in the speed is needed to make it go from an orbit to a radial plunge. For objects closer in a much larger change in speed is necessary. In addition, we can be clever by using “gravity assists” from the outer planets, in which we divert an asteroid so that it goes close by, e.g., Uranus, whose gravity then moves it onto a collision course with Mars. This principle is used all the time to save energy on orbits of satellites that are sent to planets in our Solar System. For the orbits we have in mind, the flight trajectory would take some decades to hit Mars.

Terraforming Solvency---Empirics

Popular Science ’10 (Magazine focusing on Space, Technology relating to science, Future Mars Colonists Could Learn To Terraform By Studying Darwin's Methods, Popular Science, http://www.popsci.com/science/article/2010-09/future-mars-colonists-could-learn-terraform-studying-darwins-methods) JL

The BBC interviews Darwin biographer David Catling, a professor at the University of Washington-Seattle, who says he believes Darwin decided to build a lush “Little England” on the volcanic island after visiting it in 1836. Darwin’s friend Hooker explored Ascension a few years later, and in 1847, Darwin convinced Hooker to get his father -- director of the Kew Gardens -- to send trees, hoping they would capture rain, prevent erosion and reduce evaporation. Beginning in 1850 and continuing each year, ships brought an assortment of plants from botanical gardens in Europe, South Africa and Argentina, the BBC says. By the late 1870s, eucalyptus, Norfolk Island pine, bamboo, and banana had taken hold. Today, Ascension is home to a cloud forest that would have taken millions of years to evolve naturally, according to Dave Wilkinson, an ecologist at Liverpool John Moores University in the UK. It’s proof that humans can build a fully functioning ecosystem simply through trial and error, he said. As the BBC reports, the same principle could be used in future Mars colonies: “Rather than trying to improve an environment by force, the best approach might be to work with life to help it find its own way.” Intelligent design, indeed.

\*\*\* Solvency--- Misc \*\*\*

Solvency--- Nanotech

Space Colonization is possible-Molecular Nanotech & Diamonoid Material

**Globus 11** (Al Globus, Senior Researcher at NASA, “Space Settlement Basics”, <http://settlement.arc.nasa.gov/Basics/wwwwh.html>, 5/29/2011) SV

One candidate for a major improvement in manufacturing technology is molecular nanotechnology. An important branch of nanotechnology is concerned with developing diamonoid mechanosynthesis. This means building things out of diamond-like materials, placing each atom at a precise location (ignoring thermal motion). Diamond is 69 times stronger than titanium for the same weight and is much stiffer. If spacecraft were made of diamonoid materials rather than aluminum, they could be much lighter allowing more payload. For an excellent analysis applying nanotechnology to space development, see McKendree 1995 Diamond mechanosythesis may enable a radical transportation system that could allow millions of people to go to orbit each year -- an orbital tower. An orbital tower is a structure extending from the Earth's surface into orbit. To build an orbital tower, start construction at geosynchronous orbit. Extend the tower down towards Earth and upwards at the same rate. This keeps the center-of-mass at geosynchronous orbit so the tower stays over one point on the Earth's surface. Extend the tower all the way to the surface and attach it. Then an elevator on the tower can move people and materials to and from orbit at very low cost. There are many practical problems with orbital towers, but they may be feasible. An orbital tower is in tension so it won't collapse, but it must be very strong or it will break. The point of greatest strain is at geosynchronous orbit, so an orbital tower must be thickest at that point. The ratio of the diameter of the tower between geosynchronous orbit and the ground is called the taper factor. For steel, the taper factor is greater than 10,000 making a steel orbital tower completely impractical. However, for diamonoid materials the taper factor is 21.9 with a safety factor to McKendree 1995 . thus a diamonoid orbital tower 1 meter thick at the ground would be only 22 meters thick at geosynchronous orbit. Fullerene nanotechnology, using carbon nanotubes, may be even better than diamonoid allowing a smaller taper factor. Calculations suggest that the materials necessary for construction of such an orbital tower would require one asteroid with a radius between one and two kilometers. These calculations assume the tower is built from diamonoid material with a density of 4 g/cm^3 and the asteroid has a density of 1.8 g/cm^3 and is 3% carbon. Thus, molecular nanotechnology may enable space settlement.

Solvency--- Space Hopping

Space Hopping solves Travel issues

**The Space Review 11** (“New strategies for exploration and settlement”, <http://www.thespacereview.com/article/1860/1>, 6/6/2011) SV

What is Greason’s idea for a strategy? In the speech, he proposed a “planet hopping” approach analogous to the “island hopping” strategy the US used against Japan in World War Two. “What we have to do is take the planetary destinations in sequence,” he said, referring to the Moon, near Earth objects, the moons of Mars, and Mars itself. “In each one of them, the purpose of the initial human outpost is not to be there and look cool. It is not to unfurl flags and take pretty pictures, and it is not the holy grail of science, although we will get all of those things. It’s to make gas.” That is, each destination will produce propellant that will enable a cost-effective step to the next destination. “If you do that, a lot of interesting things fall out,” he said. Such an approach would generate demand for propellant in low Earth orbit, enabling lower cost launches (through increased demand for launches to supply that propellant) and propellant depots, and also provide a predictable market for new reusable launch vehicles. That strategy also allows time to build up deep-space experience and finding ways to deal with hazards like radiation before going directly to Mars; Greason likened missions to L1 and near Earth objects to the Gemini missions that built up experience and capabilities for NASA’s early human spaceflight program before the Apollo lunar missions. Moreover, such a strategy could be affordable within NASA’s current budget. “Let’s face an uncomfortable truth: the national NASA budget is not going up,” he warned, adding that declines were all but inevitable in the years to come as overall federal spending is reduced. “It’s my belief that if we pursued this the right way, we actually could afford to do this, all the way out to the first landings on Mars, for the kind of budget NASA’s getting now,” he said, or possibly even a little less.

\*\*\* 2AC \*\*\*

Privatization CP---2AC

The private sector can’t profitably do necessary R&D for sustained human colonies

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

The key to this new paradigm is to learn if it is possible to use lunar and space resources to create new capabilities and if so, how difficult it might be. Despite years of academic study, no one has demonstrated resource extraction on the Moon. There is nothing in the physics and chemistry of the materials of the Moon that suggests it is not possible, but we simply do not know how difficult it is or what practical problems might arise. This is why resource utilization is an appropriate goal for the federal space program. As a high-risk engineering research and development project, it is difficult for the private sector to raise the necessary capital to understand the magnitude of the problem. The VSE was conceived to let NASA answer these questions and begin the process of creating a permanent cislunar transportation infrastructure.

Solely private space industry fails---government involvement’s a key insurance policy

PM 10 – Popular Mechanics, March 9, 2010, “What Happens If NASA's Constellation Program Dies?,” online: http://www.popularmechanics.com/science/space/nasa/4343791

President Obama is selling the idea of bringing private space into NASA's fold as a whole new way of thinking, but NASA under the Bush administration already got the ball rolling with ISS resupply contracts to the private space companies Orbital and SpaceX. But the Bush team hedged their bets by keeping a government program functional. What will happen if private space fails to create a reliable launch vehicle? So far they are doing well, but a small engineering flaw or a mishap could grind the effort to a halt. Also, as private space companies morph into large contractors, will the risk of bureaucratic lethargy increase, as seen in the defense industry among prime contractors?

Government-sponsored moon colonies trigger massive waves of synchronous private investment

Dinkin 4 – Sam Dinkin, columnist for the Space Review, September 7, 2004, “Colonize the Moon before Mars,” online: http://www.thespacereview.com/article/221/1

Labor-saving technologies are likely to give a boost to the terrestrial economy. The fine details of how this will affect us is hard to predict, but if the cost of labor on the Moon is high because of the high cost of transportation, new and varied uses of teleoperation and robotics will become cost effective. Some of those technologies will have immediate application on Earth. The less scripted and higher intensity nature of lunar development will allow these to emerge more quickly from lunar than martian colonization.

To sum up, the lunar economy can pay for all its imports through the tourism industry, intellectual property exports, science, entertainment, space skills, low-g skills and labor saving technology.

There could be a huge wave of private investment that is coincident with government colonization efforts. That could result in a co-development of many industries such as terrestrial point-to-point rocket service, orbital tourism, teleoperation, and robotics.

The private sector cannot act alone- government action is key.

Pace 09 (Scott, Director of the Space Policy Institute-George Washington, A Day Without Space: Economic Security Ramifications, http://www.marshall.org/pdf/materials/728.pdf)

Scott Pace: I agree. The cost per pound and those sorts of things depends on how often you are going. If you are going once a day, that is different than going once every ten years. Some of the better analyses that I have seen on that price elasticity issue point out that you have to get a pretty high flight rate to get some of those potential benefits. I think it is hard to imagine getting there solely with the government and I have a hard time imagining getting there solely with the private sector. Some of the combinations and approaches that have been examined, include private human passenger travel into space as well as using government purchasing power for sustaining markets like cargo systems to the space station and hopefully the moon. Those are some of the basic elements. Now people argue about which you do first or second, how many of one or the other and what the right portfolio mix is. The answer is that both public and private demand is going to be necessary in some part and each part of this economy plays its own role. It is not NASA’s job to promote space tourism. It can help it and support it and lobby for it; that is great. But NASA’s job is to do the public mission that has been assigned by the president and congress and use its purchasing power and things like the COTS program. We should recognize that both of those elements, the public purchasing power and support of private markets and private market opportunities, are important to exploring. This is not a done deal as to what the outcome will be. Part of what we should do in exploration is finding out what is possible.

Privatization CP---2AC

NASA and private sector co-op necessary

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

This section will address how NASA can be a good business partner by examining multiple programs and opportunities for cooperation. NASA is known as one of the largest organizations to innovate, develop and utilize new technology. Long-term exploration missions will require cooperation between the private sector and NASA, which will in turn foster an industry more equipped and willing to support space exploration.

NASA is helping Private Sector-prizes, tech, agreements, and programs

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

NASA is also a catalyst because of its current and planned actions. As of right now NASA has setup up prizes known as Centennial Challenges, which invite private companies to compete and develop new technology systems (77). NASA would like to complete by 2012 at least one prize competition for “independently designed, developed, launched, and operated missions related to space science or space exploration” (7). Besides prize competitions NASA is also stimulating the growth of a private industry by looking to expand their number of launch service providers to include emerging US companies. NASA will try to encourage the development of the launch sector by awarding intellectual property rights for technology and systems developed (7). NASA has also worked to encourage commercial involvement through Space Act Agreements, like the current Commercial Orbital Transportation System (COTS) B-10 program which is hoped to provide transportation for crew and cargo to the ISS by 2010. Finally NASA has developed the Innovative Partnerships Program, which will focus on partnering the US private sector with NASA‟s interests to produce technologies for future missions (7). This program allows NASA to leverage the private sector‟s capabilities, while fostering the growth of the industry. All of these actions and programs coordinated by NASA further the growth of the private industry.

ITAR prevents the expansion of the Private sector

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

The problems stemming from the International Traffic in Arms Regulations are complex and far reaching. Perhaps the most import issue arising from ITAR is the cost of compliance to the policy. This issue is especially relevant when considering that many of the companies on the forefront of commercial space are small compared to the normal government defense contractors. The burden of filing for export license review, in terms of money and time lost, is felt universally. However, large defense companies are acquainted with the licensing process and often have a full staff dedicated to streamlining the process. Smaller companies, like many New Space companies, are not so fortunate as to have full time staff dealing only with obtaining these licenses. In addition, these companies are often unfamiliar with the process. This increases the amount of time it takes them to receive a license and makes it more likely that the license will not get approved. The costs incurred are also more heavily felt by the smaller companies that the large ones. This creates a high barrier of entry into the space industry and ultimately hinders the ability of the smaller space companies to compete in the global marketplace.

NASA is pushing for the private sector

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

A second major catalyst for the development of the commercial industry is the attitude and actions of NASA. NASA recently launched a very pro space commercialization baseline in their 2006 Strategic Plan. In this Strategic Plan, they established six goals that are going to be followed through the next ten years to meet the Vision for Space Exploration. The fifth strategic goal of this plan was to “Encourage the pursuit of appropriate partnerships with the emerging commercial space sector” (7). This basic attitude bodes well for the commercial industry, because it shows that NASA is willing to support a fairly new industry, and it will help it to grow and flourish, rather than squash it. NASA‟s Exploration Systems Mission Directorate has also stated in the Strategic Plan that it will “stimulate new ideas and invite private entrepreneurs to provide space capabilities from the private sector” (7). Overall NASA‟s attitude is a catalyst because they are encouraging and looking for commercial involvement.

NASA uses Commercial Industry.

NASA

Page last updated: June 10, 2011

(http://www.nasa.gov/offices/c3po/home/c3po\_goal\_objectives.html) “Commercial Crew and Cargo”

Commercial Crew and Cargo Program Office (C3PO)

Program Goal

The C3PO will extend human presence in space by enabling an expanding and robust U.S. commercial space transportation industry.

Program Objectives:

Implement U.S. Space Exploration policy with investments to stimulate the commercial space industry

Facilitate U.S. private industry demonstration of cargo and crew space transportation capabilities with the goal of achieving safe, reliable, cost effective access to low-Earth orbit

Create a market environment in which commercial space transportation services are available to Government and private sector customers

Privatization CP---2AC---Leadership Adv

Commercial space assets aren’t sufficient to ensure US space security- government capabilities key.

Newton 11 (Elizabeth, Director for Space Policy- U Alabama-Huntsville, with Michael D. Griffin, United States space policy and international partnership, Space Policy 27 n 1, 2011)

As stated in the White House’s space policy and Lynn’s preview of the National Security Space Strategy, US security hinges on fostering a cooperative, predictable space environment where countries can operate in a stable, sustainable way. Planned debris tracking standards, considerations of international ‘rules of the road’, and shared data sets for collision avoidance and debris mitigation are measures that undoubtedly will contribute to the security of space as a shared venue for national activities. The stated desire to develop a Combined Space Operations Center for coalition operations could expand access to information, awareness, and services. Leveraging partner capabilities, integrating them into system architectures, and increasing the interoperability of systems are important planned steps as well. These new strategies do not diminish the USA’s current strengths in the national security space realm and quite likely stand to capitalize on international interest in multilateral solutions. Further information will doubtless be forthcoming in the Space Posture Review. One might also mention, under the theme of security, the USA’s ability to access its strategic assets in space. On the civil space side, the ‘gap’ in the government’s ability to access the International Space Station (ISS), a >$70 billion asset, after the Shuttle’s retirement is certainly detrimental from a strategic point of view. The USA will be dependent on the goodwill of international partners until an as-yet-unrealized commercial capability becomes available. However even then, the policy’s lack of support for having an independent federal capability is worrying, for it is tantamount to relying on FedEx without the back-up of a US postal service; or on commercial airlines without alternative military air transport; or on commercial weather forecasting without a National Oceanographic and Atmospheric Agency (NOAA).

Commission CP---2AC

Presidential top-down leadership key to spacepower.

Logsdon 11 (John, former Director-Space Policy Institute, and member-NASA Advisory Council, “Chapter 27: Emerging Domestic Structures: Organizing the Presidency for Spacepower,” http://www.ndu.edu/press/space-Ch27.html)

If there is to be a national strategy for space informed by a comprehensive theory of spacepower, it must come from the center of government: "The bureaucracy is no more equipped to manufacture grand designs for Government programs than carpenters, electricians, and plumbers are to be architects. But if an architect attempted to build a house, the results might well be disastrous."3 The White House must act as the "architect" for a U.S. space strategy and must persuade the various centers of spacepower within and outside the Federal Government that it is in their mutual interest to work together in turning that strategy into action. How best to achieve Presidential control over executive branch agencies is a classic problem of government organization, and it is basically no different in the space sector than in other areas of government activity.

CP cant solve policy churn- CP doesn’t set clear leadership on space policy.

Logsdon 11 (John, former Director-Space Policy Institute, and member-NASA Advisory Council, “Chapter 27: Emerging Domestic Structures: Organizing the Presidency for Spacepower,” http://www.ndu.edu/press/space-Ch27.html)

A second observation is that a separate White House space policy organization, such as a space council, has not been successful in demonstrating its superiority as an organizational approach. Although the National Aeronautics and Space Council existed from 1958 to 1973, it never became the major, much less the sole, means for developing a national approach to what would now be called spacepower. With only a few exceptions, other Executive Office organizations, particularly the Office of Science and Technology Policy and the National Security Council, not to mention the White House budget office, and the heads of the executive branch space agencies were not willing to defer to the council as the primary forum for developing space policy options for the President. Reestablishing the National Space Council in 1989 was an initiative forced on a reluctant White House by Congress. In its 4 years of operation, an activist council staff managed to alienate most executive agencies. Its major policy proposal, the Space Exploration Initiative, was stillborn; the council did not prove an effective mechanism for rallying broad support for a Presidential space initiative or for convincing the NASA leadership that the initiative was the proper course of action to follow. One possible reason for the space council's lack of influence is that it has been headed during most of its history by a Vice President who was not a close ally of the President, who had no strong Washington political base of his own, and thus could not call on either the President's or his own power to back up the guidance provided by the council and its staff. In addition, by operating outside of the National Security Council structure, the space council found it very difficult to exert influence on national security space issues.

Spending DA---2AC

The plan works within existing and projected NASA budgetary constraints

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

Subsequent statements and writings elaborated on the purpose of the VSE. Despite concerted efforts to distort its meaning, the goal of lunar return was not to repeat Apollo but to create a long-term, sustained human presence in space by learning to use the material and energy resources of the Moon. The VSE was to be implemented under existing and anticipated budgetary constraints; the guidance given to NASA for this aspect of the mission was to stretch timetables if money became short. The idea was to create this new system with small, incremental, yet cumulative steps.

NASA puts more money back into the economy as exploration increases- jobs.

Hanner, 10[Karen Hanner , Ames Research Center, 2010 “NASA Ames Stimulates Economy With Jobs, Innovation” http://www.nasa.gov/centers/ames/news/releases/2010/10-38AR.html]

MOFFETT FIELD -- NASA’s Ames Research Center generated 5,300 jobs and $877 million in total annual economic activity in the nine-county San Francisco Bay Area in 2009, according to a new economic benefits study. The study found that nationally, NASA Ames supports more than 8,400 jobs and generates $1.3 billion in annual economic activity. Coordinated by the NASA Research Park Office and prepared by Emeryville-based Bay Area Economics (BAE) in association with Architecture, Engineering, Consulting, Operations and Management’s San Francisco office, the study also reported that NASA Ames produced 5,900 jobs and contributed $932 million to California’s economy in 2009. The study also forecast that NASA Ames’ total economic impacts will grow significantly as its NASA Research Park (NRP) is completed. “As Ames explores space and our planet, it stimulates economic growth by employing scientists and engineering professionals, promoting technology innovation, and preparing the workforce of the future — all to enhance the health, growth, and long-term competitiveness of the Bay Area and the nation,” said Ames Director S. Pete Worden. Currently host to more than 70 on-site industry, university and non-profit partners, NRP will ultimately comprise 5.7 million square feet of new construction for research and development offices, university classrooms and laboratories, rental housing, museums, and a conference and education center.

NASA spending is popular- efforts to extend 6 billion dollar budget proves.

Svtiak, 4/6 [Amy Svitak, Space 06 April 2011 “Proposed Spending Bill Would Cut $139 Million from NASA Budget” http://www.space.com/11315-nasa-budget-cuts-congress-bill.html]

WASHINGTON — NASA could lose $139 million in funding this year if Congress adopts a short-term spending bill introduced by the U.S. House of Representatives April 4 to keep the government operating through mid-April. The proposal, which includes $12 billion in proposed reductions to discretionary spending in 2011 and would fund the U.S. Defense Department through the remainder of the fiscal year, would trim NASA’s space shuttle program by nearly $100 million below the 2010 appropriated level of $6.14 billion. Another $40 million cut would come from the agency’s construction and environmental compliance account, for which Congress appropriated $448 million last year. If enacted, the temporary spending bill, H.R. 1363, would prevent a government shutdown for an additional week beyond Friday (April 8), when the current stopgap spending measure expires. Rep. Hal Rogers (R-Ky.), who chairs the House Appropriations Committee, said House and Senate lawmakers had worked "diligently and fervently," albeit unsuccessfully, to negotiate a long-term spending plan that would fund federal agencies through Sept. 30, the end of the fiscal year. "This bill is not the preferable way to go forward, and I would greatly prefer to come to a final agreement with the Senate to put this long-overdue budget work behind us," Rogers said in an April 4 statement. "However, we must maintain critical programs and services for the American people and protect our nation’s financial future."

Spending DA---2AC---Mars

Mars Colonization not expensive- Humans liquidate their assets on Earth.

Hickman, 10[John Hickman, Space Review, 2010 “Space colonization in three histories of the future” http://www.thespacereview.com/article/1732/1]

Britons James Lovelock and Michael Allaby described the colonization of Mars in their 1984 book The Greening of Mars in a scenario that involved terraforming using contemporary stockpiles of banned ozone-layer-destroying chlorofluorocarbon aerosols as greenhouse gases, transported by the thousands of American and Soviet ballistic missiles that would made redundant by the anticipated end of the Cold War.2 Utterly unworkable in every particular, their scheme was remarkable because they offered suggestions for solving the two most daunting problems in space colonization: financing the project and populating the colony. Some of the cost of establishing the colony would come from the ballyhooed “peace dividend,” an economic windfall that some believed would come from dramatically reduced government spending for national security and the revenues from the sale of decommissioned military bases. Colonists would finance their own way passages to Mars by liquidating all of their assets on Earth and then investing the proceeds in Martian real estate before their departure. Selling real estate on the fourth planet also would be used to help finance the colony. Completing the difficult task of terraforming Mars and making the colony economically viable would be the responsibility of the colonists. This is how Lovelock and Allaby describe that process: The new idea was to combine the reformation of Mars with old-style colonies living in bunker-like protection, so that the new inhabitants could superintend the transformation, accelerate it dramatically, and, because they were on the spot, take advantage of new ideas and opportunities as they presented themselves… I doubt whether anyone thought of the scheme in such cruel terms, but it amounted to recruiting human volunteers and slave non-humans, transporting them to Mars, putting them in an enclosed, almost penal setting, and leaving it largely to them to work out how to escape.3

Politics DA---2AC

Massive bipartisan support for human space colonization

Spudis 10 – Paul D. Spudis, Senior Staff Scientist at the Lunar and Planetary Institute, February 9, 2010, “The New Space Race,” online: http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

The Vision for Space Exploration (the Vision, or VSE,) announced by President Bush in January 2004, called for returning the Shuttle to flight after the Columbia accident, completion of the International Space Station, a human return to the Moon and eventually voyages to Mars and other destinations. This proposal was subsequently endorsed by two different Congresses (in 2005 and 2008) under the control of different parties; both authorizations passed with large bipartisan majorities. The preface to the founding VSE document states that the new policy is undertaken to serve national “security, economic and scientific interests.”

Subsequent statements and writings elaborated on the purpose of the VSE. Despite concerted efforts to distort its meaning, the goal of lunar return was not to repeat Apollo but to create a long-term, sustained human presence in space by learning to use the material and energy resources of the Moon. The VSE was to be implemented under existing and anticipated budgetary constraints; the guidance given to NASA for this aspect of the mission was to stretch timetables if money became short. The idea was to create this new system with small, incremental, yet cumulative steps.

Massive Congressional opposition to Obama’s decision to scrap Constellation---means the plan’s hugely popular

PM 10 – Popular Mechanics, March 9, 2010, “What Happens If NASA's Constellation Program Dies?,” online: http://www.popularmechanics.com/science/space/nasa/4343791

Reporters at the Orlando Sentinel created a stir today by breaking news—citing anonymous sources—that President Barack Obama's budget will not include any funds for hardware for NASA's human space flight program. They say it axes all spending on the Constellation program: a Bush administration plan that tasked NASA with building a launch vehicle alled the Ares I to deliver supplies and staff to the International Space Station. The plan then called for a larger version of the rocket, Ares V, for longer missions including a return to the Moon.

There will certainly be a fight on Capitol Hill as politicians rush to save jobs, decry the lapse in national prestige and play blame games over who lost the moon. (In truth, both the Bush and Obama administration seem to have underfunded the Constellation plan.) Ares may be salvaged, but the program will not likely get the funds it needs to stay on track unless Congress rebels entirely. The Ares I program has already been hampered by redesigns, delays and cost overruns. (NASA has spent about $8 billion on Constellation hardware so far.) Any partial restoration of funds will only keep the program on life support and sap other NASA efforts.

Lunar colonization popular---perception of winning the new space race

Dinkin 4 – Sam Dinkin, columnist for the Space Review, September 7, 2004, “Colonize the Moon before Mars,” online: http://www.thespacereview.com/article/221/1

Politics

The Moon may become a very exciting destination with a substantial GDP. Being there first means that the high ground is already occupied for any future militarization of the Moon.

It’s possible that colonizing the Moon will help muster the political will to colonize Mars. Earthers will be able to see the colony directly with their own eyes. A convincing existence proof will be there for everyone to see that colonization is feasible and profitable.

A lunar colony is a politically feasible off-Earth gene bank increasing the chances that the species will be immortal. The act of leaving the cradle may be the other addition to our chances for immortality.

AT: Outer Space Treaty

Doesn’t prevent lunar or Mars colonization.

Edwards 06 (Bradley, Director of Research-Institute for Scientific Research, worked at Los Alamos researching advanced space technologies for 11 years, with Phillip Ragan, *Leaving the Planet by Space Elevator,* p. 126-127)

What about the space treaty? Will it prevent any nation from claiming ownership of the Moon or part of it, or Mars or any other body? In theory it does, though it only binds signatories, but in practice it is of little value. The treaty was signed at a time when the USA thought that the USSR might actually beat it to the Moon, so the USA was prepared to abandon ownership claims as long as the USSR did the same. The principle motivation was to ensure that neither side would use the Moon for military purposes. In a decade, the 1960's, when space travel costs were so prohibitive that only scientific Moon missions could be contemplated, no one seriously believed that Moon ownership could ever he an issue. Move forward to the 21st century and the outlook is very different. Now capitalism and competition rules the world, and why would it be any different for space?

\*\*\*Neg\*\*\*

\*\*\*Misc Case Answers\*\*\*

AT: Colonization/Earth is Doomed Advantage

Problems at hand come first-We have is no responsibility to care about what happens in the far future

**Stross 7** (Charles Stross, Freelance Journalist and Writer, “The High Frontier-Redux”, http://www.antipope.org/charlie/blog-static/2007/06/the-high-frontier-redux.html)

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.

AT: China Space Race

The US would win a Space Race vs. the Chinese

Boozer, 5-19 (Rick, Ph D in Astrophysics, Yahoo News, The United states will beat china in the newest space race, <http://news.yahoo.com/s/ac/20110519/sc_ac/8496119_united_states_will_beat_china_in_newest_space_race>, JG)

America is laying the groundwork for its greatest space endeavor since sending astronauts to the Moon. But that's not the story you will hear from a few senators and congressional representatives who are more concerned with bringing home pork than significantly advancing U.S. spaceflight prowess. Exaggerating China's future spaceflight plans is one of their favorite strategies. In fact Chinese space ambitions are modest. Their yet-to-be-started [space station](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=1265fvbqf/*http:/www.space.com/11592-china-space-station-tiangong-details.html) won't be complete until 2020 at the earliest. It will weigh only 60 tons compared to the International Space Station's 400 tons and less than half the defunct Russian MIR station's 130 tons. China's state news announced they are tentatively considering a [gigantic super rocket](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=12767ijcq/*http:/news.xinhuanet.com/english2010/china/2011-03/03/c_13759948.htm). It prompted [Rep. Frank Wolf of Virginia to say](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=12bo2bajo/*http:/wolf.house.gov/index.cfm?sectionid=34&sectiontree=6,34&itemid=1724), "The announcement made clear that if the United States does not get serious about its own Exploration Program, the next flag planted on the moon may be a Chinese flag." Even before the announcement, Rep. Bill Posey of Florida made similar [dire predictions](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=123kf1n0t/*http:/posey.house.gov/News/DocumentSingle.aspx?DocumentID=232177) about future Chinese space accomplishments. However, careful reading of the Chinese article reveals it is a preliminary feasibility study, NOT any actual plan to build the rocket. Furthermore, given that the rocket would carry a 130-ton payload, which is *exactly* the same payload weight as the [super rocket demanded by certain U.S. Senators](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=12lt8g6sf/*http:/www.associatedcontent.com/article/7858828/senators_crippling_nasa.html?cat=9), the Chinese study is probably just a knee-jerk response to the Senators' efforts. But the Chinese are glimpsing something that disturbs them. They are worried that the American company [SpaceX](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=10o4v26cn/*http:/www.spacex.com/) can launch satellites and people into space for [prices so low](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=12a3k6en9/*http:/www.innovationnewsdaily.com/elon-musk-private-rocket-prices-1957/) that [the Chinese can't compete with them](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=1588ehrqe/*http:/www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/asd/2011/04/15/11.xml&headline=China%20Great%20Wall%20Confounded%20By%20SpaceX%20Prices) ! SpaceX is one of the companies NASA is hiring to come up with space vehicles for sending astronauts to the ISS under its *Commercial Crew Development* (*CCDev*) program. Other CCDev companies include veteran aerospace giant [Boeing](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=1273v221v/*http:/www.boeing.com/Features/2011/04/bds_natl_space_symp_04_11.html) and newcomers [Sierra Nevada Corporation](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=1235dicir/*http:/www.nasa.gov/offices/c3po/partners/sierranevada/index.html) and [Blue Origin](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=11k7s0lc9/*http:/www.spaceref.com/news/viewsr.html?pid=36766). Competition between these companies would bring down launch prices allowing NASA to have more money for developing technology we will need [to send Americans to the Moon, asteroids, and Mars](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=13251f6mb/*http:/abcnews.go.com/Blotter/nasas-charles-bolden-americans-deep-space/story?id=13620479&page=3). However, the [money hungry super rocket](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=12lt8g6sf/*http:/www.associatedcontent.com/article/7858828/senators_crippling_nasa.html?cat=9) (that politicians are forcing NASA to build with obsolete and expensive 1980's era shuttle technology) jeopardizes the development of deep space exploration technology by potentially gobbling any money freed up with CCDev. Not relying heavily on subcontractors as its competition does, SpaceX manufactures 80% of its vehicle parts, giving them greater quality control. They use the same rocket engine in all of their launch vehicles. When they want more power, they add more engines to the vehicle, giving them economies of scale. Those are just a couple of the *many* ways they hold prices down while insuring high quality and safety. That affordability is allowing them to develop [the most powerful launcher since the Saturn V moon rocket](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=118bp67ja/*http:/www.spacex.com/falcon_heavy.php) *- totally on their own with no government money*! The other companies participating in CCDev also use American ingenuity to bring prices down. In a few years because of their cost savings, *more astronauts will be launched into orbit than have ever been before!* And if politicians can be prevented from squandering the money freed up by CCDev, Americans will lead the way in exploration throughout the inner solar system with such proposed NASA projects as [*Nautilus-X*](http://us.rd.yahoo.com/dailynews/ac/sc_ac/storytext/8496119_united_states_will_beat_china_in_newest_space_race/41535210/SIG=11dl36l6d/*http:/hobbyspace.com/nucleus/?itemid=26786) at much lower cost than the traditional way of doing things. Nautilus would be the first *true* spaceship that would *stay in space and never land*, with astronauts brought to it from Earth by the CCDev vehicles. NASA can accomplish great things without a budget increase. If we have the national will, the U.S. will dominate outer space, not the Chinese!

AT: Aerospace Advantage

ITAR prevents the development of the Aerospace Industry

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

Another area of concern with ITAR is its effect on the United States aerospace industry as a competitor in the global market. Because the process to obtain export licenses can be so costly, foreign customers often choose to deal with ITAR-free or non-U.S. companies. According to research done by the Department of Commerce and the Bureau of Industry and Security, between 2003 and 2006, the US share in the global market has decreased by 20% for all commercial communications satellites and by 10% for geosynchronous satellites. The reported loss of all foreign sales due to ITAR during the four year period was $2.35 billion. Furthermore, the study found that the average yearly cost of compliance industry-wide was $49 million. Many countries who would usually buy from the United States are instead researching the technologies themselves which is essentially proliferating the same technology that ITAR is intended to protect.,

Artificial Gravity---Status Quo Solves

New plans in place for developing artificial gravity.

Hsu 10 (Jeremy, Senior writer at Space.com, http://www.msnbc.msn.com/id/37120546/ns/technology\_and\_science-space/t/artificial-gravity-could-solve-space-problems/) OP

New plans for artificial gravity tests in space using centrifuges may hold the key to helping future astronauts ward off the debilitating loss of muscle and bone due to weightlessness on long missions to asteroids or the moon under NASA's revised space exploration plan. The new NASA budget proposed by President Barack Obama not only sets sights on long-duration missions, but also extends the lifetime of the International Space Station. Upgrades for the space station "could include a centrifuge to support research into human physiology," according to a summary by the Office of Management and Budget. Space station residents currently rely upon different exercises to keep themselves fit for the eventual return to Earth. But a spinning centrifuge device could create artificial gravity, which simulates the gravitational tug that a planet such as Earth has. The giant spinning device will give astronauts a healthy break from the weightlessness of space.

\*\*\*Colonization Impossible\*\*\*

Colonization Not Possible---Infertility

Colonization is not possible-Infertility

**Walker 11** (James Walker, Writer at gear Fuse, “Infertility Concerns May Leave Space Colonization Hopes Barren”, http://www.gearfuse.com/infertility-concerns-may-leave-space-colonization-hopes-barren/, 2/14/2011)

According to NASA Ames Chief Life Scientist Tore Straume (seen left with a villainous goatee), the radiation generated by cosmic rays and solar flares will make it difficult to conceive during interplanetary travel. Moreover, any child conceived during spaceflight could become sterilized due to the radiation. This conclusion is based on multiple studies conducted on “non-human primates” (read: “monkeys”) that were given doses of radiation and saw that the eggs of female fetuses began to die off during the second half of pregnancy, resulting in a sterile female when the fetus is finally birthed. Straume says, “One would have to be very protective of those cells during gestation, during pregnancy, to make sure that the female didn’t become sterile so they could continue the colony.” Similar problems could be seen in men, with the radiation damaging the male’s sperm. It’s also believed that in addition to the sterilization issues, other mental and physical defects could result from the radiation’s effects on a fetus.

Colonization Not Possible---No Tech

No Colonization-Tech

A. High Transportation Costs

**Woodcock 11** (Gordon R. Woodcock, Published over 100 Space Exploration books, On the NASA Advisory Board, Executive Vice President of the National Space Society, “NSS Roadmap: Technological Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/technological.html, 4/24/2011)

Lack of Affordable Transportation to Space: It's very costly today. Launching a pound of payload into space on the shuttle costs about $10,000; a typical expendable launch vehicle (ELV) charges about $5,000, and the cheapest ELV prices are about $3,000. If the shuttle were converted by putting a passenger cabin in the payload bay, it could carry about 50 passengers. At a launch cost of some $400 million, the ticket price would be at least $8 million. Only the wealthiest can afford such a price and few would choose to; at this price it is unlikely even one such excursion would ever get off the ground. Pundits and technologists have been promising that low cost space transportation is "just around the corner" for at least forty years. Shuttle was supposed to be low cost. So what's the story, really? When we watch a shuttle launch, it appears a prodigious amount of energy is being used. So much that cost simply can't come down a lot? The energy is not really that great; it is just released very rapidly. The theoretical energy of an object in orbit is about 4 kilowatt hours per pound. At typical retail energy cost of 10¢ per kWh, the result is 40¢ per pound. So why are we paying $5,000/lb? Are we doing something fundamentally wrong? Probably, but we don't know of a practical way to get to space except by rocket propulsion. We know the cost of operating a mature-industry transportation system (like motor vehicles or air transport) is about four to five times the underlying cost of the energy used. Figure it for a typical car: the gas costs about 6¢ per mile and total cost to run a car is about 30¢ per mile. Since we can't have low cost by continuing to throw away expensive aerospace hardware on every launch, let's consider the actual energy cost for reusable launch vehicles (RLVs). For a typical propellant load of hydrogen and oxygen, the cost is about $10/lb of payload. Applying 5 x energy cost as earlier, we expect $50/lb for a mature space transportation industry using RLVs. Evidently this isn't a mature industry. Why not? Because demand is too small compared to the large investments needed to develop an RLV and field a fleet of three or more vehicles. Paying off these investments means that RLVs are more cost-effective than ELVs only at traffic demand of 100 missions per year or more. Current worldwide demand is 20 to 40. The most comparable industry, commercial aviation, experiences demand of millions of flights per year. Calculations show that RLVs could approach the "mature industry" cost projection at a demand level of "only" thousands per year. If demand should grow to such numbers, a successful RLV must have certain other attributes: Turnaround time on the ground one or two days, low probability of loss, and vehicle life of more than 1,000 total flights. Two graphs illustrate: the first shows effects of traffic demand and vehicle flight rate (the latter dictated by turnaround time), and the second shows potential for cost reduction with all attributes selected to define a "successful RLV." Without high demand, the RLV business case does not close no matter how good the RLV's other attributes. Clearly, if space settlement were undertaken, traffic demand would be very large. However, without significant reduction in costs, a settlement program is seen as economically impossible. It's a "Catch-22." Government-funded human exploration supported by RLVs would improve the business case, but probably not enough for private investment: A modest lunar base needs about 25 launches/year to support four lunar trips per year. Mars exploration, assuming one trip per Mars opportunity, needs about 50 per year to put up enough equipment and propellant, and support orbital assembly operations. Other NASA demands are about 10 per year, and commercial communications, up to 20 per year. The projected total demand is about 100 launches/year, and the industry's revenue at NASA's target cost of $1,000/lb would be about $4 billion annually. That's actually a little less revenue than today. Investors and company boards will ask, "Why take high business risk if revenue doesn't grow even with success?"

B. Dependence on ELV’s

**Woodcock 11** (Gordon R. Woodcock, Published over 100 Space Exploration books, On the NASA Advisory Board, Executive Vice President of the National Space Society, “NSS Roadmap: Technological Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/technological.html, 4/24/2011)

Poor Safety Record for Launch Vehicles: This is the second barrier. Quite simply, it follows from the fact that launch vehicles evolved from military rockets, for which a reliability of 0.95 is good enough. A successful RLV, especially if it is to carry passengers, needs to evolve from the aviation tradition. It needs a fatality accident (loss) probability at least as low as one in a hundred thousand. Commercial jetliners today are about 1 in 10 million. My guess at how such an RLV would operate gives safety of flight the highest design priority. Preferably no staging events, i.e., single-stage-to-orbit. Horizontal takeoff and landing with refused takeoff capability. No in-flight engine starts unless the plane can fly back to safe landing in case of failure. Safe abort from anywhere in the trajectory with an engine out. A small number of engines. The safety optimum is 2 to 4 as for jet aircraft. Finally, redundant flight controls. Most of this comes straight out of federal air regulations for commercial jetliners. The technical challenges to achieve these attributes are daunting, and may take time. How does NASA's space launch initiative (SLI) fit into this picture? It is supposed to be paving the way for low cost and safe space transportation. NASA is anxious to show its RLV requirements "converge" with those of the commercial world. If true, NASA believes commercial investors would put up a large share of the money for RLV development. I believe commercial motivation to replace the new generation of satellite launchers just now coming into service is nil. Atlas III, Sea Launch and Delta III have had a couple of launches. Delta IV and Atlas V are yet to fly. These systems are mostly privately financed. Their investment has not been paid out. Replacing them with a lower-priced RLV is bad business. If prices are reduced, revenue is reduced.

C. No Closed-Loop Life Support System

**Woodcock 11** (Gordon R. Woodcock, Published over 100 Space Exploration books, On the NASA Advisory Board, Executive Vice President of the National Space Society, “NSS Roadmap: Technological Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/technological.html, 4/24/2011)

No Closed-Loop Life Support System The third issue facing development of a spacefaring civilization is life support. Permanent outposts or settlements can't afford to import life support supplies or equipment over the long term. The current technology is adequate for the space station. It provides partial recycling of water and oxygen, using "physico-chemical" technology. It uses chemical absorbers and reactors, and physical processes such as distillation and reverse osmosis, to recycle water and scrub CO2 from air. Oxygen is reclaimed by water electrolysis and CO2 reduction. Hydrogen and carbon from these processes are waste products, not recycled. There is no food production, and no recycling of wastes or garbage; these are returned to Earth. For the International Space Station, the crew and operations resupply requirement is about 10 kg per person per day. The ISS will typically have a crew of four; in 90 days it needs 900 kg per person; 3600 kg for the crew. This is easily within shuttle capabilities, even the capabilities of a crew and cargo vehicle flying on an ELV. There is little motivation to do better. A Mars proto-settlement of 1,000 people is a lot different. Such a settlement is not feasible with this state of technology. Consider 1000 people, 365 days, at about 10 kg/day. This figures to 3.65 million kg (about 8 million lb) per year. Even at reduced launch cost of $1,000/lb, the delivery cost to Mars is at least $5,000/lb. The annual cost therefore is $40 billion just for life support. No government or consortium of governments will put up with such high cost, and it is out of the question for the private sector. Bioregenerative technology is needed. This technology is also highly applicable to cleaning up our environment here on Earth. A permanent outpost needs a closed micro-ecology or something close to it. This means full recycling of all life support supplies, including waste and garbage. Periods of "no opportunity" for Mars resupply last almost two years; transit times are six months or more. Not only is the cost infeasible for ISS-level technology, the masses to be transported are outrageous. In a bioregenerative system, water and oxygen are recycled by semi-natural means, such as composting or oxidation of organic wastes, and condensation of water. CO2 is taken up by plants, and oxygen generated by photosynthesis. Plants produce food, and some may be ornamental or needed to make the micro-ecology stable. Food production is by "farming" — hydroponics. Animal protein production is feasible in larger outposts. Wastes are completely recycled. Nothing is thrown away. The life support and food production system must have long-term ecological stability. Such a closed-cycle technology is very poorly understood; Biosphere II showed how little we really know. Unfortunately, NASA is investing almost zero in this. A few years ago, NASA invested modestly. However, in today's political climate, these investments are seen as applicable only to non-approved programs and are strongly discouraged. It is likely that developing bioregenerative life support technology to a point of confident use, i.e., where space settlers could depend on it, will take longer to solve than the high cost of space transportation, perhaps much longer.

Colonization Not Possible---Economic Barriers

Note: In order to access this No Solvency Argument you have to win that the Plan uses status quo funding mechanisms

No Colonization-Economy

A. No Long Term Government Funding Mechanism

**Hopkins 11** (Mark Hopkins, Chairman of the Executive Committee for the National Space Society, “NSS Roadmap: Economic Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/economic.html, 4/24/2011)

No Long-term Government Funding Mechanism: Under current law Congress is not allowed to make financial commitments for more than one year. This is a major economic barrier. It forces the management of space projects to worry about next year's funding in every year of a project. This is true even if the project is on schedule and under budget. Companies can sign contracts that commit them to purchase a large number of items over a long period of time. This approach is frequently used when airlines purchase aircraft or communications satellite companies purchase launch vehicles. Block buying, as it is called, is a win-win way of doing business. It creates economies of scale and reduces the risk for both the supplier of the items (i.e., airplanes or launch vehicles) and for the company that purchases these items. It is also something the U.S. government is currently not allowed to do. Much worse than the inability of the government to do block buys are the implications for the design stability of major space projects. The early history of the International Space Station is a classic example of this problem. When the level of funding from year to year for a project becomes unstable and unpredictable, project plans must be frequently changed. The cost of redesign becomes a large fraction of the project expenses. Morale of employees can also become a problem. Who wants to spend a year of his or her life helping to design something, only to have most of his or her work thrown away? The program also becomes politicized. A savvy prime contractor needs to spend significant resources keeping the program sold in Congress. Decisions need to be made not only for technical, cost and efficiency reasons, but for political reasons as well. Selecting subcontractors so that they are located in the politically optimal congressional districts can become more important then selecting them on the basis of who can do the best job.

B. Lack of incentives for Capital Investment

**Hopkins 11** (Mark Hopkins, Chairman of the Executive Committee for the National Space Society, “NSS Roadmap: Economic Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/economic.html, 4/24/2011)

Lack of Incentives for Capital Investment: There are clear and widely accepted advantages to having the private sector run the parts of the space program where economic efficiency is important. Where markets exist, such as in communication satellites, private enterprise can do this without help from the government. In others, there may be insufficient incentive for capital investment without special help from the government. **Unless a reasonable profit can be made, commercialization will not occur**. High risk levels and unproven market size are factors that frequently pose problems to making profits and thus to attracting capital investment contributing to commercialization. A traditional approach is for the government to fund research and development that can be transferred to the private sector. This can greatly reduce risk. If the government also funds early operations, then risk can be reduced even further. In recent years there has been discussion of stronger government-sponsored incentives for capital investment. This has been particularly true in the context of how to commercialize potential reusable launch vehicles (RLVs).

C. Insurance Costs & Conditions

**Hopkins 11** (Mark Hopkins, Chairman of the Executive Committee for the National Space Society, “NSS Roadmap: Economic Barriers to Space Settlement”, http://www.nss.org/settlement/roadmap/economic.html, 4/24/2011)

Liability Insurance Costs and Conditions: By international agreement, there is an upper bound on the amount of liability that airlines have when one of their planes crashes. This reduces the possibility that a single crash will bankrupt an airline. Less risk for the airlines results in lower ticket prices. As the number of launch vehicle firms increases and failure rates approach those of commercial airlines, we can expect that RLVs will be treated similarly. Today, however, launch vehicles are known to have a much higher probability of failing. Moreover, there are virtually no players in the game and until there are more, insurance costs will remain a barrier. Current law makes the government liable for damages caused by launch vehicles being developed by the government. A private firm is liable for vehicles being developed with its own funds. In the case of a joint program, such as the X-33 project, where both government and private funds are being used to pay for development, the liability situation is unclear. This uncertainty adds needlessly to costs. We need clarifying legislation.

Colonization Not Possible---Travel Times

Travel distances and Establishment of colony takes too long-No viable Tech

**Stross 7** (Charles Stross, Freelance Journalist and Writer, “The High Frontier-Redux”, http://www.antipope.org/charlie/blog-static/2007/06/the-high-frontier-redux.html)

Historically, crossing oceans and setting up farmsteads on new lands conveniently stripped of indigenous inhabitants by disease has been a cost-effective proposition. But the scale factor involved in space travel is strongly counter-intuitive. Here's a handy metaphor: let's approximate one astronomical unit — the distance between the Earth and the sun, roughly 150 million kilometres, or 600 times the distance from the Earth to the Moon — to one centimetre. Got that? 1AU = 1cm. (You may want to get hold of a ruler to follow through with this one.) The solar system is conveniently small. Neptune, the outermost planet in our solar system, orbits the sun at a distance of almost exactly 30AU, or 30 centimetres — one foot (in imperial units). Giant Jupiter is 5.46 AU out from the sun, almost exactly two inches (in old money). We've sent space probes to Jupiter; they take two and a half years to get there if we send them on a straight Hohmann transfer orbit, but we can get there a bit faster using some fancy orbital mechanics. Neptune is still a stretch — only one spacecraft, Voyager 2, has made it out there so far. Its journey time was 12 years, and it wasn't stopping. (It's now on its way out into interstellar space, having passed the heliopause some years ago.) The Kuiper belt, domain of icy wandering dwarf planets like Pluto and Eris, extends perhaps another 30AU, before merging into the much more tenuous Hills cloud andOort cloud, domain of loosely coupled long-period comets. Now for the first scale shock: using our handy metaphor the Kuiper belt is perhaps a metre in diameter. The Oort cloud, in contrast, is as much as 50,000 AU in radius — its outer edge lies half a kilometre away. Got that? Our planetary solar system is 30 centimetres, roughly a foot, in radius. But to get to the edge of the Oort cloud, you have to go half a kilometre, roughly a third of a mile. Next on our tour is Proxima Centauri, our nearest star. (There might be a brown dwarf or two lurking unseen in the icy depths beyond the Oort cloud, but if we've spotted one, I'm unaware of it.) Proxima Centauri is 4.22 light years away.A light year is 63.2 x 103 AU, or 9.46 x 1012 Km. So Proxima Centauri, at 267,000 AU, is just under two and a third kilometres, or two miles (in old money) away from us. But Proxima Centauri is a poor choice, if we're looking for habitable real estate. While exoplanets are apparently common as muck, terrestrial planets are harder to find; Gliese 581c, the first such to be detected (and it looks like a pretty weird one, at that), is roughly 20.4 light years away, or using our metaphor, about ten miles. Try to get a handle on this: it takes us 2-5 years to travel two inches. But the proponents of interstellar travel are talking about journeys of ten miles. That's the first point I want to get across: that if the distances involved in interplanetary travel are enormous, and the travel times fit to rival the first Australian settlers, then the distances and times involved in interstellar travel are mind-numbing. This is not to say that interstellar travel is impossible; quite the contrary. But to do so effectively you need either (a) outrageous amounts of cheap energy, or (b) highly efficient robot probes, or (c) a magic wand. And in the absence of (c) you're not going to get any news back from the other end in less than decades. Even if (a) is achievable, or by means of (b) we can send self-replicating factories and have them turn distant solar systems into hives of industry, and more speculatively find some way to transmit human beings there, they are going to have zero net economic impact on our circumstances (except insofar as sending them out costs us money). What do I mean by outrageous amounts of cheap energy? Let's postulate that in the future, it will be possible to wave a magic wand and construct a camping kit that encapsulates all the necessary technologies and information to rebuild a human civilization capable of eventually sending out interstellar colonization missions — a bunch of self-replicating, self-repairing robotic hardware, and a downloadable copy of the sum total of human knowledge to date. Let's also be generous and throw in a closed-circuit life support system capable of keeping a human occupant alive indefinitely, for many years at a stretch, with zero failures and losses, and capable where necessary of providing medical intervention. Let's throw in a willing astronaut (the fool!) and stick them inside this assembly. It's going to be pretty boring in there, but I think we can conceive of our minimal manned interstellar mission as being about the size and mass of a Mercury capsule. And I'm going to nail a target to the barn door and call it 2000kg in total. (Of course we can cut corners, but I've already invoked self-replicating robotic factories and closed-cycle life support systems, and those are close enough to magic wands as it is. I'm going to deliberately ignore more speculative technologies such as starwisps, mind transfer, or AIs sufficiently powerful to operate autonomously — although I used them shamelessly in my novel Accelerando. What I'm trying to do here is come up with a useful metaphor for the energy budget realistically required for interstellar flight.) Incidentally, a probe massing 1-2 tons with an astronaut on top is a bit implausible, but a 1-2 ton probe could conceivably carry enough robotic instrumentation to do useful research, plus a laser powerful enough to punch a signal home, and maybe even that shrink-wrapped military/industrial complex in a tin can that would allow it to build something useful at the other end. Anything much smaller, though, isn't going to be able to transmit its findings to us — at least, not without some breakthroughs in communication technology that haven't shown up so far.

Colonization Not Possible---Health Hazards

Radiation, Travel times, Medical technicalities, no technology, No habitable environment

**Stross 7** (Charles Stross, Freelance Journalist and Writer, “The High Frontier-Redux”, http://www.antipope.org/charlie/blog-static/2007/06/the-high-frontier-redux.html)

Again, as with interstellar colonization, there are other options. Space elevators, if we build them, will invalidate a lot of what I just said. Some analyses of the energy costs of space elevators suggest that a marginal cost of $350/kilogram to geosynchronous orbit should be achievable without waving any magic wands (other than the enormous practical materials and structural engineering problems of building the thing in the first place). So we probably can look forward to zero-gee vacations in orbit, at a price. And space elevators are attractive because they're a scalable technology; you can use one to haul into space the material to build more. So, long term, space elevators may give us not-unreasonably priced access to space, including jaunts to the lunar surface for a price equivalent to less than $100,000 in today's money. At which point, settlement would begin to look economically feasible, except ... We're human beings. We evolved to flourish in a very specific environment that covers perhaps 10% of our home planet's surface area. (Earth is 70% ocean, and while we can survive, with assistance, in extremely inhospitable terrain, be it arctic or desert or mountain, we aren't well-adapted to thriving there.) Space itself is a very poor environment for humans to live in. A simple pressure failure can kill a spaceship crew in minutes. And that's not the only threat. Cosmic radiation poses a serious risk to long duration interplanetary missions, and unlike solar radiation and radiation from coronal mass ejections the energies of the particles responsible make shielding astronauts extremely difficult. And finally, there's the travel time. Two and a half years to Jupiter system; six months to Mars. Now, these problems are subject to a variety of approaches — including medical ones: does it matter if cosmic radiation causes long-term cumulative radiation exposure leading to cancers if we have advanced side-effect-free cancer treatments? Better still, if hydrogen sulphide-induced hibernation turns out to be a practical technique in human beings, we may be able to sleep through the trip. But even so, when you get down to it, there's not really any economically viable activity on the horizon for people to engage in that would require them to settle on a planet or asteroid and live there for the rest of their lives. In general, when we need to extract resources from a hostile environment we tend to build infrastructure to exploit them (such as oil platforms) but we don't exactly scurry to move our families there. Rather, crews go out to work a long shift, then return home to take their leave. After all, there's no there there — just a howling wilderness of north Atlantic gales and frigid water that will kill you within five minutes of exposure. And that, I submit, is the closest metaphor we'll find for interplanetary colonization. Most of the heavy lifting more than a million kilometres from Earth will be done by robots, overseen by human supervisors who will be itching to get home and spend their hardship pay. And closer to home, the commercialization of space will be incremental and slow, driven by our increasing dependence on near-earth space for communications, positioning, weather forecasting, and (still in its embryonic stages) tourism. But the domed city on Mars is going to have to wait for a magic wand or two to do something about the climate, or reinvent a kind of human being who can thrive in an airless, inhospitable environment.

\*\*\*Prizes CP\*\*\*

Prizes CP---1NC

CP TEXT: The United States Federal Government should create and administer a Prize Competition for (AFF)

Prizes Solve

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

5.4 Prizes 5.4.1 Background A proven way of accelerating an industry is through the use of prizes. Prize competitions are challenges proposed in areas in which increased involvement by private individuals or the commercial sector is sought. Prize competitions attract innovative people who are driven by passion, prestige, and personal achievement. Throughout history, prize competitions have been used to foster crucial development in many areas [Appendix C]. Prizes can create heroes, reflecting the level of visibility of the prize and the level of commitment of the general public. An example of this is Charles Lindbergh. The Ansari X PRIZE initiated the commercial development of sub-orbital space flight. The new Google Lunar X PRIZE has started a new, commercial race to the Moon. In order for man to get back to the Moon, NASA and the private industry will be forced to complete lunar characterization missions to determine th e locations of the best landing sites, habitable regions and available resources.

Prizes CP---Solves the Case---Moon Colonization

Prizes would help NASA return to the moon

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

5.4.2 Lunar Characterization Prize Proposal Currently, little is known about the lunar craters, especially those that lie in permanent shadows at the poles. A good way to gain this information is to create a new prize to complement the current missions planned by various space agencies. The goal will be to provide key measurements and information about the environment in these permanently shadowed craters. Such a competition would involve universities and other research entities, and develop 32 interest among the scientific community all around the world. Moreover, a prize competition can create a global scientific competition centered on lunar issues which will be advantageous for the return to the Moon. The instruments used may be secondary payloads on other robotics/manned lunar missions, and may then provide another source of cash-flow for emerging lunar delivery companies. If successful, not only would this prize provide valuable data on the environment in permanently-shadowed lunar craters, but it would verify a new prize model. This new model would provide smaller purses for data that could be used as a secondary funding source for commercial lunar missions. If this prize were successful, similar scientific prizes could be planned. These prizes would not necessarily be the primary mission of a spacecraft, but instead provide an additional opportunity for private companies to make a return on their investment. In the future, it is hoped that when these companies design a business model around landing a spacecraft on the surface of the Moon, that they can choose a few appropriate prizes and receive compensation for the data they collect. The model proposes that NASA would more or less buy the data that it wants and in the prize format would only pay if the data were collected successfully. This prize is detailed more thoroughly in Appendix C. The appendix also has further information on follow-on prize suggestions listed below.

Prizes CP---Solves the Case---General

Prizes increase Public excitement and Technology

Schroeder ’04 (Alex, analyst for the independence institute, The Application and Administration of Inducement Prizes in Technology, http://www.i2i.org/articles/IP\_11\_2004.pdf) JL

Twenty-five percent of all Americans had personally viewed the Spirit of St. Louis in the year immediately following Charles Lindbergh’s Trans-Atlantic flight. Given the state of personal transportation in 1927 as compared to now, this is a staggering number. Prizes in technology have shown to inspire the public much in the same way the NCAA Tournament does for college basketball. As of July 2004, the X Prize 1 had registered 3 billion print impressions of its name in newspapers, journals, and web sites. 2 This number has undoubtedly increased significantly after Burt Rutan claimed the X Prize in October. Prizes have historically been very effective at drawing public sentiment to a technology. An increase in public sentiment means a sequential increase in technology visibility and proliferation. This is evidenced by the way that the country latched on to information technology in the development of Silicon Valley.

Prize Competitions help solve NASA’s Mission and goals

Davidian ’04 (Ken, Member of DMG Associates, private company under contract to NASA, Prizes, Prize Culture, and NASA’s Centennial Challenges, http://www.ip.nasa.gov/documents/prize\_culture\_report.pdf) JL

Prizes have been used throughout history as a way to stimulate technology development with unexpected positive results for a fraction of what an equivalent contract would cost. Prizes have encouraged individuals, companies, and governments to achieve seemingly impossible goals. The popularity of prizes in the first part of the twentieth century and its resurgence in the present day have increased the membership in a “prize culture” that has led to stereotypical reactions by the traditional science and engineering communities. As is common with any stereotype, these contain some level of “truthiness,” but once examined closely, these stereotypes can be seen to link the traditional R&D and prize communities together. The Centennial Challenges program builds on the positive forces of prize competitions in an attempt to pursue NASA’s mission and goals in an exciting, innovative, and cost-effective way.

Prizes Key to Innovation

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

There are many more hurdles and various other possible business markets and accelerators. Those listed above are merely a start. To truly open up space to commercial development, many more ideas, inventions, and innovations will be required. It is thus very fortunate that free market societies such as ours thrive on such challenges. As markets evolve and demand grows entrepreneurs will be attracted to the limitless potential of space based companies. This can already be seen in the recent explosion in interest for sub-orbital space travel.

Prizes encourage different things than the Private Sector and NASA

Kay ’10 (Luciano, School of public policy @ GT, Technology R&D in the context of innovation inducement prizes Insights from the Google Lunar X Prize, PFD, http://www.spp.gatech.edu/faculty/WOPRpapers/Kay.WOPR10.2.pdf) JL

The prize literature suggests that there are at least two main reasons to think that R&D activities in prizes are different from traditional industry practices. First, the capability of prizes to attract unconventional entrants is cited very often (see for example Byko, 2004; Schroeder, 2004; Kalil, 2006). These unconventional entrants comprise individuals and teams that were not previously involved with the prize technologies and bring different approaches, perceptions, knowledge, and fresh ideas to the competition. Moreover, prizes may encourage unconventional partnerships between those entrants and other entities (Culver et al., 2007) and contribute new ways to organize R&D. Second, prizes create an instance of competition that induce a very focused R&D effort by offering a fixed reward and preestablished deadline and technology specifications (Newell & Wilson, 2005). In other words, in principle, teams have to focus their effort on a single and specific goal instead of having a continuous activity with multiple projects or customers. The difference between industry practices and prize R&D may be even more notable in a sector such as aerospace. In space technology, ―traditional industry‖ typically refers to the government led effort that has driven R&D since the 1950s. That is, the aerospace industry has been traditionally dominated by large government agencies from the U.S. and abroad, such as NASA and the Department of Defense, and large companies, such as Northrop Grumman and McDonnell Douglas Corporation (Bromberg, 2000). Technology development in this sector has been typically funded with procurement contracts and research grants with those large corporations. The performance of new systems for both manned and unmanned space flight and exploration has been increased, yet they have become more expensive and more complicated or ―tightly coupled.‖ Increasingly complex projects and longer space missions have led to more complex organizations to develop those new technologies. NASA and other space agencies have become large, centralized, bureaucratic, and less productive organizations - 5 - (McCurdy, 1994; Cucit et al., 2004; Petroni et al., 2009). In general, all these organizations have years of experience in aerospace technologies, strong internal in-house capabilities, extensive control systems to manage large and multiple projects, and hierarchical structures with division of labor and division of R&D centers. Corporate aerospace activity have concentrated in fewer players as well (Cucit et al., 2004). In particular in the U.S., the activities of large contractors have been influenced to great extent by NASA subcontracting and supervision policies (Bromberg, 2000). Only some studies show that large corporate R&D in aerospace can be differently organized for specific projects (see for example Malhotra et al., 2001). New regulations and a more commercial and entrepreneurial orientation of space activities in the U.S. in recent years is likely to lead to new forms of organization and R&D

Prizes CP---Solves R&D

Prizes solve R&D- 3 reasons:

A. Encourage Simplicity

Kay ’10 (Luciano, School of public policy @ GT, Technology R&D in the context of innovation inducement prizes Insights from the Google Lunar X Prize, PFD, http://www.spp.gatech.edu/faculty/WOPRpapers/Kay.WOPR10.2.pdf) JL

First, this paper considers the relationship between the characteristics of prize technologies and the time constraint. In aerospace development, simpler designs decrease the probability of facing - 6 - technical problems because there are fewer components and less complex interrelations between them, and the probability of detecting a problem before significant damages is much higher. In the context of prizes, assuming that the goal of teams is to win the competition, simpler designs may represent the shortest path to achieve the prize challenge considering the fixed deadline and the more or less prespecified technology challenge. According to that, technical simplicity is likely to be the most important design criterion. Teams may also draw upon already existing designs or technologies to save additional development time in their projects. Proposition 1: Limited amount of time for technology development leads to simpler designs and reliance upon existing designs or standard technologies.

B. Cost efficient technologies

Kay ’10 (Luciano, School of public policy @ GT, Technology R&D in the context of innovation inducement prizes Insights from the Google Lunar X Prize, PFD, http://www.spp.gatech.edu/faculty/WOPRpapers/Kay.WOPR10.2.pdf) JL

Second, this paper considers the relationship between resources and the budget constraint. One of the main characteristics of prizes is that they do not provide upfront funding to find solutions to the prize challenge. This may have significant implications for prizes linked to aerospace technologies. Aerospace projects have become increasingly complex and expensive, to the point that no one firm can afford to tackle space exploration projects alone (Bugos & Boyd, 2008). Moreover, the GLXP rules require teams to be mostly privately funded (90 percent of the project has to be privately funded,) pushing teams to either seek funding from investors or gather as much resources as possible from alternative sources. Previous research on aerospace prizes has observed how teams draw extensively upon volunteer effort to work on their projects (Kay, 2010). This paper looks at the volunteer effort and other forms of external resources as well, such as funding from investors and partnerships with other organizations to account for both monetary and in-kind contributions. For this research, volunteer effort is defined as sporadic or irregular collaborations of individuals with the prize teams. Proposition 2: A lack of upfront funding leads to increasing diversity of sources to - 7 - gather external resources

C. No Bureaucracy

Kay ’10 (Luciano, School of public policy @ GT, Technology R&D in the context of innovation inducement prizes Insights from the Google Lunar X Prize, PFD, http://www.spp.gatech.edu/faculty/WOPRpapers/Kay.WOPR10.2.pdf) JL

Third, this paper considers the relationship between technology characteristics and R&D organization. Teams are likely to adopt different forms of organization to respond to the prize challenge. An interesting feature of prizes is that they can reduce bureaucratic and accounting barriers that accompany typical grant and contracting processes (Newell & Wilson, 2005), which allows teams to pursue alternative approaches to R&D organization. On the other hand, considering aerospace activity in particular, if teams are only targeting the prize, they do not need to (or cannot) create an entire organization and infrastructure to pursue multiple projects. In other words, while teams face a significant technical challenge, they lack the ―traditional‖ infrastructure used for this kind of projects. Therefore, this research introduces a third proposition to explore the relationship between the characteristics of the technology that teams develop and their forms of R&D organization. Proposition 3: The organization of team R&D activities determines the general characteristics of the prize technologies.

Prizes CP---Private Sector Net-Benefit

Prizes increase investment by the private industry

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

Community and public outreach events like the X PRIZE Cup are catalysts to the commercialization of space because they energize the public and generate support for the industry. The X PRIZE Cup is a space expo that was started in 2004 where airplanes and rockets fly together for crowds of up to 85,000 people (79). These types of events can be considered catalysts because they involve the public in the industry. The public becomes thrust into the action of the emerging technology scene for the Space Industry, and their interest is peaked. The public‟s intensified interest is critical because the more excited the public is about space, the more stable the market will become, and the more investment there will be by private industry.

Prizes allow Private sector to flourish and expand

NASA Academy ’08 (NASA Academy, ROADMAP TO A SPACE FARING CIVILIZATION, http://www.eng.buffalo.edu/~cheetham/index\_files/NA08\_GSFC\_RSFC\_VER\_1.0.pdf) JL

A major catalyst for the involvement of private companies is the contests and challenges presented by the X PRIZE Foundation and NASA. With these challenges hype is generated and money is poured into the space industry through private investors, universities and small companies as they compete to be the first to develop the technology and complete the challenge. The Ansari X Prize for example featured a $10 million prize for a spacecraft that was capable of carrying the weight of three people to 100 km above the Earth‟s surface, twice in two weeks. For this prize the 26 teams competing spent a combined total of over $100 million, which is ten times the prize value (11). Also, since the prize has been won by Scaled Composites with SpaceShipOne, over $1.5 billion dollars in public and private spending has occurred for development of the private spaceflight industry (11). This prize alone developed by the X PRIZE Foundation shows how invaluable these contests and challenges are to the development of the private sector. The challenges presented by the X PRIZE Foundation allowed many new companies to form and allowed small existing companies like Armadillo Aerospace and Scaled Composites to develop technology products without having to compete against well established Aerospace giants like Lockheed Martin, Northrop Grumman and Boeing. X PRIZEs allow the industry to grow and flourish so that there will no longer just be three of four large companies that run the private sector.

Prizes CP---AT: Perm---Government Involvement Bad

Prizes Side step bureaucratic processes

Schroeder ’04 (Alex, analyst for the independence institute, The Application and Administration of Inducement Prizes in Technology, http://www.i2i.org/articles/IP\_11\_2004.pdf) JL

Both recognition and inducement prizes seek to reward an individual or team for a breakthrough in a given field. These prizes have the option of rewarding advances in traditional thinking or the development of nontraditional thinking. This freedom plays a major advantage when weighing the potential methods employed to attain a prize. The vast audience that a prize competition allows for increases the possibility of non-traditional ideas to be proven more effective. Specifically, inducement prizes sidestep the bureaucratic approval often necessary to gain grant and project funding. Since prizes do not discriminate against the ideas that are involved in achieving a certain technological breakthrough a new methodology is free to gain otherwise unlikely exposure. These new ideas often spark public interest and media attention creating yet another benefit of prizes.

Government Agencies are restricted, unlike contestants

Davidian ’04 (Ken, Member of DMG Associates, private company under contract to NASA, Prizes, Prize Culture, and NASA’s Centennial Challenges, http://www.ip.nasa.gov/documents/prize\_culture\_report.pdf) JL

Members of a traditional government contract or grant selection board will typically not select non-standard, non-traditional, innovative, or risky proposals for many legitimate reasons, including responsible stewardship of tax-payers' money and the impact a project’s potential failure would have on future funding, as well as the proposed approach being too far outside the reviewer's experience base. Throughout history, many prize winners have demonstrated a great ability to imagine, build, and demonstrate technologies that were “non-traditional,” including John Harrison (solving what was thought to be an astronomical problem with a mechanical timepiece solution), Louis Blériot (before his successful “No. 11” aeroplane design, his first ten designs can only be described as “creative”), Paul MacCready (with his human-powered Gossamer Condor and Gossamer Albatross), and Burt Rutan (with demo

Incentives CP Solvency

Aerospace industry struggling-incentives key to rehabilitation

AIAA ’10 (American Institute of Aeronautics and Astronautics (AIAA) is the world's largest technical society dedicated to the global aerospace profession., RECRUITING, RETAINING, AND DEVELOPING A WORLD-CLASS AEROSPACE WORKFORCE: An AIAA Information Paper, https://info.aiaa.org/SC/PMEC/Lists/Training%20and%20Workforce%20Development%20Information/Attachments/1/Retaining%20Aero%20Workforce%20031309%20v02.pdf) JL

The American Institute of Aeronautics and Astronautics (AIAA) is extremely concerned about the need to maintain and enhance a strong aerospace workforce, without which the United States would lose invaluable economic and national security benefits. Since aerospace constitutes about $200 billion (or 1.5%) to the domestic economy, and in 2007 delivered a $56 billion positive trade balance, it is critical during the current uncertain economic climate to keep this sector healthy and growing. AIAA provides this informational paper to raise awareness of the unique criticality of workforce issues in the aerospace industry and stimulate discussion in Congress about measures to maintain US leadership and excellence in this important strategic industry. ISSUE Without a strong aerospace workforce, the United States will lose the resulting economic and national security benefits. Incentives are needed for industry to invest in domestic aerospace workforce development, and for U.S. students to choose an engineering career. Barriers to employing talented foreign nationals must also be removed. BACKGROUND

\*\*\*Come Back To Later\*\*\*

Space colonization solves climate, waste management, immune-related and aging concerns

Siegfried 03 (W.H., The Boeing Company, Integrated Defense Systems “Space Colonization—Benefits for the World” http://www.aiaa.org/participate/uploads/acf628b.pdf)SV

The world population has finally recognized that we are polluting our nest. We are using energy at a prodigious rate (Fig. 1) (Siegfried, 1991). There is a demonstrated connection between the cost of energy, its availability and a nation’s standard of living. Long-term clean energy sources must be provided to assist not only with our future needs, but also with those of all nations’ current requirements. Energy sources are an important part of environmental thrusts. Nuclear research is progressing, but it does not promise near-term solutions and developing nations are reaching a plateau of available power. The emerging nations’ need for power must be balanced against potential environmental damage from such dangers as fossil fuel emissions (if there were enough fuel available), which could be greater than nuclear energy risks. Currently, the United States annually consumes approximately 3 trillion Kwh’s of electrical energy and, if this rate grows at only 2% per year, by 2050 United States power requirements will be around 9 trillion Kwh’s per year. Total world needs, assuming a very low use by developing nations (not a conservative estimate) easily exceeds an estimated 20 trillion Kwh’s by 2050. Even with an attendant tripling of non-nuclear systems, such as hydroelectric to avoid fossil fuel depletion, nuclear power system generation would have to increase by a factor of 6 to meet requirements. This increase in nuclear energy production flies in the face of a rising discontent with adverse environmental effects of nuclear waste disposal, where some plants are being converted to utilize fossil fuels. A clean renewable source of energy must be found and implemented. Space Colonization can lead to solutions to this problem. Three potential energy sources are described in Table 1. Helium 3, solar power satellites (SPS), and a lunar (solar) power system (LPS) all have significant feedback potential for other commercial applications. A space-based energy system would be global in scale and funding and would thus be a challenging goal for macro-engineering management to achieve. This management experience would be globally shared and would be utilized for other global projects. Robotics and artificial intelligence would also benefit from the use of smart and capable robots to autonomously conduct such functions as space assembly and lunar mining and processing. Computer systems would be extended in capacity and reliability, energy-transfer technology would be enhanced, and materials research would quest for more efficient space systems and learn to utilize in-situ materials. SPS and LPS will require advancement in photovoltaic cell technology. This quest can also influence transportation technology because at least one of the solutions could lead to more efficient space propulsion. This would reduce travel times and minimize exposure to potentially debilitating space environments. Two of the items listed here represent major concerns of most developed nations and are emerging concerns in developing nations. A technological revolution is needed to address food shortages to allow adequate nutrition for our exploding world population in concert with ever-growing water shortages, and a growing realization that our current pesticide methods are polluting our planet. While previous short-duration human space programs have depended on open-loop life support systems, Space Colonization cannot. Development of a closed-cycle bioregenerative controlled ecological life support system (CELSS) would lead to world benefits. Areas of CELSS development are listed in Table 2. Many long-term (and pressing short-term) world problem solutions can be approached by reaching for the stars. For example, Shimizu Corporation is most interested in bio-regenerative systems as a path toward solution of Tokyo’s waste management problems. Many current human problems are the result of failures of the body’s natural immune system. We can diagnose many of these problems and have made great strides in ameliorating the symptoms, but to date, understanding immune system function and enhancement is seminal. Both United States and Russian long-term space missions have induced similar red blood cell and immune system changes. Hematological and immunological changes observed during, or after, space missions have been quite consistent. Decreases in red cell mass were reported in Gemini, Apollo, Skylab and Soyuz, and Mir programs—probably due to diminished rates of erythrocyte production. Space flight at microgravity levels may produce changes in white blood cell morphology and a compromise of the immune system. Skylab studies indicated a decrease in the number of T lymphocytes and some impairment in their function. Certain United States and Russian findings suggest that space flight induces a transient impairment in immune system function at the cellular level. Space flight offers a clinical laboratory unlike any place on Earth that may lead to an improved understanding of the function of the human immune system. Perhaps cures of aging, HIV, and other immune function-related illnesses can result from a comprehensive approach to Space Colonization.