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\*\*\*Inherency\*\*\*

**Inherency**

There is currently no government planned manned mars mission

Mars to Stay, Marstostay.com, 11

(Mars to Stay, “Why isn’t it being done?”, http://www.marstostay.com/#/why-isnt-it-being-done/4545841259, accessed 6-1-11, JG)

But sadly people would rather talk about a famous singer or actor doing something stupid than talk about a mission to Mars or the future of humanity. In our opinion **there are** only 2 **ways for a Mars to Stay mission to become a reality**: 1- There is a fundamental shift in peoples opinion and attitude towards space exploration, to the extent that there is a clear demand for a mission to Mars, enough for politicians to see it as a popular policy, and even for businesses to sponsor. 2- A high ranking politician or an extremely wealthy individual is passionate about it and wants to see it get done. In which case, they have the influence/finances to lobby other people in similar positions, and would see that either a government and/or private mission was put in place. **In terms of a mission such as this going ahead in current circumstances, we see that as extremely unlikely. While there are vague plans by the Obama administration to send humans to orbit Mars in the mid 2030’s,** then on to the surface**, there is certainly no real ambition or funding planned for such a task. It will only happen if there is a set goal and guaranteed funding**, similar to the scale of the Apollo missions of the 1960’s.

**There is no funding for a one-way mission in the status quo**

Kaufman, Washington Post Writer, 11

(Marc, Vancouver Sun, 5-25-11, “Would you go to Mars, knowing you’d (probably) never come back?”, http://www.vancouversun.com/technology/Would+Mars+knowing+probably+never+come+back/4838656/story.html, accessed 6-1-11, JG)

"Our initial goal was to find a way to develop a human mission to Mars that could actually take place, that wouldn't cost so much that it would be impossible to pull off," Davies said. "And the one-way trip, as we costed it out, would be about one-quarter the price of a there-and-back mission." "But the response told us the spirit of exploration remains alive around the globe and that some people understand that the science involved would be extraordinary," he said. "Just like with earlier explorers, they are prepared to set out knowing they won't come back, but willing to do it because their time on Mars would be so remarkable." The idea, which is clearly not what NASA managers have in mind for Mars exploration, has now led to the release of "A One Way Mission to Mars: Colonizing the Red Planet," a compilation of articles from the Journal of Cosmology, plus some additions from scientists with the Mars Society and others. Among the articles in the book are "The Search for Life on Mars," "Medical Care for a Martian Transit Mission and Extended Stay on the Martian Surface" and "Sex on Mars: Pregnancy, Fetal Development and Sex in Outer Space." The authors include dozens of NASA researchers, some former astronauts and some scientists and advocates who have pushed for decades (with no success) for a human mission to Mars. The whole effort, authors say, is geared to sparking public interest in a human mission to Mars, something long discussed by NASA and others but receding into the distance with diminished NASA budgets expected in the years ahead.

**Inherency**

**Obama cut Mars funding for other space development, specifically a Moon mission**

Calabrese, Director of Public Information for NSS, 10

(Michael, Suite 101, 9-13-10, “An American Future in Space – Without Mars”, http://www.suite101.com/content/an-american-future-in-space--without-mars-a285539, accessed 6-2-11, JG)

We aren't there. Today, it appears that George Jetson is the only one who made it to the 21st Century. The President's new space policy postpones U.S. efforts to go to Mars and it is possible that this shift will prove to be a jump start for U.S. space development. The National Space Society (NSS), while it supports NASA and all of its missions, also takes the position that the recent delay in a manned mission to Mars should not push back a return to the Moon by the United States.

Current NASA objectives do nothing for achieving a Mars Mission

Roop, HudsonAlpha Institute for Biotechnology, 10

(Lee, Al.com, 2-25-10, “NASA’s Bolden says Mars is the goal, but ‘we can’t get there now’”, http://blog.al.com/breaking/2010/02/nasas\_bolden\_says\_mars\_is\_the.html, accessed 6-1-11, JG)

HUNTSVILLE, AL - "**We want to go to Mars**," **NASA Administrator Charles Bolden told a congressional committee** Wednesday. "We can't get there now." **With the White House now officially behind that long-term goal, Bolden tried to calm a Senate NASA oversight committee concerned about President Obama's proposed 2011 NASA budget**. U.S. Sen. Richard Shelby, R-Tuscaloosa, wasn't impressed. Shelby, a member of the powerful Senate Appropriations Committee, said afterward that **Bolden still didn't articulate a clear direction for NASA**. "The administration's plan appears to be a complete surrender of American leadership in human space flight - an area where we are the envy of the world," Shelby said in a statement. "**This new plan has no exploration goal, and because there is no clear objective**, I can guarantee **they will achieve 100 percent of what they propose to do - nothing**." Obama wants to cancel the current Constellation rocket program and give $6 billion over five years to commercial companies for rockets to haul cargo and astronauts into orbit. Meanwhile, NASA would do research aimed at an eventual Mars mission. "I have never seen the appropriators and the authorizers so united" in opposing a budget, Sen. Bill Nelson, D-Florida, said as he opened a hearing before the Senate Commerce Committee's space and science subcommittee. **It's a "radical departure" from NASA's previous direction**, added ranking Republican member Sen. David Vitter of Louisiana. It kills the human space flight program in favor of "a hope and prayer" commercial companies can fill the gap, Vitter said.

A one-way mission is not on NASA’s current agenda

Taylor, Economics Senior, 11

(Andrew, The Daily Cougar, 3-1-11, “Don’t plan on exploring Mars”, http://thedailycougar.com/2011/03/01/don’t-plan-exploring-mars/, accessed 6-3-11, JG)

Berger wrote in his column that **a trip to Mars under current conditions** pertaining to our national budget and space technology **would have to be a one-way trip. “In a budget-constrained world**, given the challenges posed by radiation and launching with enough propellant to blast back off Mars once we get there, **it’s becoming increasingly obvious that if we’re going to go to Mars in the next half-century, it probably will be a one-way mission**,” Berger said. **There hasn’t been much in terms of interest from NASA regarding this one shot idea**. Also, according to Berger’s column, the interest among college students is low as well. While visiting a UH journalism class he asked the students if they were interested in space flight.

Inherency

Even if they prove that there are current Mars missions there are no one-way missions which is what our internal links are based on

Geranios, Associated Press, 10

(Nicholas, Chronicle, 11-15-10, “Scientists offer faster way to get to Mars”, http://www.chron.com/disp/story.mpl/chronicle/7295599.html, accessed 6-4-11, JG)

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. Nowhere 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

A2: Obama Mars Plan

Obama’s mars plan is a goal – it’s set for 2030 and is stuck in budgetary limbo

Pasztor, International politics and business, 11

(Andy, Wall Street Journal, 2-14-11, “NASA Budget Plan Restricts Spending On Private Rockets”, http://online.wsj.com/article/SB10001424052748703515504576142391287397056.html, accessed 6-1-11, JG)

Commercial-space projects are years behind schedule, and critics still worry about placing undue reliance on them. After scrapping plans to return astronauts to the moon, Mr. **Obama set a 2025 goal for getting to an asteroid. And** he has also talked about sending U.S. **astronauts to Mars five years later. But NASA's funding remains in flux, and officials have warned they may need more money and time than Congress has provided to** build a heavy-lift rocket capable of **reaching either destination**. The White House's vision for NASA also is likely to emphasize the contributions of the agency's research to U.S. innovation, economic vitality and competitiveness. **But with House Republican leaders looking for deeper NASA cuts,** and some of them targeting agency initiatives to assess climate-change, **U.S. space programs could continue to be buffeted by conflicting budget signals**.

Obama’s goal is non binding – and has no way of being accomplished

Rhian, Public Relations and Nasa Internships, 11

(Jason, Examiner, 1-30-11, “NASA’s new path working to rewrite history”, http://www.examiner.com/nasa-in-national/some-supporters-of-nasa-s-new-path-working-to-rewrite-history, accessed 6-2-11, JG)

Problem is? Obama’s plans for space have been called a lot of things – ‘clear’ is not one of them. There now is no program-of-record, only the vague objective of reaching an asteroid by 2025 – and Mars – sometime within the president’s lifetime. And while it is true that Congress past the 2010 NASA Authorization Act – they only did so after the following took place: Obama went back on his campaign promises by attempting to completely cancel the Constellation Program including the troubled Ares family of rockets and the Orion spacecraft. This came out with the release of the FY 2011 budget – and on the anniversary of the loss of the space shuttle Columbia no less. When this decision met with fierce opposition President Obama traveled to NASA’s Kennedy Space Center in Florida – to reiterate his ideas and throw NASA a “Constellation” prize – a stripped down Orion capsule that could be used for the International Space Station as a lifeboat. When his explanation met with little approval – he again reiterated his plan (as there is no official program – just a vague outline) in the National Space Policy of 2010.

AT: Government Space Focus Now

Their evidence is just rhetoric—US missions in space weak

Logsdon, Director of the Space Policy Institute at George Washington University, 3

(John M, Astropolitics, “Reflection on Space as a Vital National Interest”, <http://www2.gwu.edu/~spi/assets/docs/space_as_a_national_interest.pdf>, CH)

Specific wording is important here. The phrase “vital national interest” is applied in U.S. government policy documents only to those U.S. objectives and capabilities so important that the nation would use armed force to protect and preserve them. It would be logical to conclude that if space were indeed a vital national interest, it would receive high priority in government policy and funding decisions to ensure that the country was committed to the pursuit of space power – “the pursuit of national objectives through the medium of space and the use of space capabilities.”7 This is not the reality, however. There is a substantial gap between statements about the high importance of space to U.S. interests, and both the current state of U.S. space capabilities and the priority given to the space sector by the country’s leadership. The result is that a seemingly crucial national security, economic, public service, and scientific capability rests on a very fragile foundation.

A2: MPCV/ORION

Current space policy for the MPCV is a 21-day mission limit – meaning a Mars mission can’t take place in the status quo

Whittington, Space Periodicals, 11

(Mark R., Yahoo! News, 5-25-11, “NASA’s MPCV Inadequate for Asteroid, Mars Mission; Ideal for Lunar Missions”,http://news.yahoo.com/s/ac/20110525/sc\_ac/8534339\_nasas\_mpcv\_inadequate\_for\_asteroid\_mars\_ mission\_ideal\_for\_lunar\_missions, accessed 6-2-11, JG)

NASA has announced the concept for the future space craft that is envisioned to take astronauts beyond low Earth orbit. It is called **the "Multi-Purpose Crew Vehicle**" or MPCV. It **seems very much like the old Orion from the Constellation project**. According to NASA: "The spacecraft will carry four astronauts for 21-day missions and be able to land in the Pacific Ocean off the California coast. The spacecraft will have a pressurized volume of 690 cubic feet, with 316 cubic feet of habitable space. It is designed to be 10 times safer during ascent and entry than its predecessor, the space shuttle." Just by way of contrast the Apollo space craft had 210 cubic feet of habitable space for three astronauts. Since the MPCV will carry four astronauts, that translates as 79 cubic feet per astronaut as opposed to 70 cubic feet per astronaut for Apollo. **Officially the MPCV is envisioned for missions to Earth approaching** asteroids and eventually **Mars, in compliance with Obama administration space policy. However the 21-day mission limit would tend to foreclose such missions**; asteroid missions would take upwards from 60 to 90 days. Clearly, modifications would be needed for an MPCV to be part of any deep space mission that the current NASA is officially envisioning, perhaps the addition of a habitation module. There are a variety of deep space missions that an MPCV, presumably launched on the heavy lift vehicle that is also envisioned.

The MPCV is for short-term missions not long term ones

Atkinson, Space Journalist, 11

(Nancy, Universe Today, 5-24-11,”NASA’s Next Crew Vehicle Will be Based on Orion”, http://www.universetoday.com/85917/nasas-next-crew-vehicle-will-be-based-on-orion/, accessed 6-4-11, JG)

During a press conference today, Doug Cooke, associate administrator for NASA’s Exploration Systems Mission Directorate said that the approach on the MPCV vehicle is that it primarily will be for launch and entry with in-space capabilities for only certain periods of time. “For long term missions, we would assume that we have an in-space habitation in a larger compartment or module since the crew would need more space for longer periods of time. So whether they are going to lunar orbit or near earth asteroids, this vehicle would be maintained in a dormant mode while the crew would be in another volume that would be capable of longer term use, but this vehicle would be used as launching to a larger volume, or for reentry.” The Orion vehicle at one time had been pegged to be a rescue vehicle for the International Space Station. Cooke said that this new vehicle is not being designed for that, but another vehicle could be in designed for that. One big selling point is that the new MPCV is designed to be 10 times safer during ascent and entry than its predecessor, the space shuttle. “This selection does not indicate a business as usual mentality for NASA programs,” said Cooke, “The Orion government and industry team has shown exceptional creativity in finding ways to keep costs down through management techniques, technical solutions and innovation.” Now, NASA just needs a rocket that can take the MPCV somewhere — as well as a new name for the MPCV. (Cooke said a name for the vehicle hasn’t been their top priority.) Cooke said they hope to make an announcement in July about the launch system that will be used.

A2: MPCV/ORION

The MPCV is only around because of congressional liking – it has no other purpose

Page, British Space Affairs, 11 (Lewis, Officer in the British Navy, The Register, 5-26-11, “NASA ‘deep space’ ship: Humans beyond orbit by 2020?”, http://www.theregister.co.uk/2011/05/26/orion\_mpcv/, accessed 6-3-11, JG)

Well, this isn’t happening any more. It remains unclear how the newly-renamed Multi Purpose Crew Vehicle (MPCV) will travel into space, when it will do so and what its destination might be – though a near-Earth asteroid is a likely possibility. A major reason for Orion’s continued survival appears to be ignoble pork barrel politics – but there is a tantalizing possibility that it might fly beyond Earth orbit in the relatively near future. The history of Orion stretches back to 2004.

The MPCV is useless – we solve for a Mars mission better and cheaper

Page, British Space Affairs, 11 (Lewis, Officer in the British Navy, The Register, 5-26-11, “NASA ‘deep space’ ship: Humans beyond orbit by 2020?”, http://www.theregister.co.uk/2011/05/26/orion\_mpcv/page2.html, accessed 6-3-11, JG)

You might alternatively keep Orion going for use in the projected deep-space missions of the future, but on stated plans the lifting rockets and the **funding** for these **will not be ready until well into the 2020s**: even the heavy-lift rocket decision is not until 2015, **a year after Orion/MPCV is supposed to be ready. The ISS has now had its life extended, too, which will eat up US manned-space funds. A development timeline of 20 years and more** from its 2004 kickoff to first flight **would make Orion very expensive indeed: financially it would probably make more sense to** mothball it or **scrap it and start over again** once the deep-space plans firmed up. Probably **cancellation followed by a new ship would work out cheapest**, as Orion is an old school, cost-plus, joint effort between NASA and established contractors led by Lockheed. Almost **any kind of new and more appropriately-timed effort would** be likely to **cost less**.

A2: Private Exploration

There are no private sector Mars exploration plans

News Journal, Online Journal, 11

(News Journal, News-Journal Online, 6-6-11, “NASA needs clear plan for the future”, http://www.news-journalonline.com/opinion/editorials/n-j-editorials/2011/06/06/nasa-needs-clear-plan-for-the-future.html, accessed 6-6-11, JG)

The crew vehicle is said to be much safer than a space shuttle, but it lands in water when it returns, meaning each vehicle will be retired to a museum after each use. (Blame salt water for that.) For now, the general game plan is to use the private sector's considerable space program to get astronauts to the International Space Station, or to get cargo into space. That's a good idea -- one that encourages private-sector innovation regarding our very important maintenance of satellites and scientific research in space. But even the private sector isn't planning on the kind of missions that the space shuttles were doing. And there certainly is no private plan for exploration on the moon, Mars or the asteroids of this solar system.

\*\*\*Adv 1 – Colonization\*\*\*

Mars Key

Mars Colonization possible and key – it has the resources enough to spill over

Zubrin 97 (Robert, 1997, Aerospace engineer, president of Mars Society and Pioneer Astronautics, “The Vaibility of Colonizing Mars”, http://www.aleph.se/Trans/Tech/Space/mars.html)AH

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 Key

Mars is the best starting point for colonization-all necessary raw materials and better than immediate alternatives

Zubrin, Aerospace engineer and head of the Mars Society, ‘96

(Robert, *National Space Society*, “The Case for Colonizing Mars,” July/August, http://www.nss.org/settlement/mars/zubrin-colonize.html, 5-31-2011, SRF).

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 the Earth'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 such 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.

Mars Key

Mars is the most habitable planet

Popular Science 11 (March “AFTER EARTH: Why? Where? How? When?” Pg. 46 Vol. 278 No. 3) NS 5/24/11

Other space-settlement advocates suggest skipping the moon entirely. Although our moon is closer and we've already landed people there, the moons of Jupiter, Saturn, Uranus and Neptune are believed to contain variously greater quantities of water, carbon or nitrogen. But the most Earth-like of the destinations in our solar system is Mars. "Mars compares to the moon as North America compared to Greenland in the previous age of maritime exploration," says Robert Zubrin, the head of the Mars Society, a group pushing for expeditions to and settlement of the Red Planet. Unlike the moon, Mars has a bit of an atmosphere, which would offer some protection from cosmic rays, and about 40 percent of Earth's gravity. In 2002, NASA's Mars Odyssey spacecraft detected continentsize regions of water ice in the Martian ground, and in 2008, photographs from the Phoenix Mars lander confirmed the presence of ice there. Enough carbon also resides in the soil to grow plants, and the daytime temperatures occasionally reach a balmy 70°F. It's plausible, too, that over time the planet could be "terraformed," using water from underground ice (or importing it from an ice asteroid) to form a thin ocean and, much later, to create an atmosphere offering breathable air and a better shield against cosmic radiation. "It's much easier to settle a planet than to build one," Zubrin says. "Christopher Columbus sailed across the ocean in a boat. Imagine if he'd had to build the American continent once he got there."

Mars First

Colonizing Mars before the moon is best—self-sustainability, terraformation and asteroid mining all create the key conditions for success and moon first missions can’t solve.

Holtgrefe 7 (Dennis Holtgrefe, Bachelor of Science @ Worcester Polytech, May 2, 2007, “The Moon or Mars: Expanding Humanity’s Domain, Pp. 50) CJQ

Finally, when examining the long term prospects of a facility on the Moon or Mars, Mars emerges with a huge advantage over the Moon. While many consider the Moon to be a staging point for missions to mars and the rest of the solar system, this logic is flawed. In reality, the Moon would not actually function well as a practice mission to mars or as a staging point. The environments are too different for one to be a good analog for the other, and competing plans for a Mars mission directly from the Earth to not justify using the Moon as a staging point. Mars, conversely, presents a huge number of important opportunities for the future. The distance of Mars dictates that it establish its own government for a reasonably sized colony, an opportunity to explore new ideas in government and personal freedoms. The asteroid belt can be mined from Mars, supplying materials to both the growing colony and back to buyers on earth. The present conditions of Mars make it a fantastic candidate for terraforming, or changing its entire environment to more closely match that of earth. Finally Mars offers far better opportunities to comb for extra terrestrial life, helping to answer the fundamental question of whether we are alone. Overall, when these three perspectives are taken as a whole, a mission to Mars to establish a colony is the most appropriate course for NASA to pursue.

Mars > Moon

Moon colonization would fail—deficient in all necessary resources and fails to interest industrial actors.

Zubrin 96 (Robert Zubrin, former Chairman of the National Space Society, <http://www.nss.org/settlement/mars/zubrin-colonize.html>, July/August 1996, accessed 6/20/11) CJQ

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 such 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.

Mars Unique/AT: Moon Solves

Mars is specifically key to any hope of colonization – every other place like the moon fails - multiple reasons

Zubrin 97 (Robert, 1997, Aerospace engineer, president of Mars Society and Pioneer Astronautics, “The Viability of Colonizing Mars”, http://www.aleph.se/Trans/Tech/Space/mars.html)AH

Among extraterrestrial bodies in our solar system, Mars is unique 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 the Earth'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 CO2 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 sea water. Oxygen is abundant on the Moon, but only in tightly bound oxides such as SiO2, Fe2O3, MgO, and Al2O3, which require very high energy processes to reduce. Current knowledge indicates that if Mars were smooth and all it's 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 were grown in greenhouses on the Moon ( a very difficult proposition, as we shall see) most of their biomass material would have to be imported. The Moon is also deficient in about half the metals (for example copper) of interest to industrial society, as well as many other elements of interest such as sulfur and phosphorus. Mars has every required element in abundance. Moreover, on Mars, as on Earth, hydrologic and volcanic processes have occurred, which is likely to have concentrated various elements into local concentrations of high-grade mineral ore. Indeed, the geologic history of Mars has been compared with that of Africa7, 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. But the biggest problem with the Moon, as with all other airless planetary bodies and proposed artificial free-space colonies (such as those proposed by Gerard O'Neill8) is that sunlight is not available in a form useful for growing crops. This is an extremely important point and it is not well understood. Plants require an enormous amount of energy for their growth, and it can only come from sunlight. For example a single square kilometer of cropland on Earth is illuminated with about 1000 MW of sunlight at noon; a power load equal to an American city of 1 million people. Put another way, the amount of power required to generate the sunlight falling on the tiny country of El Salvador exceeds the combined capacity of every power plant on Earth. Plants can stand a drop of perhaps a factor of 5 in their light intake compared to terrestrial norms and still grow, but the fact remains; the energetics of plant growth make it inconceivable to raise crops on any kind of meaningful scale with artificially generated light. That said, the problem with using the natural sunlight available on the Moon or in space is that it is unshielded by any atmosphere. (The Moon has an additional problem with its 28 day light/dark cycle, which is also unacceptable to plants). Thus plants grown in a thin walled greenhouse on the surface of the Moon or an asteroid would be killed by solar flares. In order to grow plants safely in such an environment, the walls of the greenhouse would have to be made of glass 10 cm thick, a construction requirement that would make the development of significant agricultural areas prohibitively expensive. Use of reflectors and other light-channeling devices would not solve this problem, as the reflector areas would have to be enormous, essentially equal in area to the crop domains, creating preposterous engineering problems if any significant acreage is to be illuminated. Mars, on the other hand, has an atmosphere of sufficient density to protect crops grown on the surface against solar flares. On Mars, even during the base building phase, large inflatable greenhouses made of transparent plastic protected by thin hard-plastic ultra-violet and abrasion resistant geodesic domes could be readily deployed, rapidly creating large domains for crop growth. Even without the problems of solar flares and a 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. Even during the base building phase, domes of this type up to 50 meters in diameter could be deployed on Mars that could contain the 5 psi atmosphere necessary to support humans. If made of high strength plastics such as Kevlar, such a dome could have a safety factor of 4 against burst and weigh only about 4 tonnes, with another 4 tonnes required for its unpressurized Plexiglas shield. In the early years of settlement, such domes could be imported pre-fabricated from Earth. Later on they could be manufactured on Mars, along with larger domes (with the mass of the pressurized dome increasing as the cube of its radius, and the mass of the unpressurized shield dome increasing as the square of the radius: 100 meter domes would mass 32 tonnes and need a 16 tonne Plexiglas shield, etc.). Networks of such 50 to 100 meter domes could rapidly be manufactured and deployed, opening up large areas of the surface to both shirtsleeve human habitation and agriculture. If agriculture only areas are desired, the domes could be made much bigger, as plants do not require more than about 1 psi atmospheric pressure. Once Mars has been partially terraformed however, with the creation of a thicker CO2 atmosphere via regolith outgassing, the habitation domes could be made virtually to any size, as they would not have to sustain a pressure differential between their interior and exterior. The point, however, is that in contrast to colonists on any other 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.

Moon Sucks

Moon colonization fails—no conditions for successful crop growth means the colonists will starve. Mars is self-sufficient.

Zubrin 96 (Robert Zubrin, former Chairman of the National Space Society, <http://www.nss.org/settlement/mars/zubrin-colonize.html>, July/August 1996, accessed 6/20/11) CJQ

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.

Mars -> VTL

Mars is the only place where colonists will have valuable lives—they’ll have to live underground on the moon and cant grow food.

Zubrin 96 (Robert Zubrin, former Chairman of the National Space Society, <http://www.nss.org/settlement/mars/zubrin-colonize.html>, July/August 1996, accessed 6/20/11) CJQ

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.

Moon Bad

Mars colonization is superior to the moon—food, water and other resources lead to success. Moon lacks everything.

Zubrin 96 (Robert Zubrin, former Chairman of the National Space Society, <http://www.nss.org/settlement/mars/zubrin-colonize.html>, July/August 1996, accessed 6/20/11) CJQ

Why then not the Moon? The answer is because there's not enough there. True, the Moon has a copious supply of most metals and oxygen, in the form of oxidized rock, and a fair supply of solar energy, but that's about it. For all intents and purposes, the Moon has no hydrogen, nitrogen or carbon — three of the four elements most necessary for life. (They are present in the Lunar soil, but only in parts per million quantities, somewhat like gold in sea water. If there were concrete on the Moon, Lunar colonists would mine it to get its water out.) You could bring seeds to the Moon and grow plants in enclosed greenhouses there, but nearly every atom of carbon, nitrogen and hydrogen that goes into making those plants would have to be imported from another planet. While sustaining a Lunar scientific base under such conditions is relatively straightforward, growing a civilization there would be impossible. The difficulties involved in supporting significant populations in artificial orbiting space colonies would be even greater. Mars has what it takes. It's far enough away to free its colonists from intellectual, legal, or cultural domination by the old world, and rich enough in resources to give birth to a new. The Red Planet may appear at first glance to be a desert, but beneath its sands are oceans of water in the form of permafrost, enough in fact (if it were melted and Mars' terrain were smoothed out) to cover the entire planet with an ocean several hundred meters deep. Mars' atmosphere is mostly carbon-dioxide, providing enormous supplies of the two most important biological elements in a chemical form from which they can be directly taken up and incorporated into plant life. Mars has nitrogen too, both as a minority constituent in its atmosphere (three percent) and probably as nitrate beds in its soil as well. For the rest, all the metals, silicon, sulfur, phosphorus, inert gases and other raw materials needed to create not only life but an advanced technological civilization can readily be found on Mars. The United States has, today, all the technology needed to send humans to Mars. If a "travel light and live off the land" strategy such as the Mars Direct plan were adopted, then the first human exploration mission could be launched within 10 years at a cost per year less than 20 percent of NASA's existing budget. Once humans have reached Mars, bases could rapidly be established to support not only exploration, but experimentation to develop the broad range of civil, agricultural, chemical and industrial engineering techniques required to turn the raw materials of Mars into food, propellant, ceramics, plastics, metals, wires, structures, habitats, etc. As these techniques are mastered, Mars will become capable of supporting an ever-increasing population, with an expanding division of labor, capable of mounting engineering efforts on an exponentially increasing scale.

Colonization Adv—Impact (Gen)

Asteroids, warming, nuclear war, and ice ages threaten human survival—Mars colonization is the first step of preservation

Pazmino, contributing science writer for the New York Space Society, 4

(John, National Space Society, “Space is Our Survival”, 11-28-04, http://www.nyskies.org/articles/pazmino/gottsurv.htm, CH)

 Dr Gott believes that the true motive for human space travel is survival of the species. By remaining on Earth the entire species is vulnerable to calamity and potential extinction. We have geologic evidence that at various times in the past Earth was assaulted by ice ages, asteroid collisions, climate swings. In the past half century we have new human-induced threats of global warming, nuclear war, genetic and biological accidents, and food chain disruption. He used the example of a printed book. To ensure that the contents are preserved into the future, you make many copies of the book and disperse them. That way, if one or even many, are lost to fire, theft, rot, others will survive to carry their material to later readers. This example recalled to me one of the [losing] entries in the contest for the millennium time capsule at the American museum of natural History. To keep intact our culture despite all conceivable hazards, the entry proposed etching into the DNA of a cockroach all the contents of the NY Times newspaper. This actually could be done from the electronic archives and modern gene manipulation. The roaches will multiply and spread over the world. These creatures already lasted thru several species decimations and, as most of us know, are awfully tough to exterminate locally. Intelligent beings in the far future could capture a roach -- any roach by then -- and decode its DNA back into newsprint and read about human civilization. Hence, Gott figures, by spreading humans over several planets, we increase the chances of keeping up the culture, if one of the planets gets whumped or frozen. To do so, we must now do the groundwork for the eventual mass migration. He plans on placing small settlements on Mars for starts, where they will stay as permanent residences for independent colonies of humans. Although they must be provisioned from Earth for a while, maybe several decades, the colonies will be self sustaining, like the New World did with Europe.

Solves Extinction

Sun radiation and environmental degradation will destroy the Earth—only colonization solves sustainable living and extinction

Mitchell and Staretz 10 (Edgar D., ScD. in Aeronautics and Astronautics and lunar module pilot of Apollo 14 and Robert, M.S., as Executive Director of Quantrek, October-November, Journal of Cosmology, “Our Destiny—A Space-Faring Civilization?, http://journalofcosmology.com/Mars104.html) CH

This is an historic time for humanity and also one of the most challenging times as well. We stand on the threshold of becoming a space faring civilization shedding the bonds that have tied us to Earth since the very beginnings of the planet’s history. In the last 40 years, we have looked back at Earth from space, walked on our moon, sent robotic probes to most of the planets, moons and even some of the asteroids of our solar system. We have explored the depths of our galaxy and the visible universe with both Earth and spaced based telescopes and instrumentation. Later this century we will very likely walk on the surface of another planet. Why? Humanity has always had an insatiable appetite to know, for adventure and a remarkable curiosity to explore the unknown. In spite of the sacrifices and challenges required, history has shown over and over the benefits and rewards of exploration have always far exceeded expectations and mostly in ways that were impossible to predict. No doubt such will be the case again in the exploration of space. There are many other reasons to travel to other worlds and beyond besides the urge to explore the unknown. One is the obvious long term motivation to become an inter-stellar space faring civilization. At some point in the distant future we will have no choice but to leave our home world. Our sun, already a middle aged star, is powered by fusing hydrogen in the nuclear inferno at its core. As the remaining fuel is consumed, the sun will continue to expand in size and with it the intensity of the radiation increasing at the planets. Already the sun’s output is 15% greater than it was a few billion years ago and eventually it will destroy all life on the planet. The long term prognosis is that the sun will expand to such a large degree that in due course it will cause our oceans to boil away into the vacuum of space leaving an uninhabitable desert wasteland behind. More immediate concerns for inter-planetary travel but perhaps less well known by most of humanity are the issues associated with insuring a sustainable future for our civilization. Much of our planet’s non renewable resources such as ores and precious metals will not last forever especially with our already large and exponentially growing population. Mining and refining these ores in space for shipment to Earth will be necessary within short order if we are to maintain and broaden our current standard of living on the planet. Establishment of space colonies will also teach us much about sustainability issues and many will have direct applicability to the future of Earth. Until now our planet has had a thriving ecosystem because nature has long ago evolved and fine tuned Earth’s biogeochemical processes to maintain its long term stability. That stability is now being threatened by our own doing.

Solves Extinction

A one-way mission is the best option for long-term survival and avoiding multiple extinction level impacts

Leitner and Firneis 11 (Johannes J. Leitner, Ph.D. , University of Vienna, Research Platform on ExoLife, Maria G. Firneis, Ph.D. University of Vienna, Institute for Astronomy, “Is A Manned (One-Way) Journey To Mars Our Responsibility?” [http://journalofcosmology.com/Mars151.html] JG)

Life on Earth with its prodigious diversity and especially the homo sapiens sapiens as the most intelligent or at least most dominant species on Earth is exposed to permanent threats from inside and outside. Threats from inside as consequences of **social conflicts** and **wars**, **but also pandemics denote only some** of these **conceivable scenarios. Impacts from asteroids have caused mass extinctions in the past and still pose the most popular risk for life on Earth**. Furthermore gamma-ray bursts, supernovae, solar eruptions, cosmic rays and the stellar evolution of our Sun form additional astronomical hazards for life on our home-world. Certainly the chance for world-wide extinction is very low at present, but not zero. In this context the question is of importance how large is the risk (percentually) to demand a massive, expensive reaction from our side. **Human life on Earth, being the most evolved species which we know up to now**, according to our moral standards, **has to be preserved absolutely**. This is our responsibility! **Colonizing our Solar System can help to minimize this risk of extinction and a manned journey to Mars should be the first step to initiate the conquest of space**. Why a manned mission to Mars? Can it only be justified by the scenario of a threatened Earth or by the argument of bringing the first human to another planet as gaining his outstanding place in history. While overrating the development of robotics may seem to abolish the necessity of a steering (deciding) human, in reality the trained scientist collecting data on the Moon (Apollo 17) delivered more important data/samples to the Earth, than any robot/untrained colleague before. A space probe has to be configurated well in advance with a restricted equipment to clarify specific hypotheses, for which at least part of the solutions have to be known prior to pose the correct questions. A human can decide on the spot in an unexpected situation. Why **a one-way mission to Mars**? This **has the advantage** that a part by part **construction of a science-mission habitat could be set-up** in a modular way in advance to provide the human investigators with an apparatus-set comparable to terrestrial geological and biological laboratories to perform experiments, which were not anticipated, while a robot could carry out only preconceived investigations. **Thus a** sample-**return mission is obsolete**. The greatest advantage is seen in the sociological point. **A one-way mission and the necessary supply for humans** with food, clothing and techniques (daily utensils) with several replenishment flights **would maintain a long-persistent equipment which can outlast the lifespan of a radiation contaminated human**.

Solves Extinction

We can’t keep our eggs in one basket—disasters threaten humanity in the status quo

CNN 8 (Oct 9, “Hawking: If we survive the next 200 years, we should be OK”) CH

CAMBRIDGE, England (CNN) -- Professor Stephen Hawking, one of the world's great scientists, is looking to the stars to save the human race -- but pessimism is overriding his natural optimism. Stephen Hawking, here delivering a lecture in May, spoke recently to CNN about his vision of the future. Hawking, in an exclusive CNN interview, said that if humans can survive the next 200 years and learn to live in space, then our future will be bright. "I believe that the long-term future of the human race must be in space," said Hawking, who is almost completely paralyzed by the illness ALS. "It will be difficult enough to avoid disaster on planet Earth in the next 100 years, let alone next thousand, or million. The human race shouldn't have all its eggs in one basket, or on one planet. Let's hope we can avoid dropping the basket until we have spread the load." Hawking is one of the few scientists known to a wide audience outside academia thanks to his best-selling books, a guest spot on "The Simpsons" and an ability to clearly explain the complexities of theoretical physics. He has 12 honorary degrees, was awarded the CBE in 1982 and since 1979 has been at Cambridge University's Department of Applied Mathematics and Theoretical Physics, where he is Lucasian Professor of Mathematics -- a post once held by Isaac Newton. Speaking at Cambridge's Centre for Mathematical Studies, he said: "I see great dangers for the human race. 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. We shall need great care and judgment to negotiate them all successfully. "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." Twenty years ago, Hawking wrote "A Brief History of Time." Now he is looking forward to a space flight of his own next year. He said: "I don't think the human race has a moral obligation to learn about space, but it would be foolish and short sighted not to do so. It may hold the key to our survival."

Solves Extinction

All of our eggs are in one basket – now is key to fund a one-way mission

Gott 11 (J. Richard Gott, Ph.D., Department of Astrophysics, Princetion University, “A One-Way Trip to Mars” [http://journalofcosmology.com/Mars151.html] JG)

That's where they benefit human survivability.... Many people might hesitate to sign up for a one-way trip to Mars, but the beauty is that we only have to find 8 adventurous, willing souls" (Gott 2001). I've been stressing the fact that **we should be in a hurry to colonize space, to improve our survival prospects**, since my Nature paper in 1993 (Gott 1993). The real space race is whether we get off the planet before the money for the space program runs out. **The human spaceflight program is only 50 years old, and may go extinct on a similar timescale**. Expensive programs are often abandoned after a while. In the 1400s, China explored as far as Africa before abruptly abandoning its voyages. **Right now we have all our eggs in one basket: Earth. The bones of extinct species in our natural history museums give mute testimony that disasters on Earth routinely occur that cause species to go extinct. It is like sailing on the Titanic with no lifeboats. We need some lifeboats. A colony on Mars might as much as double our long-term survival prospects by giving us two chances instead of one**. Colonies are a great bargain: you just send a few astronauts and they have descendants on Mars, sustained by using indigenous materials. It's the colonists who do all the work. If one is worried that funds will be cut off, **it is important to establish a self-supporting colony as soon as possible**. Some have argued that older astronauts should be sent on a one-way trip to Mars since they ostensibly have less to lose. But I would want to recruit young astronauts who can have children and grandchildren on Mars: people who would rather be the founders of a Martian civilization than return to a ticker-tape parade on Earth. **Founding a colony on Mars would change the course of world history**. You couldn't even call it "world" history anymore. **If colonizing Mars to increase the survival prospects of the human species is our goal**, then, since money is short, **we should concentrate on that goal**. In New Scientist (Gott 1997) I said: "And if colonization were the goal, you would not have to bring astronauts back from Mars after all; that is where we want them. Instead we could equip them to stay and establish a colony at the outset, a good strategy if one is worried that funding for the space programme may not last.

Solves Extinction

Numerous extinction events make it necessary to “get off the rock”

Popular Science 11 (March, “AFTER EARTH: Why? Where? How? When?” Pg. 46 Vol. 278 No. 3) NS 5/24/11

Earth won't always be fit for occupation. We know that in two billion years or so, an expanding sun will boil away our oceans, leaving our home in the universe uninhabitable-unless, that is, we haven't already been wiped out by the Andromeda galaxy, which is on a multibillion-year collision course with our Milky Way. Moreover, at least a third of the thousand mile-wide asteroids that hurtle across our orbital path will eventually crash into us, at a rate of about one every 300,000 years. Indeed, in 1989 a far smaller asteroid, the impact of which would still have been equivalent in force to 1,000 nuclear bombs, crossed our orbit just six hours after Earth had passed. A recent report by the Lifeboat Foundation, whose hundreds of researchers track a dozen different existential risks to humanity, likens that onein- 300,000 chance of a catastrophic strike to a game of Russian roulette: "If we keep pulling the trigger long enough we'll blow our head off, and there's no guarantee it won't be the next pull." Many of the threats that might lead us to consider off-Earth living arrangements are actually manmade, and not necessarily in the distant future. The amount we consume each year already far outstrips what our planet can sustain, and the World Wildlife Fund estimates that by 2030 we will be consuming two planets' worth of natural resources annually. The Center for Research on the Epidemiology of Disasters, an international humanitarian organization, reports that the onslaught of droughts, earthquakes, epic rains and floods over the past decade is triple the number from the 1980s and nearly 54 times that of 1901, when this data was first collected. Some scenarios have climate change leading to severe water shortages, the submersion of coastal areas, and widespread famine. Additionally, the world could end by way of deadly pathogen, nuclear war or, as the Lifeboat Foundation warns, the "misuse of increasingly powerful technologies." Given the risks humans pose to the planet, we might also someday leave Earth simply to conserve it, with our planet becoming a kind of nature sanctuary that we visit now and again, as we might Yosemite. None of the threats we face are especially far-fetched. Climate change is already a major factor in human affairs, for instance, and our planet has undergone at least one previous mass extinction as a result of asteroid impact. "The dinosaurs died out because they were too stupid to build an adequate spacefaring civilization," says Tihamer Toth-Fejel, a research engineer at the Advanced Information Systems division of defense contractor General Dynamics and one of 85 members of the Lifeboat Foundation's space-settlement board. "So far, the difference between us and them is barely measurable." The Alliance to Rescue Civilization, a project started by New York University chemist Robert Shapiro, contends that the inevitability of any of several cataclysmic events means that we must prepare a copy of our civilization and move it into outer space and out of harm's way-a backup of our cultural achievements and traditions. In 2005, then-NASA administrator Michael Griffin described the aims of the national space program in similar terms. "If we humans want to survive for hundreds of thousands or millions of years, we must ultimately populate other planets," he said. "One day, I don't know when that day is, but there will be more human beings who live off the Earth than on it."

**Solves Extinction**

Multiple ways extinction could happen on Earth – colonization solves

Sowers, transhumanist, 2

(George F., “The Transhumanist Case for Space” April 2002, http://www.georgesowers.com/Other\_pdf/The\_trans\_case\_for\_space.pdf, accessed 6-9-11, JMB)

What can we do to maximize our odds of survival, irrespective of what those odds might actually be? Furthermore, as humans or aspiring transhumans, we desire much more than mere survival. We also wish to grow in our capabilities and enjoy not only continued life but an ever increasing abundance of life. In this light the question becomes one of risk management. How can we best avoid any large-scale events that would either threaten our survival or significantly degrade our quality of life or limit our ability to grow our technology? Risk management is a fairly standard technique practiced in the management of many (if not most) large scale engineering projects, especially those involving significant amounts of technological development. It came of age in the era of the massive nuclear power plant projects10 and has become stock and trade in the aerospace and defense industry.11 The logic of risk management is straightforward. A risk is an event that has consequences adverse to the achievement of the project’s goals. It is quantified by two numbers: the probability of the event and the severity of the consequences. Typically, the severity of the consequences is measured in dollars of additional cost or weeks of schedule delay or some technical measurement of the performance of the system. The risk management process consists of several basic steps. First is risk identification, followed by risk assessment and analysis and finally risk handling. Risk identification involves the recognition of possible future adverse events—events with consequences detrimental to the projects goal’s. Risk assessment and analysis is the process of estimating the probability of occurrence and consequences of the identified events. Since uncertainty is a significant element of risk, a key element of risk analysis is bounding the uncertainties on the estimated probabilities and consequences. Finally, risk handling is determining and executing a set of actions to reduce the overall risk level, the point of risk management. By now you may be wondering what all this has to do with transhumanism and space. The transhumanism agenda can certainly be seen as embodying a set of goals, among them being extended life and mental capabilities for individual humans/transhumans. Furthermore, it is clear that there are possible future events that would severely curtail, or prohibit our ability to achieve those goals. Those events - 10 - constitute risks to the transhumanist movement, and risk management techniques can be applied to mitigate them. My claim here will be that the expansion of humanity into space, colonizing other planets and eventually other solar systems, provides substantial mitigation for the most severe risks facing transhumanists and the human species as a whole. What kinds of future events should we be worried about? Nick Bostrom has taken a credible stab at developing a list.12 Although he was ostensibly looking at existential risks—no, not the risk of becoming like Camus, but risks that threaten the existence of the species, risks of extinction—his list is a good starting point for general risks to the transhumanist future. Among the items he mentions are deliberate or accidental misuse of nano-technology, nuclear holocaust, badly programmed superintelligence, genetically engineered biological agents, and asteroid impact. We can think of others that don’t have existential consequences but can cause grave harm to transhuman objectives through derailment and delay. For example, anti-technology sentiment generated by religious or environmentalist groups, economic crisis spurred by energy scarcity or regional conflict or simply the chaotic dynamics of economies, global environmental or climatic catastrophe leading to economic crashes—any of these might severely curtail the technological progress necessary for transhumanist aims. Of course, eventually the earth will be consumed by the death of the sun, an event we should have a few billion years to prepare for. So much for risk identification. You can add your own favorites. Clearly there is no lack of things to worry about. Next comes risk assessment and analysis. In this phase we attempt to estimate the probability of ocurance and severity of consequences for the identified events. For proper risk assessment, the estimates should include not only a point estimate but also confidence intervals, as the range of possibilities is important to the mitigation planning phase. A detailed assessment of these risks is far beyond the scope of this article, but let me make a few general comments. In order to make the probability estimate precise, we need to specify the time horizon, say the next 100 years or the next 1000 years. For example, we could say that the probability of a significant asteroid strike (greater than x tons) to the earth within the next 100 years is y y to 95% confidence. It happens that the probability of an asteroid strike is perhaps the easiest of all to estimate given the - 11 - available astronomical data. The other events are devilishly hard to get credible numbers for, so we would resort to a relative likelihood. The severity of consequences is again very difficult to predict but would generally range from complete extinction through collapse of civilization to a relatively mild economic downturn. Here it is helpful to devise some common system of measurement in order to facilitate comparison of different risks. For example, each risk could be quantified in terms of the resulting time delay to achieving some transhumanist milestone. In this case, extinction would be tantamount to an infinite delay, where an economic crash might delay things only a few years. The third and final phase of risk management is risk handling or risk mitigation. Standard risk management identifies four risk handling techniques: avoidance, control, assumption, and transfer. Risk avoidance means eliminating the event as a possibility. For example, we could avoid the risk of nano-technology disaster by refusing to pursue nano-technology research. I am not advocating that course of action. Risk control consists of taking actions to either reduce the probability of occurrence or reduce the severity of consequences or both. It is what we traditionally think of as risk mitigation. Risk assumption occurs when we resign ourselves to the fact that a particular risk exists and there is not much we can do about it. Risk transfer is shifting the consequences of the event to someone else and is typically used when considering the financial consequences of an event, i.e., who pays for the disaster. The exploration and colonization of space falls into the category of risk control for the risks we have identified above. To see this it is only necessary to recognize that the effects of these risk events are confined to a particular limited spatial locale, namely Earth. Hence, distributing the species across space reduces the consequences of such an event to only that portion of the population resident in that particular spot. This phenomenon is well known in biology. If you look at the wide diversity of biological species, the ones at greatest risk for extinction are those who are geographically isolated. Most of the modern extinctions have come from species indigenous to one or a handful of islands. Species that are wide spread are far more resilient. The reasons are simple. Just one bit of bad luck can wipe out an island species: the introduction of a new predator, a new more virulent disease, a change of climate, the loss of food sources, etc. But if a - 12 - species is geographically diverse, one of these kinds of events will lead to only local extinction.13 The analogy is straightforward: humanity is on an island called earth. As long as we are confined to this one locale, we are vulnerable to various calamities: nuclear war, bio-terrorism, global warming, asteroid impact, invasion by a super intelligent race, or some nano-tech experiment run amok. Once humanity or transhumanity becomes dispersed among the stars we become far less exposed to extinction by our own stupidity or just bad luck.

Asteroids Impact Calculus

Catastrophic impacts come first-their impact evaluation framework is wrong

Chichilnisky and Eisenberger 10

(Graciela and Peter, Chichilnisky has a masters and PhD in Math from MIT and UC Berkeley and a PhD in economics from Berkeley and is a statistics professor at Columbia University while Eisenberger has taught physics at princeton and Earth and environmental sciences at Columbia University, “Asteroids: Assessing Catastrophic Risks,” *Journal of Probability and Statistics,* Volume: 2010, May 9, page 2, SRF).

The purpose of this paper is to provide answers to these questions. We examine systematically how to deal with catastrophic risks such as asteroid impacts, which are small probability events with enormous consequences, events that could threaten the survival of our species, and compare their treatment with risks like global warming that are more imminent and familiar but possibly less catastrophic. The task is not easy. Classic tools for risk management are notoriously poor for managing catastrophic risks, \_see Posner \_2\_ and Chichilnisky \_3, 4\_\_. There is an understandable tendency to ignore rare events, such as an asteroid impact, which are unlikely to occur in our lifetimes or those of our families \_2, 5\_. Yes this is a questionable instinct at this stage of human evolution where our knowledge enables to identify such risks. Standard decision tools make this task difficult. We show using the existing data that a major disturbance caused by global warming of less than 1% of GDP overwhelms in expected value the costs associated with an asteroid impact that can plausibly lead to the extinction of the human species. We show that the expected value of the loss caused by an asteroid that leads to extinction—is between $500 million and $92 billion. A loss of this magnitude is smaller than that of a failure of a single atomic plant—the Russians lost more than $140 billion with the accident at Chernobyl—or with the potential risks involved in global warming that is between $890 billion and $9*.*7 trillion \_2\_. Using expected values therefore we are led to believe that preventing asteroid impacts should not rank high in our policy priorities. Common sense rebels against the computation we just provided. The ability to anticipate and plan for threats that have never been experienced by any current or past member of the species and are unlikely to happen in our lifespans, appears to be unique to our species. We need to use a risk management approach that enables us to deal more effectively with such threats \_2\_. To overcome this problem this paper summarizes a new axiomatic approach to catastrophic risks that updates current methods developed initially by John Von Neumann, see Chichilnisky \_3, 4, 6–9\_, and offers practical figures to evaluate possible policies that would protect us from asteroid impacts. Our conclusion is that we are underinvesting in preventing the risk of asteroid like threats. Much can and should be done at a relatively small cost; this paper suggests a methodology and a range of dollar values that should be spent to protect against such risks to help prevent the extinction of our species.

Asteroids Impact Calculus

Statistical Analysis shows that asteroids outweigh warming and all other impacts.

Chichilnisky and Eisenberger 10

(Graciela and Peter, Chichilnisky has a masters and PhD in Math from MIT and UC Berkeley and a PhD in economics from Berkeley and is a statistics professor at Columbia University while Eisenberger has taught physics at princeton and Earth and environmental sciences at Columbia University, “Asteroids: Assessing Catastrophic Risks,” *Journal of Probability and Statistics,* Volume: 2010, May 9, page 2, SRF).

Our rational decision maker who values the future of the species and understands what probabilities really mean, could go through the following simple analysis. For any value of u even close to one half the expected value we have calculated and makes asteroids more threatening than global warming that is attracting all the attention of policy makers and the public today. In one sense this is satisfying since we would like to believe that we would give great value to prevent our extinction. However, we used the number of US$300 trillion (\_ = 1=2) for the expected value and argued that it is what we should spend to defend against extinction also does not seem to be intuitively correct for many reasons, not the least of which is that we would have no resources left to do anything else. The answer to this dilemma is to recognize that what we are really interested in is utility loss from extinction rather than expected value for the dollars we allocate. This view can help us achieve an intuitively pleasing answer that we should spend as much money today on defenses against extiction that can be usefully transferred into improved protection. In the case of asteroids based on current estimates many experts believe this might be only about 10 times what we are now spending which is about US$30 million dollars. This is such a small number and the correct valuation of the risk is high enough that we should need no further analysis to decide to increase our efforts now and when new opportunities become available in the future.

\*Colonization Possible/Technically Feasible\*

Timeframe

Must colonize Mars now

Gott 11 (J. Richard, January, Department of Astrophysics at Princeton, “A One-Way Trip to Mars”, Journal of Cosmology, Vol 13, http://journalofcosmology.com/Mars151.html) CH

I've been stressing the fact that we should be in a hurry to colonize space, to improve our survival prospects, since my Nature paper in 1993 (Gott 1993). The real space race is whether we get off the planet before the money for the space program runs out. The human spaceflight program is only 50 years old, and may go extinct on a similar timescale. Expensive programs are often abandoned after a while. In the 1400s, China explored as far as Africa before abruptly abandoning its voyages. Right now we have all our eggs in one basket: Earth. The bones of extinct species in our natural history museums give mute testimony that disasters on Earth routinely occur that cause species to go extinct. It is like sailing on the Titanic with no lifeboats. We need some lifeboats. A colony on Mars might as much as double our long-term survival prospects by giving us two chances instead of one. Colonies are a great bargain: you just send a few astronauts and they have descendants on Mars, sustained by using indigenous materials. It's the colonists who do all the work. If one is worried that funds will be cut off, it is important to establish a self-supporting colony as soon as possible. Some have argued that older astronauts should be sent on a one-way trip to Mars since they ostensibly have less to lose. But I would want to recruit young astronauts who can have children and grandchildren on Mars: people who would rather be the founders of a Martian civilization than return to a ticker-tape parade on Earth. Founding a colony on Mars would change the course of world history. You couldn't even call it "world" history anymore. If colonizing Mars to increase the survival prospects of the human species is our goal, then, since money is short, we should concentrate on that goal. In New Scientist (Gott 1997) I said: "And if colonization were the goal, you would not have to bring astronauts back from Mars after all; that is where we want them. Instead we could equip them to stay and establish a colony at the outset, a good strategy if one is worried that funding for the space programme may not last. So we should be asking ourselves: what is the cheapest way to establish a permanent, self-sustaining colony on Mars?"

Population and resource pressures threaten colonization plans if delayed for future

Hender 9 (Matthew, August, University of Adelaide School of Mechanical Engineering, “Colonization: A Permanent Habitat for the Colonization of Mars”, http://digital.library.adelaide.edu.au/dspace/bitstream/2440/61315/3/02chapters1-4.pdf) CH

It is considered that we should think about it now and plan to be ready to commence colonization in the near future. If the process is left for the distant future it is possible that the resources to perform such a feat will no longer exist, absorbed for the purpose of survival by a swelling population. If the population levels exceed a “critical mass” or resource use continues at unsustainable levels there could conceivably become a time when the opportunity has passed us by. If we wish to open up this frontier we will need to do so whilst resources are available.

Innovation – Energy & Disease Tech

Mars specifically will spur more efficient technology, that’s key to resource preservation and disease

Rampelotto 11 (Pabulo, January, Federal University of Santa Maria, “Why Send Humans to Mars? Looking Beyond Science”, http://bruceleeeowe.wordpress.com/2011/02/24/why-send-humans-to-mars-looking-beyond-science/) CH

The permanence of humans in a hostile environment like on Mars will require careful use of local resources. This necessity might stimulate the development of novel methods and technologies in energy extraction and usage that could benefit terrestrial exploitation and thus improve the management of and prolong the existence of resources on Earth. The study of human physiology in the Martian environment will provide unique insights into whole-body physiology, and in areas as bone physiology, neurovestibular and cardiovascular function. These areas are important for understanding various terrestrial disease processes (e.g. osteoporosis, muscle atrophy, cardiac impairment, and balance and co-ordination defects). Moreover, medical studies in the Martian environment associated with researches in space medicine will provide a stimulus for the development of innovative medical technology, much of which will be directly applicable to terrestrial medicine. In fact, several medical products already developed are space spin-offs including surgically implantable heart pacemaker, implantable heart defibrillator, kidney dialysis machines, CAT scans, radiation therapy for the treatment of cancer, among many others. Undoubtedly, all these space spin-offs significantly improved the human’s quality of life.

Commercial Development

Mars makes money—key to asteroid mining, sells real estate, and catalyzes new technology

Zubrin 95 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration and former chairman of the National Space Society, “The Economic Viability of Mars Colonization”, http://www.aleph.se/Trans/Tech/Space/mars.html, IWren)

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.

Minerals

Natural mineral concentrations and billions of dollars’ worth of deuterium available—can be transported back

Zubrin 96 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, Ph. D in nuclear engineering and former chairman of the National Space Society, “The Case for Colonizing Mars”, in Ad Astra July/August 1996, http://www.nss.org/settlement/mars/zubrin-colonize.html, IWren)

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.

Minerals- Deuterium

Deuterium is present in large amounts on Mars-key to nuclear reactors

Zubrin, Aerospace engineer and head of the Mars Society, ‘96

(Robert, *National Space Society*, “The Case for Colonizing Mars,” July/August, http://www.nss.org/settlement/mars/zubrin-colonize.html, 5-31-2011, SRF).

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Solves Fossil Fuel Dependence

Mars solves fossil fuel dependence

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Q: Why concentrate on Mars when there are so many problems on Earth? A: Many prominent people, such as actor Patrick Stewart (who depicted Captain Jean-Luc Picard on Star Trek), have argued that it makes more sense to use government resources to solve Earthly problems, and that we should only attempt a humans to Mars mission after Earth's problems have been solved. Given the imperfect nature of humanity, however, this simply amounts to a cheap cop-out. Humanity will never solve all of its problems, even given an infinite amount of time -- much less within the time each of us has remaining on Earth. Equally important is the fact that humans to Mars missions could actually help solve some of those very same problems. For example, long-term plans for space exploration currently include development of nuclear propulsion systems, which when combined with the abundant supplies of helium isotope H-3 available on the Moon and Mars, could provide a practically pollution-free, virtually inexhaustible supply of cheap power for all of Earth that would end our dependence on fossil fuels.

Martian Atmosphere=fuel

The Martian atmosphere is an excellent fuel source

Gustafson has a BS in engineering mechanics, Rice is the founder of Orbital Technologies Corporation, Gramer writes technical articles for Orbitec, and White writes articles for Orbitec, 2003

(Robert J., Eric E., Daniel J., and Brant C., “A View of Future Human Colonies on Mars”, *EBSCO,* pg. 1, 6-17-2011, SRF)

Probably the most cost-effective and easiest use of Martian resources is the atmosphere (95% CO2). The CO2 can be easily processed and converted to carbon monoxide or carbon and oxygen. Water vapor is also present in the Mars atmosphere in small concentrations; soil-based water (especially in the polar regions) is in much greater abundance. With the availability of C, CO, O2, and H2O through processing the atmosphere, excellent propellants can be made (SC/LOX, SCO/LOX, LCO/LOX, LCH4/LOX, SCH4/LOX, SC2H2/LOX, LC2H4/LOX, SC2H4/LOX, LH2/SOX, LH2/LOX, H202/CH3OH, and etc). For this study period, we focused upon a 50-year period beyond the initial manned Mars exploration activity (from 2040 through 2090). For the 2040-2090 periods, we have assumed that two different levels of activity and missions that require the use of propellants and fuels are possible, namely: (a) an extended presence on Mars for research/exploration, and (b) a Mars terraforming program that requires a large colony. In the first case, we envision a permanent research outpost on the surface of Mars with a steady-state population of 100. We refer to this as the 100-person colony scenario. In the later case, we envision a large-scale colonization effort where the colony population eventually reaches 10,000. We refer to this case as the 10,000-person colony scenario (Rice, 2000).

Scientific Research

Mission to Mars would create a research bonanza.

Lamb 10 (Gregory M., November 17, CSMonitor, “One-way ticket to Mars?,” http://www.csmonitor.com/Innovation/One-way-ticket-to-Mars) KA

Colonist-scientists living on Mars could produce a bonanza in basic research, the authors say. That would include a better understanding of the origin of Earth itself, and perhaps even the discovery of the first extraterrestrial life. And in the long term, a Martian colony would be a huge first step toward humans moving away from Earth. Famed theoretical physicist [Stephen Hawking](http://www.csmonitor.com/tags/topic/Stephen%2BHawking) has been among those arguing that because of the chance of a disaster on Earth, humans must start moving out into the solar system.

Missions to Mars would include researching human evolution, the planet Mars and how it relates to Earth, breakthrough technology, while furthering international cooperation and inspiring the world.

Hoffman and Kaplan, 1997 (Stephen J., and David I., “Human Exploration of Mars: The Reference Mission of the NASA Mars Exploration Study Team,” NASAA Special Publication 6107, <http://spacecraft.ssl.umd.edu/design_lib/NASA-SP6107.Mars_DRM.pdf>, SL)

1.2 Background The Mars Exploration Study Project was undertaken to establish a vision for the human exploration of Mars that would serve as a mechanism for understanding the programmatic and technical requirements that would be placed on existing and planned Agency programs. In August 1992, the first workshop of the Mars Study Team held at the Lunar and Planetary Institute in Houston, Texas, addressed the “whys” of Mars exploration to provide the top-level requirements from which the Mars exploration program could be built (Duke and Budden 1992). The workshop attendees identified the major elements of a potential rationale for a Mars exploration program as: •Human Evolution – Mars is the most accessible planet beyond the Earth-Moon system where sustained human presence is believed to be possible. The technical objectives of Mars exploration should be to understand what would be required to sustain a permanent human presence beyond Earth. •Comparative Planetology – The scientific objectives of Mars exploration should be to understand the planet and its history, and therefore to better understand Earth. •International Cooperation – The political environment at the end of the Cold War may be conducive to a concerted international effort that is appropriate to, and may be required for, a sustained Mars program. •Technology Advancement – The human exploration of Mars currently lies at the ragged edge of achievability. The necessary technical capabilities are either just available or on the horizon. Commitment to the program will both effectively exploit previous investments and contribute to advances in technology. •Inspiration – The goals of Mars exploration are grand; they will motivate our youth, benefit technical education goals, and excite the people and nations of the world. The study team of personnel from NASA field centers used these inputs to construct the Reference Mission, and then translated the inputs into a set of goals and objectives. Ground rules and assumptions were agreed upon and reflect the lessons learned from previous study efforts. From this work, a mission and a set of systems were developed.

**One Way Best – Mars Research**

Human missions to Mars is the only way to continue effective Mars research

Levine, Garvin and Beaty 10 (Joel S., James B. and David W., NASA research center co-chairs and researchers, “Humans on Mars: Why Mars? Why Humans? Planning for the Scientific Exploration of Mars by Humans. Part 1.”, *Journal of Cosmology*, volume: 12, p. 3627-3635, http://journalofcosmology.com/Mars115.html) EK

Humans have unique capabilities for performing scientific measurements, observations and sample collecting. Human attributes to exploration include: intelligence, adaptability, agility, dexterity, cognition, patience, problem solving in real-time, in situ analyses - more science in less time! Humans are unique scientific explorers. Humans could obtain previously unobtainable scientific measurements on the surface of Mars. Humans possess the abilities to adapt to new and unexpected situations in new and strange environments, they can make real-time decisions, have strong recognition abilities and are intelligent. Humans could perform detailed and precise measurements of the surface, subsurface and atmosphere while on the surface of Mars with state-of–the-art scientific equipment and instrumentation brought from Earth. The increased laboratory ability on Mars that humans offer, would allow for dramatically more scientific return within the established sample return limits. The HEM-SAG envisions that the scientific exploration of Mars by humans would be performed as a synergistic partnership between humans and robotic probes, controlled by the human explorers on the surface of Mars. Robotic probes could explore terrains and features not suitable or too risky for human exploration. Under human control, robotic probes could traverse great distances from the human habitat covering distances/terrain too risky for human exploration and return rock and dust samples to the habitat from great distances. The unique capabilities that humans would provide for each of the MEPAG science disciplines mentioned above are summarized as follows: Geology Human explorers can perform intelligent sample selection, real time assessment of site sampling progress and strategy development to optimize science return. Human explorers can perform drilling in environments difficult for core recovery (ice, sediments, other unconsolidated materials) without human involvement. Human explorers can perform rapid assessment of subsurface and sampling/trenching (efficiency factor). Geophysics Humans are likely to be far more efficient and skilled than robots in carrying out the careful emplacement of instruments, networks, and site surveys required to meet geophysical investigation goals and objectives. Even if rover-borne instrumentation is deployed telerobotically, that would require human oversight from the habitat. Some geophysics instrumentation must be deployed and then recovered following measurements (e.g., active seismic systems, or electromagnetic sensors). Humans would make this deployment/recovery process more efficient and perhaps even more carefully done, as well as providing instant gratification on the health and performance of the instruments. Atmosphere/Climate Human enabled investigations on Mars would benefit atmospheric, polar cap, and ancient climate science objectives in a variety of ways. Human dexterity and efficiency would be important qualities for micrometeorological investigations where activities such as radiosonde preparation and release are not yet automated on Earth due to the dynamic interaction with surface turbulence and winds. Cognitive ability, dexterity and efficiency would be necessary attributes in the search for relevant rock outcrops and samples, providing the ability to identify sources of trace gases for studies of current climate on Mars as well as locating pristine impact glasses containing trapped gasses for the study of ancient Mars climate. These unique human capabilities would be vital to deep drilling and coring activities. Touch and sound would be used to monitor the drill performance and respond rapidly to changing subsurface conditions. We believe that the human element is value added to all aspects of the MEPAG Goals and Objectives. Technology development in the decades leading up to a human mission to Mars would determine the best synergistic fit between human and robotic exploration and perhaps technology challenges would be overcome to shift the balance of physical activity toward robotic assignment. However, certain uniquely human attributes could not be duplicated by or relegated to robots or to operations remotely operated by humans on a planet substantially separated in time and space from Earth. Only a human presence in Mars mission surface operations activities could facilitate and achieve the ambitious scientific goals and objectives of MEPAG.

Innovation/Asteroids

Structural conditions will force invention and innovation on Mars—makes megabucks and serves as a staging point for asteroid mining

Zubrin 96 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, Ph. D in nuclear engineering and former chairman of the National Space Society, “The Case for Colonizing Mars”, in Ad Astra July/August 1996, http://www.nss.org/settlement/mars/zubrin-colonize.html, IWren)

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.

Exploration & Tech Development

Mars to Stay encourages further exploration into space

Hamilton 9 (Grant, July 17, “Time to go to Mars – and stay. So says Buzz Aldrin”)KA

Writing in the Washington Post, the second man on the Moon says that going back to that “lifeless barren world” is a dead-end. Buzz Aldrin, instead, proposes that we (read: America) set our sights on going to Mars — and not as explorers, but as homesteaders: Robotic exploration of Mars has yielded tantalizing clues about what was once a water-soaked planet. Deep beneath the soils of Mars may lie trapped frozen water, possibly with traces of still-extant primitive life forms. Climate change on a vast scale has reshaped Mars. With Earth in the throes of its own climate evolution, human outposts on Mars could be a virtual laboratory to study these vast planetary changes. And the best way to study Mars is with the two hands, eyes and ears of a geologist, first at a moon orbiting Mars and then on the Red Planet’s surface. Mobilizing the space program to focus on a human colony on Mars while at the same time helping our international partners explore the moon on their own would galvanize public support for space exploration and provide a cause to inspire America’s young students. Mars exploration would renew our space industry by opening up technology development to all players, not just the traditional big aerospace contractors. If we avoided the pitfall of aiming solely for the moon, we could be on Mars by the 60th anniversary year of our Apollo 11 flight. That is 20 years from now. Not exactly “by the end of this decade” but still pretty ambitious/audacious. I’m very much in favour of a permanent outpost or colonization-style space policy. Not only will it incalculably advance science in ways we can’t even imagine, it will provide a “frontier” for dreamers and explorers of all sorts.

Colonization Feasible

It is possible to colonize Mars (technologically and humanly feasible)

Lamb 10 (Gregory M., November 17, CSMonitor, “One-way ticket to Mars?,” http://www.csmonitor.com/Innovation/One-way-ticket-to-Mars) KA

They propose that, after several unmanned missions drop supplies at a base station on the Red Planet, two spacecraft carrying two humans each would be sent on the six- to eight-month voyage to Mars to begin the first human colony on another planet. Further missions would continue to supply the first settlers, who would be older, beyond child-bearing age, and – of course – volunteers. Eventually, as the colonists made more use of Mars' own resources, including water trapped as ice, they would be joined by more migrants from Earth. "It's not a suicide mission at all," argues Dr. Schulze-Makuch, coauthor of the paper and an associate professor at the school of earth and environmental sciences at [Washington State University](http://www.csmonitor.com/tags/topic/Washington%2BState%2BUniversity) in Pullman.Mars, he admits, "will never be a second Earth, you know, our home planet. But it's feasible to have people staying for a long time, and people living there, actually." Last spring, [President Obama](http://www.csmonitor.com/tags/topic/Barack%2BObama) put forth a set of new goals for US space exploration, including sending astronauts into orbit around Mars by the mid-2030s and returning them to Earth. While Mars has a much weaker gravitational field than Earth's, the pull is significant, which would mean that ferrying astronauts to and from the Martian surface would be an additional challenge requiring more resources. As Schulze-Makuch and Dr. Davies, a professor at [Arizona State University](http://www.csmonitor.com/tags/topic/Arizona%2BState%2BUniversity), have promoted their idea, many people have stepped forward to volunteer for such a mission, they say. One-way trips of colonization are common to human history, the authors argue. Most of the early settlers coming by ship to America had little hope of ever returning to [Europe](http://www.csmonitor.com/tags/topic/Europe). "They knew that they would never be coming back," Schulze-Makuch says.

Colonization Feasible- Martian Propellants Solve Fuel/Energy

The use of propellant made from Martian resources solves for fuel and energy needs.

Hoffman and Kaplan, 1997 (Stephen J., and David I., “Human Exploration of Mars: The Reference Mission of the NASA Mars Exploration Study Team,” NASAA Special Publication 6107, <http://spacecraft.ssl.umd.edu/design_lib/NASA-SP6107.Mars_DRM.pdf>, SL)

1.3.3.2 In Situ Resource Production The highly automated production of propellant from martian resources is another defining attribute of the Reference Mission. The technology for producing methane and liquid oxygen from the martian atmosphere and some nominal hydrogen feedstock from Earth is an effective performance enhancement and appears to be technologically feasible within the next few years. The split mission strategy allows the propellant production capability to be emplaced, checked out, and operated to produce the required propellant prior to launching the crew from Earth. In addition to spacecraft propulsion, the production capability on Mars can provide fuel for surface transportation, reactants for fuel cells, and backup caches of consumables (water, oxygen, nitrogen, and argon) for the life support system.

IMLEO Solves Cost/Weight

**Water on Mars means decreased IMLEO, which is weight, due to the use of Martian-made propellents. The less weight, the cheaper transporting cargo and explorers will be and the more sustainable missions to Mars will become**

Landau, Outer Planet Mission Analyst at the Jet Propulsion Laboratory, 09 (Damon F., “Comparative assessment of human Mars Mission technologies and architectures” Acta Astronoautica, Volume 65, Issues 7-8, <http://www.sciencedirect.com.ezproxy.baylor.edu/science/article/pii/S0094576509001118>, SL)

If water is available on Mars, then we advocate the following scenario to establish and sustain human exploration of Mars based on the combination of IMLEO benefits and technology development. Before the first mission to Mars, EP systems with thrust levels of around ten Newtons (at a specific mass of 50 kg/kW) should be developed. These systems will be used to transport cargo to Mars (to build infrastructure for exploration) and boost transfer vehicles from LEO to a high-energy elliptical Earth orbit. The first few missions should be semi-direct with EP for cargo and LOX/LH2 chemical propulsion systems for the taxis and transfer vehicles. With a crew of four, the initial IMLEO will be 274 mt (from row 5 of Table 4). Then, after the construction of four reusable transfer vehicles, the Earth–Mars semi-cycler architecture only requires 186 mt of IMLEO with no cargo transfer (from row 5 of Table 5). The next step is to develop a method to collect and electrolyze water on Mars and store the LOX and LH2 propellants. With this technology, the IMLEO is reduced to 107 mt (from row 20 of Table 5). With the development of reusable Mars launch vehicles and transfer vehicle propulsion systems, the IMLEO becomes 108 mt (from row 24 of Table 5) and no more EP vehicles are required. Moreover, we can reduce the IMLEO significantly by sending Marsproduced propellants to Earth. Assuming 60-mt transfer vehicles to support a crew of eight, the IMLEO is only 77.5 mt using the stop-over architecture (from Table 9). With this architecture and technology base, Mars exploration can continue to grow in terms of crew number and vehicle size with the least impact on IMLEO as compared to other scenarios. Only two transfer vehicles are required and no exotic propulsion systems are used. Furthermore, only half as many launch vehicles are needed to transport twice the crew of the initial exploration missions. Such a scenario can be a safe, economic, and reliable means to sustain a human presence on Mars

Water Key

**Finding water on Mars is key to sustaining the mission**

Grimm and Stillman, 2009 (Robert E., David E., “Subsurface water detection on Mars by astronauts using a seismic refraction method: Tests during a manned Mars simulation” Acta Astronautica, Volume 64, Issues 5-6, March-April 2009, pgs. 654-655, <http://www.sciencedirect.com.ezproxy.baylor.edu/science/article/pii/S0094576508002609>, SL)

It is known that water on the surface of previous Mars term exists in its solid form in the polar caps, but cannot exist in its liquid form due to the low Martian atmospheric pressure. However, it is suspected that liquid water could exist under the surface possibly as underground pockets or trapped in rocks. Detecting liquid water under the Martian surface at a depth accessible to a human crew (from several to a few hundred meters) is important for two main reasons. First, under the adage “find the water, and you may find life”, detecting liquid water would increase the chances of finding evidence of past or present life, possibly in a bacterial form somehow similar to terrestrial extremophile bacteria. Second, water sources detected close to the first Martian human settlement could help to sustain the presence and operations of the human crew in terms of consumption and fuel generation.

Searches for oases on Mars is key to finding putative life forms

Horneck, 2008 (Gerda, “The microbial case for Mars and its implication for human expeditions to Mars,” Acta Astronautica, 24 January 2008, <http://www.sciencedirect.com.ezproxy.baylor.edu/science/article/pii/S0094576507003104>, SL)

The present atmosphere of Mars is too cold—the average surface temperature is View the MathML source—to support liquid water on the surface for long and too thin—the average surface pressure is 560 Pa—to support ice; especially at the equatorial regions any ice that does form will quickly sublimate into water vapor. Therefore, the current surface conditions of Mars do not allow liquid water to persist over longer periods. The search for putative extant Martian life must therefore concentrate on subsurface biological oases where liquid water still exists under the current conditions. More information has been provided by the on-board measurements of the spacecraft Mars Express and Mars Reconnaissance Orbiter, currently orbiting Mars Prominent results of the current Mars Express mission are the detection of deep underground water-ice at the South Pole by the Mars advanced radar for subsurface and ionospheric sounding (MARSIS) instrument estimating a total volume of View the MathML source of water, which is equivalent to a present global water layer of about 11 m [14], the discovery of large-scale explosive volcanism on recent Mars (about 350 Ma ago) [15], indications of relatively young volcanic activities in the north polar ice regions [16], and the global distribution of anhydrous and hydrated minerals [9]. 3. Terrestrial extreme habitats as relevant for putative microbial oases on Mars If life once started on Mars the gradual decreasing pressure and temperature might have forced the emerging biota to retreat to some protective oases [17], where it might persist even today. Potential oases, to which putative life on Mars might have withdrawn are inferred from terrestrial analogues, such as deep subsurface rocks inhabited by cryptoendolithic microbial communities [18], the polar ice caps and permafrost regions [19], submarine or sub-ice hydrothermal vents [20] or other hydrothermal areas in connection with volcanic activities, or endoevaporites, i.e. microbial communities that live in salt crystals, e.g., halite or gypsum [21] and [22]. In the following terrestrial extreme habitats will be investigated, namely extremely dry environments, extremely cold environments, extremely salty environments, and those exposed to an intense flux of solar UV radiation, which may be considered as analogues for putative Martian oases.

Terraforming

We can achieve suitable temperature by artificial instigation of global warming

Zubrin and McKay 02 (Robert M., Christopher P., Pioneer Astronautics., NASA Ames Research Center, “Technological Requirements for Terraforming Mars” <http://www.users.globalnet.co.uk/~mfogg/zubrin.htm>) NS 5/25/11

The three most promising options for inducing the required temperature rise to produce a runaway greenhouse on Mars appear to be the use of orbital mirrors to change the heat balance of the south polar cap (thereby causing its CO2 reservoir to vaporize), the importation of ammonia rich objects from the outer solar system [3], and the production of artificial halocarbon ("CFC") gases on the Martian surface. We discuss each of these in turn. It should be noted, however, that synergistic combination of several such methods may yield better results than any one of them used alone [4]. Orbiting Mirrors While the production of a space-based sunlight reflecting device capable of warming the entire surface of Mars to terrestrial temperatures is theoretically possible [5], the engineering challenges involved in such a task place such a project well outside the technological horizon considered in this paper. A much more practical idea would be to construct a more modest mirror capable of warming a limited area of Mars by a few degrees. As shown by the data in fig. 1, a 5 degree K temperature rise imposed at the pole should be sufficient to cause the evaporation of the CO2 reservoir in the south polar cap. Based upon the total amount of solar energy required to raise the black-body temperature a given area a certain number of degrees above the polar value of 150 K, we find that a space-based mirror with a radius of 125 km could reflect enough sunlight to raise the entire area south of 70 degrees south latitude by 5 K. If made of solar sail type aluminized mylar material with a density of 4 tonnes/km^2, such a sail would have a mass of 200,000 tonnes. This is too large to consider launching from Earth, however if space-based manufacturing techniques are available, its constructing in space out of asteroidal or Martian moon material is a serious option. The total amount of energy required to process. the materials for such a reflector would be about 120 MWe-years, which could be readily provided by a set of 5 MWe nuclear reactors such as are now being considered for use in piloted nuclear electric spacecraft. Interestingly, if stationed near Mars, such a device would not have to orbit the planet. Rather, solar light pressure could be made to balance the planet's gravity, allowing it to hover as a "statite" [6] with its power output trained constantly at the polar region. For the sail density assumed, the required operating altitude would be 214,000 km. The statite reflector concept and the required mirror size to produce a given polar temperature rise is shown in figs 8 and 9. Fig.8 Solar sails of 4 tonnes/km^2 density can be held stationary above Mars by light pressure at an altitude of 214,000 km. Wasting a small amount of light allows shadowing to be avoided. Fig.9. Solar sail mirrors with radii on the order of 100 km and masses of 200,000 tonnes can produce the 5 K temperature rise required to vaporize the CO2 in Mars' south polar cap. It may be possible to construct such mirrors in space. If the value of Td is lower than 20 K, then the release of the polar CO2 reserves by themselves could be enough to trigger the release of the regolith's reserves in a runaway greenhouse effect. If however, as seems probable, Td is greater than 20 K, then either the importation or production of strong greenhouse gases will be required to force a global temperature rise sufficient to create a tangible atmospheric pressure on Mars. Moving Ammonia Asteroids Ammonia is a powerful greenhouse gas, and it is possible that nature has stockpiled large amounts of it in frozen form on asteroidal sized objects orbiting in the outer solar system. If moving material from such objects to Mars is envisioned, then such orbits would be quite convenient, because strange as it may seem, it is easier to move an asteroid from the outer solar system to Mars than it is to do so from the Main Belt or any other inner solar system orbit. This odd result follows from the laws of orbital mechanics, which cause an object farther away from the Sun to orbit it slower than one that is closer in. Because an object in the outer solar system moves slower, it takes a smaller DV to change its orbit from a circular to an ellipse. Furthermore, the orbit does not have to be so elliptical that it stretches from Mars to the outer solar system; it is sufficient to distort the objects orbit so that it intersects the path of a major planet, after which a gravity assist can do the rest. The results are shown in Fig. 10. It can be seen that moving an asteroid positioned in a circular orbit at 25 AU, by way of a Uranus gravity assist to Mars, requires a DV of only 0.3 km/s, compared to a 3.0 km/s DV to move an asteroid directly to Mars from a 2.7 AU position in the Main Belt. the time of flight required for such transfers is shown in Fig. 11.

Terraforming

Halocarbons could transform the environment making Mars suitable for diverse lifeforms

Zubrin and McKay 02 (Robert M., Christopher P., Pioneer Astronautics., NASA Ames Research Center, “Technological Requirements for Terraforming Mars,” <http://www.users.globalnet.co.uk/~mfogg/zubrin.htm>) NS 5/25/11

In Table 1 we show the amount of halocarbon gases (CFC's) needed in Mars' atmosphere to create a given temperature rise, and the power that would be needed on the Martian surface to produce the required CFC'c over a period of 20 years. If the gases have an atmospheric lifetime of 100 years, then approximately 1/5th the power levels shown in the table will be needed to maintain the CFC concentration after it has been built up. For purposes of comparison, a typical nuclear power plant used on Earth today has a power output of about 1000 MWe. and provides enough energy for a medium sized (Denver) American city. The industrial effort associated with such a power level would be substantial, producing about a trainload of refined material every day and requiring the support of a work crew of several thousand people on the Martian surface. A total project budget of several hundred billion dollars might well be required. Nevertheless, all things considered, such an operation is hardly likely to be beyond the capabilities of the mid 21st Century. In a matter of several decades, using such an approach Mars could be transformed from its current dry and frozen state into a warm and slightly moist planet capable of supporting life. Humans could not breath the air of the thus transformed Mars, but they would no longer require space suits and instead could travel freely in the open wearing ordinary clothes and a simple SCUBA type breathing gear. However because the outside atmospheric pressure will have been raised to human tolerable levels, it will be possible to have large habitable areas for humans under huge domelike inflatable tents containing breathable air. On the other hand, simple hardy plants could thrive in the CO2 rich outside environment, and spread rapidly across the planets surface. In the course of centuries, these plants would introduce oxygen into Mars's atmosphere in increasingly breathable quantities, opening up the surface to advanced plants and increasing numbers of animal types. As this occurred, the CO2 content of the atmosphere would be reduced, which would cause the planet to cool unless artificial greenhouse gases were introduced capable of blocking off those sections of the infrared spectrum previously protected by CO2. The halocarbon gases employed would also have to be varieties lacking in chlorine, if an ultraviolet shielding ozone layer is to be built up. Providing these matters are attended to, however, the day would eventually come when the domed tents would no longer be necessary.

AT: Environment Harsh—Terraforming Solves

Terraforming inevitable with colonization—solves temperature and oxygen shortage in 30 years

Zubrin 95 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, “The Economic Viability of Mars Colonization”, http://www.aleph.se/Trans/Tech/Space/mars.html, IWren)

If a viable Martian civilization can be established, its population and powers to change its planet will continue to grow. The advantages accruing to such a society of terraforming Mars into a more human-friendly environment are manifest4. Put simply, if enough people find a way to live and prosper on Mars there is no doubt but that sooner or later they will terraform the planet. The feasibility or lack thereof of terraforming Mars is thus in a sense a corollary to the economic viability of the Martian colonization effort. Potential methods of terraforming Mars have been discussed in a number of locations.5,6. In the primary scenario, artificial greenhouse gases such as halocarbons are produced on Mars and released into the atmosphere. The temperature rise induced by the presence of these gases causes CO2 adsorbed in the regolith to be outgassed, increasing the greenhouse effect still more, causing more outgassing, etc. In reference 6 it was shown that a rate of halocarbon production of about 1000 tonnes per hour would directly induce a temperature rise of about 10 K on Mars, and that the outgassing of CO2 caused by this direct forcing would likely raise the average temperature on Mars by 40 to 50 K, resulting in a Mars with a surface pressure over 200 mbar and seasonal incidence of liquid water in the warmest parts of the planet. Production of halocarbons at this rate would require an industrial establishment on Mars wielding about 5000 MW or power supported by a division of labor requiring at least (assuming optimistic application of robotics) 10,000 people. Such an operation would be enormous compared to our current space efforts, but very small compared to the overall human economic effort even at present. It is therefore anticipated that such efforts could commence as early as the mid 21st Century, with a substantial amount of the outgassing following on a time scale of a few decades. While humans could not breath the atmosphere of such a Mars, plants could, and under such conditions increasingly complex types of pioneering vegetation could be disseminated to create soil, oxygen, and ultimately the foundation for a thriving ecosphere on Mars. The presence of substantial pressure, even of an unbreathable atmosphere, would greatly benefit human settlers as only simple breathing gear and warm clothes (i.e. no spacesuits) would be required to operate in the open, and city-sized inflatable structures could be erected (since there would be no pressure differential with the outside world) that could house very large settlements in an open-air shirt-sleeve environment. Nevertheless, Mars will not be considered fully terraformed until its air is breathable by humans. Assuming complete coverage of the planet with photosynthetic plants, it would take about a millennia to put the 120 mbar of oxygen in Mars' atmosphere needed to support human respiration in the open. It is therefore anticipated that human terraformers would accelerate the oxygenation process by artificial technological approaches yet to be determined, with the two leading concepts being those based on either macroengineering (i.e. direct employment of very large scale energy systems such as terrawatt sized fusion reactors, huge space-based reflectors or lasers, etc.) or self reproducing machines, such as Turing machines or nanotechnology. Since such systems are well outside current engineering knowledge it is difficult to provide any useful estimate of how quickly they could complete the terraforming job. However in the case of self-replicating machines the ultimate source of power would be solar, and this provides the basis for an upper bound to system performance. Assuming the whole planet is covered with machines converting sunlight to electricity at 30% efficiency, and all this energy is applied to releasing oxygen from metallic oxides, a 120 mbar oxygen atmosphere could be created in about 30 years.

Crops

Effective crop growth on Mars is possible – carbon dioxide and artificial resources prove

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Although direct and complete analysis of Martian soil is necessary to confirm the soil\_s suitability for crop growth, and although organic matter is not present, it is shown that Mars soil does contain most of the nutrients required for sustaining crop growth, requiring limited enhancement and management. Whilst low light, limited water and low nutrient environments are detrimental to crop yield, each of these can be overcome through the use of an atmosphere enriched with carbon dioxide, or overcome through other methods such as artificial lighting, efficient water recycling and suitable soil blending and management respectively. Further to this, other factors, such as pollination, temperature and pressure levels, and magnetic field strengths are shown to be either manageable in the Martian environment, or pose no significant effect on crop yield. Whilst much is ascertainable about the effects of crop yield under Martian conditions, some additional experimentation is still to be undertaken, including assessment of the impact of increased solar radiation (due to low ozone levels on Mars) on plant reproduction. Additionally, Martian conditions are still to be closely replicated for largescale crop growth experimentation, which will demonstrate the effect of multiple concurrent stresses and determine the ideal environmental set-up for use on Mars. However, initial investigations are encouraging and it is considered that effective crop growth on Mars will, one day, be achieved.

Martian soil has enough nutrients to grow crops

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

It can be seen that the Martian soil is nutritionally poorer than a typical Earth soil sample in both nitrogen and potassium, but contains a greater abundance of other macronutrients and of most micronutrients. Nitrogen can be readily obtained from the atmosphere and converted into ammonia through inputting nitrogen (instead of carbon dioxide) and hydrogen into the Sabatier process (Zubrin 1997), creating an excellent fertilizer. The presence of hydroxides in the Martian soil should not pose a threat to crops, as they will quickly reduce in the presence of water. However, this addition of water may result in other chemical reactions, depending on mineralogical form of the nutrients, the effect of which will need further investigation. Unfortunately, at this stage, the mineralogical forms of all these nutrients is not known and so, without further sample analysis, it is not possible to determine all chemical reactions or the solubility and availability of the nutrients to the plant root system. Furthermore, Banin (1989) noted that the leaching of soluble salts from the soil may be necessary to prevent osmotic stress on the plants; however, this should be feasible in a fully enclosed greenhouse environment with an adequate water supply.

Crops

Inflatable greenhouse on Mars makes crops able to grow

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

An alternative, or in addition to the suggestion of Campbell and Moore, is an inflatable greenhouse. This may be the simplest lightweight method to provide sufficient arable farmland to sustain a colony. These plastic greenhouses could be semicylindrically shaped, be laid flat side down, filled with Martian regolith and soil (although the fine Martian soil has not been exposed to biotic effects it has several attributes which render it a soil rather than a planetary regolith1, Banin 1989) to an appropriate depth and pressurized with gas derived from the Martian atmosphere (the greenhouse atmosphere can be specially mixed from available resources). An atmosphere pressurized to between 500 and 1000 mbar, relatively rich in carbon dioxide (around 10 % is within the bounds of some experimental data, however higher concentrations may prove to be beneficial) with high nitrogen and moderate oxygen levels (all available from the Martian atmosphere), should be suitable for most crops, including corn, sugarcane and millet. Due to their naturally lower respiration levels and their more conservative use of moisture than other crops these particular crops should be relatively well suited to withstand the relatively stressful conditions of Mars, as discussed below.

High CO2 levels on Mars actually help crops grow better

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

There is significant evidence that increased CO2 levels in greenhouse atmospheres produce a faster growing and larger biomass. In fact, plants grown in atmospheres of increased carbon dioxide grow larger, have more branches and leaves, have a more extensive root system and produce more flowers and fruit (Idso 1989). Das et al. (2002) demonstrated in mungbean crops that the majority of this benefit is obtained during exposure to higher CO2 levels during the early phases of the plant\_s growth. Depending on plant species and age, plants show signs of accelerated growth in the presence of CO2 concentrations up to as much as 10 000 p.p.m. (Bugbee and Salisbury 1988). Further to this benefit, increased levels of CO2 cause the partial closing of the stomata resulting in a reduction in moisture loss through transpiration (Wittwer 1992), reducing the water use requirements of the plants. It should be noted that this effect also reduces the output of oxygen, thus reducing the quantity of oxygen available for humans, assuming a bioregenerative source of oxygen is required for the colony. Wittwer (1992) discussed experiments conducted on the benefits of increased CO2 concentrations in greenhouses. It was shown that plant productivity continues to rise up to concentrations of 1000 p.p.m. and over. Rice, for example, has an optimal CO2 concentration of 1500–2000 p.p.m. and unicellular algae have optimal levels of 10 000– 15 000 p.p.m. A doubling of CO2 levels has shown vegetables, such as tomatoes, cucumbers and lettuce, to have an average increase in yield of 20–50 %, reaching as high as 70 %. Cereal grains with C3 metabolism, including wheat, rice, barley, oats and rye, have shown yield increases from 25 % to 64 %. C4 crops have shown yield increases from 10 % to 55 %, primarily resulting from the more efficient use of water. Tuber and root crops, including potatoes and sweet potatoes, show an increase in tuberization and root growth of 18–75 %. De Costa et al. (2003) investigated the benefits of increased CO2 concentrations at an ambient temperature of 27–28 \_C, noting that many such experiments tend to be conducted under ambient temperatures of approximately 20 \_C, and confirmed the beneficial effect on photosynthesis and yield. Finally, legumes, including peas, soya beans and beans, have shown yield increases of 28–46 % with a large increase in biological nitrogen fixation of the soil, in the case of soya bean, efficiently fertilizing the soil as the carbon dioxide directly stimulates the nitrogen-fixing bacteria in the soil, in the presence of certain elements (Lowe and Evans 1962). Consideration must be given to importing nitrogen-fixing organisms, such as cyanobacteria from Earth for the conversion of dinitrogen to ammonia (Smernoff and MacElroy 1989), alternatively ammonia may be produced using the Sabatier process, as described above. There are other useful benefits of a high carbon dioxide level besides a greater efficiency in photosynthesis and reduced water loss. High CO2 levels benefit plants under many different environmental stresses, including low light, low water and low nutrient conditions.

Crops

Crops can still grow on Mars in low light intensities – carbon dioxide compensates

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Importantly, whilst Mars receives 78 %of the solar radiation reaching Earth, both planets have similar day–night cycle durations, such that crops on Mars do not necessarily require a controlled lighting environment. In a review of 10 years of scientific studies by Idso and Idso (1994) it has been demonstrated that plants grown in a CO2-enriched environment can produce a higher yield when grown under reduced light conditions. Of the 37 studies reviewed decreasing light intensity was shown to have no significant effect on plants’ photosynthetic response to increased concentrations of CO2 until the experiment dealing with the lowest light intensity was reviewed. In this experiment it was shown that, with a CO2 increase of 300 p.p.m. (over current Earth atmospheric levels) the mean increase in photosynthesis rose from 68 %, under normal lighting condition, to 80 % under low light levels. The effect is more significant at a 600-p.p.m. increase in CO2, with photosynthesis rising from 111 %, under normal light conditions, to 194 % under low light conditions. Subsequent studies have supported this finding, for example, Osborne et al. (1997) demonstrated the fact in forest under-story experiments. They showed that increased carbon dioxide levels allowed for a positive net photosynthetic uptake of carbon on days, and at locations, where light intensities were usually low enough to prevent positive net photosynthesis uptake under normal CO2 conditions.

The water for crops on Mars is sufficient and works in the increased CO2 conditions

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Further to the benefits of reduced lighting in CO2- enriched environments, Idso and Idso\_s (1994) analysis revealed interesting results under conditions of water limitation. With a CO2 increase of 300 p.p.m. plants demonstrated a 31 % growth enhancement under optimal water conditions and a 63 % increase at less than optimal water conditions. At a CO2 increase of 600 p.p.m., a growth enhancement of 51 % was observed under optimal water conditions whilst, at below optimal water levels, a 219 % enhancement was observed. Again, these observations have been supported by subsequent studies including Liang and Baruyama (1995), Mishra et al. (1999), Roden and Ball (1996), Goodfellow et al. (1997) and Polley et al. (1996). It should be noted that, whilst water can be considered scarce on Mars, it is available from the atmosphere and the soil, depending on altitude and distance from the equator, and supply is not considered a problem where recycling is utilized in a closed ecological environment.

CO2 on Mars increases crop growth

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Additionally, a significant increase of CO2 in the atmosphere has also shown the ability of plants to withstand insufficient soil nutrients (Idso and Idso 1994). This effect, however, is only apparent at higher carbon dioxide levels; slight reduction in growth was observed for only moderate CO2 increases. With a CO2 increase of 300 p.p.m., growth enhancements of 51 % have been demonstrated under good nutrient conditions, declining to 45 % under poorer nutrient conditions. Conversely, at a CO2 increase of 600 p.p.m. a growth enhancement of 43 % was observed under good nutrient conditions whilst, at poorer nutrient levels, a 52 % enhancement was observed. As CO2 levels increased by 1200 p.p.m., growth enhancement was more significant, rising from 60 % under good nutrient conditions to 207 %under poorer nutrient conditions. There is widespread utilization of CO2 enrichment for greenhouse crops on Earth and the process is relatively well understood. It is, therefore, a very attractive method for achieving high yields in pressurized Martian greenhouses. All crop production should be undertaken in a greenhouse with appropriate levels of CO2 for the particular crop variety with an overall atmosphere, preferably, remaining breathable. Oxygen tanks can be utilized in situations where optimum conditions are not breathable by humans.

Crops

Manual pollination could be done on Mars due to lack of wind in greenhouse

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

With the exception of plants that can self-pollinate (such as wheat and soya bean), on Earth insects or wind generally pollinate plants. Bees would make ideal greenhouse inhabitants provided they are considered when the atmosphere composition is determined. Bees would perform two useful roles in the greenhouse, that of pollination as well as the useful by-product, honey. It must be noted that bees require UV-A radiation for navigation and so the greenhouse materials must not block this wavelength of light, or an artificial source must be provided. Whilst there would be no wind within a greenhouse on Mars, where beneficial, the use of statically charged brushes may provide a low-tech, manual, pollination solution for wind-pollinated plants.

Desired temperatures for crops on Mars can be achieved through greenhouse

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Temperature is also important in plant growth. Cold temperatures, such as those in Earth\_s Arctic regions, require plants to increase their concentrations of photosynthetic enzymes to balance photosynthesis reactions with other limiting factors, such as carbon, water or light restrictions. To achieve these higher concentrations, the plants must maintain higher than normal nitrogen concentrations. High temperatures can have a detrimental effect by increasing photorespiration and, in extreme conditions, the inactivation of enzymes and the destruction of photosynthetic pigments. A moderate temperature is, therefore, desirable. In the case of Mars this will require the heating of the greenhouse atmosphere to levels typical of a sunny day on terrestrial farmlands as average day–night Martian surface temperatures are around )55 \_C.

The Martian soil can be slightly altered in able to grow crops

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

One aspect obviously lacking in Martian soil is the presence of organic matter, however, this is not necessarily a limiting factor. Walkinshaw and Galliano (1990) have discussed experiments undertaken during the Apollo era (1961–1975) on lunar samples, samples that are also devoid of organic matter. Apollo lunar samples stimulated the germination and growth of several plant varieties, including a fern regarded as \_sensitive\_. Furthermore, in experiments on tobacco tissue cultures, those treated with Apollo 11, 12, 14 and 15 lunar samples contained 21–35 % more pigment of chlorophyll than untreated samples. Therefore, given the soil nutrients and this information, the use of Martian soils for crop growth appears feasible with the addition of organic matter (from composted sewerage and unused plant components – carefully managed, with initial composting bacterial loads being transported from Earth), nitrogen (from cyanobacteria or fertilizer) and potassium (from fertilizer or sourced from locally rich Martian sources). Due to the fine grain size of Martian surface soil it is probable that, when watered, the particles would compact into a clay-like material. This would limit nutrient and (further) water infiltration and minimize root aeration. This can be overcome by blending the soil material with a coarse sand, fine gravel mix or organic waste material to increase porosity.

Crops

Low atmospheric pressure not an issue with plan growth – CO2 compensates

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

There have been relatively few studies on the germination and growth of plants in low-pressure environments, however, whilst of short duration and thus not addressing certain longer term implications, Walkinshaw (1986) performed experiments on crop germination and growth under low pressure situations with encouraging results. These experiments revealed that crops could tolerate low levels of oxygen and carbon dioxide and even the replacement of nitrogen with hydrogen during germination and early growth. Table 3 indicates results for various crop varieties grown under varying pressures (14 and 101 kPa) and with atmospheric compositions of both air, and air containing 10 % CO2. During these experiments germination percentages and stem lengths were recorded after 7 days. It can be seen that the increase in CO2 levels typically compensates for any reduction in growth or germination due to a lowered atmospheric pressure. Pressure had no statistical effect on the total protein content of soya beans (pressures of 33, 67 and 101 kPa produced protein contents of 221, 198 and 224 lg respectively).

Crop growth possible in reduced magnetic field

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Walkinshaw and Galliano (1990) discussed crop growth in a reduced magnetic field within a specially lined room, reducing geomagnetic forces from 55 000 to 75–140 gammas2. Germination, seedling growth, root and stem length, and tissue cultures were shown to be unaffected. Respiration was reduced by 40 % in lettuce; however, the significance of this is expected to be minimal in a CO2-enriched environment (depending on CO2 concentrations) due to the atmospheric-induced, lower rate of respiration. As such, low magnetic field strengths on Mars are not expected to have a detrimental impact on crop growth.

Crops

There is enough surface area on Mars to support a large number of people with crops

Hender 7 (M.R., University of Adelaide, SA, Australia, February 13, “Stability of Martian Environmental Conditions for Crop Growth on Mars”, J. Agronomy & Crop Science 193, Ebsco) KA

Numerous studies have been undertaken to determine the surface area required for crops to support a Martian habitat. Boston (1995) undertook a comparison of six such studies showing required areas ranging from 13 to 56.9 m2 per person. Previous to this Caudill (1985) calculated an area of 58.9 m2 per person, composed of 17.6 m2 for wheat, 13.9 m2 for rice, and 27.4 m2 for fruit and vegetables. Most studies undertaken are for relatively small crew sizes (often six to eight people). However, Johnson and Holbrow (1977), in one of the most comprehensive studies undertaken, calculated a requirement of 61 m2 per person to support a colony of 10 000 people. Whilst this final study was undertaken to consider a colony orbiting Earth, it is considered applicable in a Martian situation. For comparison, the Biosphere 2 experiment in Oracle, Arizona (USA) allowed 279 m2 per person for a crew of eight (Nelson and Dempster 1995), although space was not a limiting factor in the design.

There is significant evidence that increased CO2 levels in greenhouse atmospheres produce a faster growing and larger biomass. In fact, plants grown in atmospheres of increased carbon dioxide grow larger, have more branches and leaves, have a more extensive root system and produce more flowers and fruit (Idso 1989). Das et al. (2002) demonstrated in mungbean crops that the majority of this benefit is obtained during exposure to higher CO2 levels during the early phases of the plant\_s growth. Depending on plant species and age, plants show signs of accelerated growth in the presence of CO2 concentrations up to as much as 10 000 p.p.m. (Bugbee and Salisbury 1988). Further to this benefit, increased levels of CO2 cause the partial closing of the stomata resulting in a reduction in moisture loss through transpiration (Wittwer 1992), reducing the water use requirements of the plants. It should be noted that this effect also reduces the output of oxygen, thus reducing the quantity of oxygen available for humans, assuming a bioregenerative source of oxygen is required for the colony. Wittwer (1992) discussed experiments conducted on the benefits of increased CO2 concentrations in greenhouses. It was shown that plant productivity continues to rise up to concentrations of 1000 p.p.m. and over. Rice, for example, has an optimal CO2 concentration of 1500–2000 p.p.m. and unicellular algae have optimal levels of 10 000– 15 000 p.p.m. A doubling of CO2 levels has shown vegetables, such as tomatoes, cucumbers and lettuce, to have an average increase in yield of 20–50 %, reaching as high as 70 %. Cereal grains with C3 metabolism, including wheat, rice, barley, oats and rye, have shown yield increases from 25 % to 64 %. C4 crops have shown yield increases from 10 % to 55 %, primarily resulting from the more efficient use of water. Tuber and root crops, including potatoes and sweet potatoes, show an increase in tuberization and root growth of 18–75 %. De Costa et al. (2003) investigated the benefits of increased CO2 concentrations at an ambient temperature of 27–28 \_C, noting that many such experiments tend to be conducted under ambient temperatures of approximately 20 \_C, and confirmed the beneficial effect on photosynthesis and yield. Finally, legumes, including peas, soya beans and beans, have shown yield increases of 28–46 % with a large increase in biological nitrogen fixation of the soil, in the case of soya bean, efficiently fertilizing the soil as the carbon dioxide directly stimulates the nitrogen-fixing bacteria in the soil, in the presence of certain elements (Lowe and Evans 1962). Consideration must be given to importing nitrogen-fixing organisms, such as cyanobacteria from Earth for the conversion of dinitrogen to ammonia (Smernoff and MacElroy 1989), alternatively ammonia may be produced using the Sabatier process, as described above. There are other useful benefits of a high carbon dioxide level besides a greater efficiency in photosynthesis and reduced water loss. High CO2 levels benefit plants under many different environmental stresses, including low light, low water and low nutrient conditions.

AT: Environment Harsh—Domes Solve

Inflatable domes solve solar flares, radiation, and temperature extremes—can be deployed immediately

Zubrin 95 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, “The Economic Viability of Mars Colonization”, http://www.aleph.se/Trans/Tech/Space/mars.html, IWren)

Mars, on the other hand, has an atmosphere of sufficient density to protect crops grown on the surface against solar flares. On Mars, even during the base building phase, large inflatable greenhouses made of transparent plastic protected by thin hard-plastic ultra-violet and abrasion resistant geodesic domes could be readily deployed, rapidly creating large domains for crop growth. Even without the problems of solar flares and a 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. Even during the base building phase, domes of this type up to 50 meters in diameter could be deployed on Mars that could contain the 5 psi atmosphere necessary to support humans. If made of high strength plastics such as Kevlar, such a dome could have a safety factor of 4 against burst and weigh only about 4 tonnes, with another 4 tonnes required for its unpressurized Plexiglas shield. In the early years of settlement, such domes could be imported pre-fabricated from Earth. Later on they could be manufactured on Mars, along with larger domes (with the mass of the pressurized dome increasing as the cube of its radius, and the mass of the unpressurized shield dome increasing as the square of the radius: 100 meter domes would mass 32 tonnes and need a 16 tonne Plexiglas shield, etc.). Networks of such 50 to 100 meter domes could rapidly be manufactured and deployed, opening up large areas of the surface to both shirtsleeve human habitation and agriculture. If agriculture only areas are desired, the domes could be made much bigger, as plants do not require more than about 1 psi atmospheric pressure. Once Mars has been partially terraformed however, with the creation of a thicker CO2 atmosphere via regolith outgassing, the habitation domes could be made virtually to any size, as they would not have to sustain a pressure differential between their interior and exterior.

AT: Solar Storms

Science solves effects of solar storms

Alleyne 8 (Richard, science correspondent @ Telegragh, “Manned mission to Mars boost after British breakthrough”, 11/4/8, http://www.telegraph.co.uk/science/science-news/3394959/Manned-mission-to-Mars-boost-after-British-breakthrough.html) JPG

A manned mission to Mars is a step closer to reality after British scientists overcame one of its biggest obstacles - shielding astronauts from deadly solar storms. Putting a man on the Red Planet has been the favourite subject of science fiction writers and the dream of scientists ever since space travel was first envisaged. But, the vast distances aside, the greatest challenge facing explorers has been how to protect astronauts and their space ships from solar storms - radioactive clouds of particles that shred human DNA and destroy electronic instruments. Now British researchers believe they have come up with a practical solution by mimicking the Earth's own protection - a mini magnetic field that deflects the fatal particles. The British scientists based at the Rutherford Appleton Laboratory and universities of York and Strathclyde have applied kinetic theory, borrowed from experiments into nuclear fusion, to the problem. They have tested it in the laboratory with a model space craft and discovered that it offers almost total protection. Prof Bob Bingham, a theoretical physicist at the University of Strathclyde, said the team were currently patenting their technology and could have a working full size prototype within five years.

AT: No Plants

Greenhouses on Mars will protect plant life and help create an atmosphere

Zubrin, Aerospace engineer and head of the Mars Society, ‘96

(Robert, *National Space Society*, “The Case for Colonizing Mars,” July/August, http://www.nss.org/settlement/mars/zubrin-colonize.html, 5-31-2011, SRF).

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 could be 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.

AT: Radiation—Normal Means Solves

Normal means solves—radiation measuring would be required and happening in the status quo

Straume et al 10 (Tore Straume, Ph.D., Steve Blattnig, Ph.D., and Cary Zeitlin, Ph.D., Straume and Blattnig work at the NASA Ames research center, Zeitlin works at the Southwest Research Institute, “Radiation Hazards and the Colonization of Mars:Brain, Body, Pregnancy, In-Utero Development, Cardio, Cancer, Degeneration”, Journal of Cosmology, 2010, Vol 12, 3992-4033. JournalofCosmology.com, October-November, 2010, IWren)

It is expected that colonization of Mars would be a process requiring many phases, each phase having learned from the ones before. To better understand radiation exposure levels, it is possible to employ relatively low-cost precursor missions to Mars prior to human missions. Radiation measurements in Mars orbit have been performed and surface measurements are scheduled to begin in 2012. Radiation measurements were made by the MARIE instrument onboard the Odyssey spacecraft (launched 2001) while orbiting Mars with additional data on neutron doses coming from the HEND instrument (Tretyakov et al. 2009) also onboard Odyssey. The next radiation instrument that will make measurements on Mars will be the Radiation Assessment Detector (RAD) onboard the Mars Science Laboratory (MSL) planned to launch late 2011. The RAD instrument is a combined charged particle and neutron spectrometer. MSL will land on Mars in 2012, and RAD will provide the first radiation measurements on the surface of Mars. As measurement technologies continue to advance, particularly in the areas of microelectronics and low-power devices, we expect precursor missions to include measurement stations on the surface of Mars in locations under consideration for a base. These stations could characterize the radiation environment during an entire solar cycle and measure the radiation impact of SPEs. There may also be an interest in such a measurement station on Phobos, possibly in Stickney crater, which is on the side of Phobos facing Mars and therefore shielded by both the crater walls and Mars from cosmic radiation. Knowing the radiation environment in locations where human missions may be planned is of critical importance. To obtain such knowledge it is necessary to perform radiation measurements and validate computational models well in advance of a human mission so that adequate protective measures can be designed into the mission. It is also expected that the transit to/from Mars would be better characterized by both modeling and validation measurements. A significant issue of concern during transit is how radiation exposures will vary as one moves away from 1AU where the vast majority of radiation measurements have been taken (Mars Architecture Steering Group 2009). For example, missions such as short-term Mars with trajectories closer to the Sun and longer transit duration would result in greater chance for large SPE exposures while in the spacecraft as well as greater chance of a SPE at closer proximity to the Sun. GCR doses are also larger for long transit/short stay missions because dose rate is higher in transit than on Mars. From the radiation perspective, the short-stay mission profile could potentially be higher-risk than the long-stay.

AT: Robots Solve

Only human will spur the interest necessary to access technology, disease control, and investment

Fish 9 (Greg, Nov 21, Discovery News, “NEVER SEND A MACHINE TO DO A HUMAN'S JOB”, http://news.discovery.com/space/greg-fish-humans-robots.html)CH

Of course there's another big question: Why should we even bother investing billions into the space program? Aside from the concept that scientific exploration and pushing technology to the limits of what's possible always yields something useful, we should also note that developing the kind of compact, highly efficient methods of generating energy, growing food and avoiding the dangers of solar flares and alien storms could be directly applied to Earth to boost our infrastructure. The same kind of technology that would help us build and maintain a base on Mars could be scaled up and applied to the developing world to radically stabilize their energy supplies, manage the spread of disease and help boost foreign and local direct investment by giving businesses a robust infrastructure they can use to hit the ground running. And of course there's always the potential for high tech spin-offs to be used in the consumer markets and by the military. Simply put, companies who can build and test technology for space flight could use their new libraries of patents and apply them into innovative business models or drastically upgrade their existing product lines. Exploring space can only help expand our knowledge and improve our life in the long run, but as long as it depends on government funding or the whims of wealthy thrill-seekers, we need to make people care and offer them real inspiration for one day walking on the Moon or surfing on Titan's lakes. Just sending a robot or two when the budget allows for it is not going to motivate us to care about the future of space travel, no matter how practical or efficient it is.

AT: Null Gravity Dooms the Astronauts

Mars gravity is enough, and it could be recreated anyway.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Q: Won't the lack of gravity during the trip to Mars hurt the astronauts? A: The problem of zero gravity during the trip to Mars is actually not a problem at all: zero-gravity conditions can be eliminated altogether during the trip, as artificial gravity can be created through the use of centrifugal force. After launch from LEO, the upper-stage booster would be used as a counterweight to the habitat module, with a long, durable, multi-thread tether in between. With the two rotating around a central axis, Earth gravity could be mimicked for the duration of the trip; upon reaching Mars orbit, the tether could be cut (as there's no use for the burnt-out upper stage booster). The same process would apply to the return trip. Q: What are the effects of Mars gravity on humans? A: Obviously, nothing can be done to alter gravity on the surface of Mars. However, at 38% of Earth's gravity, the effects associated with microgravity are reduced considerably.

AT: Astronauts Go Crazy

Unlimited space, research, reading and games check astronaut discomfort.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

 Q: What about the "human problem"? A: The objection is often raised that no group of people can live in such tight quarters for such a long period of time as required by a Mars mission without either going crazy or fighting endlessly, making necessary cooperation impossible. However, on close examination, this argument falls apart quickly. For the 6-month flight to Mars, the crew of a Mars Direct mission will have a little over 1,000 square feet to live in -- a space that's somewhat small for the average American, but which is luxuriously large for, say, the average Japanese citizen. Once on the surface of Mars, the crew will have that space, the roughly 500-square-foot Earth Return Vehicle, and of course the entire surface of Mars to roam through. Combined with the immense amount of scientific work the crew will be conducting, boredom and cramped living quarters will not be a problem on Mars. The return flight, in the smaller ERV, is the roughest leg of the trip -- but the combination of ample reading material, games, etc., along with the anticipation of a return home to fame and fortune, will make that trip perfectly bearable. In the meantime, studies are being done with the crews of the Flashline Mars Arctic Research Station and the Mars Desert Research Station, both Mars Society simulation missions, to research how people live and work together under conditions similar to potential Mars missions.

AT: Atmosphere Loss

Their atmosphere loss argument is flawed, only tiny amounts are blown off by solar wind

Stan, works for the department of Petroleum at the University of Ploiesti in Romania, 10

(Marius, *EBSCO,* “Application of Similarity Theory to Establish Important Parameters to Drill on Mars”, accessed 6-13-2011, SRF)

Based on the information communicated by Mars Global Surveyor, it has been affirmed that the lack of protection against the cosmic radiation made the martial atmosphere to be simply “blown” by the solar wind. Meanwhile, new facts have come to contradict that hypothesis. The European explorer Mars Express, helped by the instrument ASPERA – 3 (Analyzer of Space Plasmas and Energetic Atoms) has also found that Mars is losing atmosphere, but it is all about 20 grams/ second. Focusing upon this rhythm of loss of the atmosphere, then, in all its history, Mars has only lost a layer of water measuring few centimeters and only a thousandth of the Carbon Dioxide from the atmosphere. We already know many things about the martial water, thanks to the observations made by the explorers Mars Odyssey and Mars Express. We know that there are huge quantities of water on Mars, and they will be charted by the following martial missions. Barabash has declared to the New Scientists magazine that : “There are huge quantities of water. In order to garner it somewhere, really huge basins are needed. The chances to find this water in a liquid condition are quite big now.

Life on Mars NO

Meridiani site shows low probability of life formation on Mars

Squyres, dept. of astronomy at Cornell and Knoll, Botanical Museum at Harvard, 5 (Steven W. and Andrew H., “Sedimentary rocks at Meridiani Planum: Origin, diagenesis and implications for life on Mars” Earth and Planetary Science Letters 240, 1-10, http://www.geol.umd.edu/~kaufman/ppt/G436/G436\_PDF\_library/Squyres05.pdf, accessed 6-14-11, JMB)

The Athena science payload carried by Opportunity was designed to search for geologic evidence of paleoenvironments that might have permitted life [3], not to search for evidence of life itself. Of the several physical and chemical biosignatures found in ancient terrestrial rocks, only macroscopic bedding features formed by the interaction of microbial communities with physical sedimentary processes might have been detected in Pancam images. They have not been observed. Nonetheless, as explored in this issue by Knoll et al. [19], the characterization of Meridiani paleoenvironments as arid, acidic and oxidizing places important constraints on astrobiological inference. Obviously, many terrestrial organisms thrive under oxidizing conditions, and some microorganisms also live in strong acids or at low water activity. So, strictly speaking, the ancient Meridiani environment was likely habitable, at least transiently when relatively dilute ground waters saturated accumulating evaporitic sands, at times also pooling on the surface. Of course, geochemical evidence also suggests evaporation to dryness, perhaps several times, and the duration of habitable conditions and the length of time between habitable intervals is unknown. Even if water was present at Meridiani for a substantial period of time, there are significant complicating factors regarding the suitability for life of the environment recorded there [19]. One key issue concerns phylogeny — the evolutionary relationships of terrestrial extremophiles to the great majority of organisms that live under less extreme conditions. With few exceptions, terrestrial organisms that live in arid, acidic, or oxidizing habitats are derived from ancestors that could not tolerate such environments. Thus, consideration of Meridiani requires that we not only ask whether members of a more broadly distributed biota could adapt to the Meridiani paleoenvironment, but also whether life could originate or gain an early foothold in such a place. Acidic and oxidizing environments present a severe challenge to the type of prebiotic chemical reactions generally thought to have played a role in the origin of life on Earth [19]. Meridiani geology does not tell us whether life could have originated earlier in martian history under different environmental conditions, but any early biota would have been subject to impact frustration during late heavy bombardment. On Earth, deep sea hydrothermal habitats might have provided refuge against large impacts [29], but there is no evidence that the martian surface provided comparable safe houses. Therefore, if Meridiani is representative of the most favorable surface environments that Mars possessed after late heavy bombardment, acidity, oxidation, and increasingly severe cold [30] and aridity [31] would have presented significant challenges to surface biology. We do not know to what extent Meridiani environments were representative of the planet’s surface as a whole when the outcrop rocks formed, but the only other martian location explored in similar detail, Gusev Crater, shows evidence for conditions significantly less favorable than those at Meridiani.

AT: Microbial Contamination

Significant contamination unlikely and countermeasures solve – modeling

Lupisella, astrobiology engineer at NASA and PhD candidate in biology, 6

(Mark, “A Theoretical Microbial Contamination Model for a Human Mars Mission” pg. 99-100, PhD dissertation for the University of Maryland, http://innovim.academia.edu/MarkLupisella/Papers/211749/A\_Theoretical\_Microbial\_Contamination\_Model\_for\_a\_Human\_Mars\_Mission accessed 6-13-11, JMB)

There are several overarching themes of the results, but the primary theme is that while some results show substantial populations, they have parameter values that are unlikely, and so this model suggests that under the most likely set of circumstances and environmental conditions, it is difficult to generate a significant viable terrestrial microbial population on Mars from leaked microbes, water, and nutrients from a human mission. This is a leaning some have suggested previously based on limited empirical data, reasonable intuition, but without comprehensive modeling. In part, because of the latter, it is worthwhile to build a theoretical modeling framework to pursue this question comprehensively and quantitatively to allow scenario exploration and to increase confidence and understanding of possible scenarios. The low population numbers are due to a number of factors such as a the low initial survival fraction once microbes are exposed to the Martian surface, the subsequent death rate, and the limiting growth factors of liquid water and organic nutrients. Liquid water will likely only exist in transient phases for a small part of the diurnal cycle, allowing for growth during a very limited period, and much liquid water is likely to evaporate regardless. Water leaked into the environment would have to be at unusually high levels and this is unlikely for a well designed habitat and careful mission procedures. 100 However, the results do suggest sufficiently plausible, albeit unlikely, possibilities for problematic populations to arise, especially if microbes are leaked into an area or situation that provides protection from the ultraviolet radiation. But these scenarios can be mitigated by mission design and procedural measures such as controlling the microbial shedding of astronauts and other habitat biomass and/or tightly controlling the number of microbes that are leaked from the habitat. Controlling water leakage is also an obvious requirement that will reduce contamination possibilities, however indigenous water sources may make water leakage control less effective in preventing microbial population growth and so a confident water assessment of potential habitat locations is critical.

Life on Mars

Our aff is key to colonization of Mars- life detection needed to determine livability

Steele et al 6 (Andrew, Carnegie Institution of Washington , Beaty, D.W., Amend, J., Anderson, R., Beegle, L, Benning, L, Bhattacharya, J., Blake, D., Brinckerhoff, W., Biddle, J., Cady, S., Conrad, P., Lindsay, J., Mancinelli, R., Mungas, G., Mustard, J., Oxnevad, K., Toporski, J., and Waite, H., September 26, Final report of the MEPAG Astrobiology Field Laboratory Science Steering Group (AFL-SSG), mepag.jpl.nasa.gov/reports/AFL\_SSG\_WHITE\_PAPER\_v3.doc)LK

Although it has been generally assumed in the past that these two objectives need to be pursued sequentially, the AFL SSG has concluded that organisms and their environment together constitute a system, and each produces an effect on the other. Many kinds of investigations of this system can simultaneously provide information about both. This implies that habitability and habitation can be investigated together. This expands significantly on the current mission concept for MSL, with AFL having an expanded instrument suite dedicated more towards life detection and precision sample handling than MSL. Moreover, the process of life detection on Mars involves two sequential steps: 1). Proposing that a set of phenomenon are, or could be, biosignatures. This will constitute a working hypothesis that life is or was present. 2). Establishing that at least one of these biosignatures is definitive. This requires extensive effort and careful planning and a number measurements mutually confirming each other. Finally, we know that some kinds of scientific investigations will measure signs of both extinct and extant life without needing to distinguish between these two possibilities before launch.

 Given the expected state of our knowledge about Mars during the period 2013-2018, the AFL SSG has reached three conclusions: It is both possible and reasonable to do life detection first, then determine whether it is extinct or extant on the basis of a positive result.

Missions during this period can reasonably begin the process of life detection by characterizing potential biosignatures. It is reasonable to set mission objectives that relate to both habitability AND habitation. It is not necessary to choose one at the expense of the other.

Mars K2 Life

Mars colonization is the key internal link to discovering extraterrestrial life—other projects won’t fill in.

Holtgrefe 7 (Dennis Holtgrefe, Bachelor of Science @ Worcester Polytech, May 2, 2007, “The Moon or Mars: Expanding Humanity’s Domain, Pp. 49-50) CJQ

A long term base on Mars is required for this search because small missions simply don’t have the man power or expertise to conduct a thorough search. If there is still life on the planet right now, the most likely place to find that life would be in underground lakes of water or other liquids (Cowen, “Cavernous Findings”). Searching these would require drilling teams to venture out onto the surface of the planet to take samples of the various locations. Additional people would be required to comb the surface of the planet for other possible habitats for life. If instead all life on Mars is actually extinct and our only hope of finding out anything about them is through a fossil record, then it is even more important to have many scientists scouring the planet for clues. Finding fossils on Earth is even a difficult task, so expert archaeologists and fossil hunters should be imported from Earth to help with the search. A large Mars base would be required to support all of these personnel and grant us the greatest opportunity to discover life.

\*Mining Add-ons\*

Mars K2 Mines

Colonization success contingent on ability to mine asteroids—means only Mars is successful.

Jacobs 1 (Mike Jacobs, Faculty Advisor for the Pennsylvania State HEDS-UP Team, “Mining the Foundation of the Future,” submitted 2001, Pp. 3) CJQ

With the ever increasing potentials of the space program, one question keeps arising; “what next?” Since the initial voyages to the Moon, humankind has yet to venture outside of low earth orbit. Eventually humankind will desire to venture out to the further reaches of space. The Moon does not offer much of a quenching for our adventurous thirst, and we have already begun to look past that. The most logical next step will be to send human missions to our neighbor, Mars. Several different groups, such as the Mars Society, are looking into the feasibility of such a mission. Because Mars is the only hospitable planet within humankind’s current reach, plans are to send several missions to Mars, and eventually establish colonization efforts there. Depending on the success of these initial colonization efforts, such efforts could expand to support a large population there. As with any society, a certain amount of raw material is required for the construction of shelters and other infrastructure. The early structures will be constructed of pre-fabricated modular components that will be easy to set up onsite. The materials will have to be shipped from Earth. While this is the most practical solution for the short-term missions, this will not suffice for any long-term efforts. In order to establish a society of any decent size, a rather exorbitant amount of raw materials will be needed. Because it currently costs about $22,000 to launch a single kilogram of material from Earth’s surface, it is not economically feasible to launch thousands of tons of materials from Earth. This leaves the dilemma of how to transport the needed materials to Mars. One possible solution would be to travel to an asteroid and mine this material. The costs to transport material from an asteroid would be only a tiny fraction of the costs of launching it from Earth. It is with colonization efforts such as this in mind that the Penn State HEDS-UP Team has decided to design an asteroid mining mission.

Mars K2 Mines

Colony on Mars would successfully mine asteroids—spurs robotic development and profit.

Holtgrefe 7 (Dennis Holtgrefe, Bachelor of Science @ Worcester Polytech, May 2, 2007, “The Moon or Mars: Expanding Humanity’s Domain, Pp. 47) CJQ

A colony on Mars is in a good position to begin harvesting resources from the asteroid belt. The asteroid belt sits between Mars and Jupiter, marking the boundary between the inner and outer solar system. Even if travel into the main belt is considered too dangerous for mining, Mars has almost ten times as many asteroids that orbit close to the planet than earth does. Getting to and setting up the Mars base in the first place will have already developed the necessary rockets and ships to be able to make it out to the asteroids. (Zubrin, Entering Space.) It is likely that the asteroids would actually be mined by robotic or remote controlled robotic systems. This type of system would dramatically decrease the amount of risk involved in mining materials on an asteroid. These dangers not only include exposure to cosmic rays, but the risk associated with landing on asteroids that may be unstable, or the collision between two asteroids in the main belt. The components for these autonomous systems would likely be developed in the Mars base itself. As mentioned previously, the most important resource on the Martian base is going to be labor and man power. As such, great advances are going to be made in the areas of robotics and automation. The mining of the asteroids would be a fantastic application for new robotic technology. The wealth present in asteroids is much greater than the lay person might suspect. Based on samples from asteroids which have fallen to Earth, reliable estimates place the value of the rare mineral ore contained in a single small 1 km asreroid at about $150 billion (Zubrin, Entering Space). Considering that there are millions of asteroids of this size in the main belt, the Mars based mining operation should have plenty of profits to look forward to. Not only are the minerals present in the asteroids, but the ore is actually more pure than that found on Earth and is easier to extract in a zero gravity environment. Materials from the asteroids could either be put to use right in the Mars base or could be exported to Earth. In either case, the financial benefit of mining the asteroids makes it a near certainty.

Moon Mining Fails

Don’t believe their hype—the surface of the moon fails to give any resources that asteroid mining gives.

Ross 1 (Shane D. Ross, PhD Caltech, “Near-Earth Asteroid Mining,” Dec. 14, 2001) CJQ

Many assume the Moon to be the obvious source of resources in space, but it is instructive to compare the richness of the resources available in meteorites (and by inference in the NEA population) with that of the Moon. Typical free metal concentrations in stony meteorites are about 20%, compared to a few hundred ppm in the lunar regolith. Iron meteorites, or metallic M-type asteroids, are even more metal-rich; about 99% metal. C-type asteroids and carbonaceous meteorites typically have 5% to 20% water. The lunar surface, by contrast, has no native water. Solar wind implantation of hydrogen on the lunar surface offers up to about 50 ppm hydrogen, which, if fully released and fully converted into water, would optimistically give the lunar surface about 0.045% water. Overall, the lunar surface is volatile-poor and metal-poor, similar in composition to the slag discarded in metallurgical processing on Earth (Lewis [1997]).

Mars -> Platinum

Mars colonization returns 170 million tonnes of platinum—now is key: We have to get there before the Russians and Chinese take it.

Williams 9 (Marcel F. Williams, writer for New Papyrus magazine, <http://newpapyrusmagazine.blogspot.com/2008/09/mining-moons-of-mars.html>, Jan 3, 09, accessed 6/20/11) CJQ

Interestingly, two additional potential sources of asteroid material may be in orbit around the fourth planet of our solar system. Mars has two moons, Phobos and Deimos. Both of these rocky moons resemble C type asteroids and may have originated elsewhere in the solar system before being permanently captured in orbit around the *red planet*. The inner moon, Phobos, orbits approximately 9377 kilometers from the center of Mars. The outer moon, Deimos, orbits more than 23,000 kilometers away from Mars. Our own Moon, orbits the Earth more than 384,000 kilometers away. It is interesting that Russia and China are currently planning a joint robotic mission to Phobos to be launched in 2009 to analyze-- and retrieve-- a sample of the material from the surface of Phobos for return to Earth. The potato shaped Phobos has a maximum diameter of nearly 27 kilometers with surface area of approximately 6100 square kilometers and an estimated mass of more than 10 trillion tonnes. So at possibly 15 parts per million, Phobos could contain 150 million tonnes of platinum, enough to supply the Earth at current levels for about 500,000 years and at ten times current consumption for 50,000 years. Deimos is the smaller outer moon of Mars. It has a maximum diameter of 15 kilometer and a total mass of approximately 1.5 trillion. So at 15 parts per million, Deimos could contain more than 20 million tonnes of platinum. Even without platinum mining, the resources of the Martian moons would be extremely valuable for space exploration, space tourism and colonization and perhaps even for the extraterrestrial manufacturing and deployment of satellites in space. Because of the deleterious effects of cosmic and solar radiation, permanently manned facilities in orbit-- even within the Earth's magnetic field, are going to require at least hundreds to thousands of tonnes of shielding material. Phobos and Deimos with their low gravity wells have the potential to supply such shielding much more economically than such resources from the Earth or even the Moon-- if interplanetary lightsails are utilized to transport the material from the orbit of Mars. Approximately 40% of the chemical material of Phobos and Deimos is composed of oxygen, the principal oxidizer for rocket fuel and of course the essential element for breathing aboard space vehicles and orbiting space stations. Phobos and Deimos may also contain significant amounts of chemicals containing hydrogen, and essential rocket fuel and chemical component water (H2O) essential for human life and for growing food. Phobos and Deimos could also contain other valuable chemicals for growing food such as carbon and nitrogen. The metals and silicates from these Martian moons could also be used for manufacturing satellites for eventual deployment in Earth orbit.

Platinum -> Catalytic converters

Platinum is crucial to new catalytic converters—key to pollution standards.

Williams 9 (Marcel F. Williams, writer for New Papyrus magazine, <http://newpapyrusmagazine.blogspot.com/2008/09/mining-moons-of-mars.html>, Jan 3, 09, accessed 6/20/11) CJQ

Platinum is an extremely rare metal that is 30 times rarer than gold. It occurs as only 0.003 ppb (parts per billion) in the Earth's crust. If all of the world's gold reserves were poured into an Olympic-size swimming pool, three such pools would be required to accommodate the total gold supply. But all of the world's platinum reserves would not even fill up one such Olympic-sized pool, only coming up deep enough to reach one's ankles. Platinum currently sells at approximately $27 per gram. And 239 tonnes of platinum was sold in 2006. 80% of that supply came from South Africa with most of the rest coming from Russia and Canada. Approximately 130 tonnes of platinum was used for automobile catalytic converters, a demand that is likely to increase as rapidly growing economies like China and India begin to conform to Western automobile pollution standards. Another 49 tonnes was used for jewelry. The remaining 60 tonnes was utilized for various applications including electronics, chemical catalyst, electrodes, spark plugs and even anticancer drugs. But if platinum were required for high efficiency fuel cells for automobiles, only 20% of the world's ground vehicles could be supplied. This of course doesn't even include the substantially higher demand for platinum if electrolysis became the primary means for producing hydrogen for a carbon neutral hydrocarbon fuel and industrial chemical economy. While alternatives to platinum use in fuel cells and electrodes for electrolysis are currently being intensely pursued by researches, it is interesting to note that while platinum is rare in the regolith of Earth, it is extremely abundant in space-- in the form of asteroids. In fact, the largest sources of platinum on Earth occur in regions that appear to have been hit by large asteroid impacts in the more recent geologic past.

Colonies -> Mines

Colonies are key to successful mining operations.

Whittington 5 (Mark Whittington, writer for the Free Republic, Nov 15, 2005, http://www.freerepublic.com/focus/news/1523385/posts , accessed 6/20/11) CJQ

Whatever method is used to extract material from an asteroid, some kind of habitat would have to be built nearby to sustain the human crew. While a great part of asteroid mining would be automated, humans will still have to be on hand for troubleshooting and maintenance. Once extracted, material will have to be transported, either to a lunar or Mars colony, or perhaps a micro gravity factory in Earth orbit, for processing and fabrication into useful products, building materials, and even consumables like oxygen and water. It takes a low deltaV (i.e. the cost of changing velocity) to reach an near Earth asteroid from low Earth orbit or, say, the Moon as opposed to that required to travel from the Earth's surface to Earth orbit or the Moon. Hence mining asteroids and transporting the material to facilities in Earth orbit or on the Moon is an attractive alternative to bringing such from the Earth. This is especially true if one uses rocket fuel mined at the asteroid itself to return material. What are the potential markets for materials mined from asteroids? Human settlements on the Moon or Mars could use a source of industrial materials (i.e. iron, silicon, etc) and consumables (i.e. water, oxygen, etc) that are readily accessible. Factories in low Earth orbit, manufacturing high value pharmaceuticals, semiconductors, ultra-pure crystals, and exotic alloys, would also be a potential market. Asteroid materials could be used for building large scale facilities in space, such as solar power stations. Some high valued material, such as platinum group metals, would be useful for applications on Earth, such as building hydrogen fuel cells.

Platinum crisis coming

Platinum needed and demand increasing – causes platinum crisis – without more there isn’t going to be hydrogen energy reform

Yang, technology policy analyst with the Climate Change Policy Partnership (CCPP) at Duke University, 9

(Dr. Chi-Jen, “An impending platinum crisis and its implications for the future

of the automobile.”*Energy Policy*, Volume 37, Issue 5, May 2009, Pages 1805-1808, http://www.duke.edu/~cy42/Pt.pdf, AH)

The global demand for platinum has consistently outgrown supply in the past decade. This trend likely will continue and the imbalance may possibly escalate into a crisis. Platinum plays pivotal roles in both conventional automobile emissions control and the envisioned hydrogen economy. A platinum crisis would have profound implications on energy and environment. On the one hand, inadequate platinum supply will prevent widespread commercialization of hydrogen fuel-cell vehicles. On the other hand, expensive platinum may enhance the competitiveness of hybrid, plug-in hybrid, and battery-powered electric cars. Policymakers should weigh the potential impacts of a platinum crisis in energy policy.

Increased Platinum K2 “hydrogen econ”

Increased platinum supply is key to the formation of a hydrogen economy

Yang, technology policy analyst with the Climate Change Policy Partnership (CCPP) at Duke University, 9

(Dr. Chi-Jen, “An impending platinum crisis and its implications for the future

of the automobile.”*Energy Policy*, Volume 37, Issue 5, May 2009, Pages 1805-1808, http://www.duke.edu/~cy42/Pt.pdf, AH)

The Arthur D. Little assessment overlooked an important point: with 200g per unit and 500.000 units per year, this hypothetical factory would be expected to consume 100 Mg of platinum annually. In 2001. the worldwide supply of platinum was 182.3 Mg and the demand was 193.8 Mg. This means not only was all the platinum mined and recycled in that year entirely consumed, but also an additional 11.5 Mg were removed from inventories and used up. The large-scale fuel-cell factory envi­sioned by Arthur D. Little would dramatically exacerbate the imbalance by adding 100 Mg of demand. The extent or shortage (over 50%) would be unprecedented. It is not reasonable to expect a stable platinum price with such demand jump. Furthermore, a hydrogen economy certainly cannot be built with only one factory. If a hydrogen economy actually emerges, the demand for platinum must necessarily outgrow supply by several folds. The dramatic increase in demand will definitely raise the platinum price by such a magnitude that makes the widespread adoption of fuel-cell vehicles impossible.

In 2003. TlAX LLC (also with a DOE contract) assessed the long-term availability and price stability of platinum given anticipated demand from fuel-cell vehicles (Carlson et al.. 2003). It suggested that the long-term real price of platinum will stabilize at around 5300 per troy ounce (S10/gX The report justified its optimistic projection: "Historic price behavior indicates that as long as supply and demand remain in balance, the long-term real price of platinum will remain stable.- The reality is that supply and demand have not been in balance, and prices have continued to be volatile.

Most existing assessments have underestimated ihe platinum shortage issue and have concluded that platinum supply will not be a barrier to the officially touted hydrogen economy (Carlson et aL 2003: Department for Transport (UK). 2006). However, researchers indeed recognize the problems with high platinum price. Intensive R&D has been devoted to reducing platinum loading, and it has achieved significant success. The platinum loading for a vehicular fuel-ceD has been reportedly reduced to 60g in 2006. However, potential platinum price hikes can easily outpace the reduction of platinum loading. With low-hanging fmits already picked, further reductions will become increasingly difficult. Even if the most optimistic target (about 1S-20g per vehicle) were met. a fuel-ceD car would still require ten times more platinum than a gasoline-powered car.

More evidence

Yang, technology policy analyst with the Climate Change Policy Partnership (CCPP) at Duke University, 9

(Dr. Chi-Jen, “An impending platinum crisis and its implications for the future

of the automobile.”*Energy Policy*, Volume 37, Issue 5, May 2009, Pages 1805-1808, http://www.duke.edu/~cy42/Pt.pdf, AH)

I conclude that commercial demonstration of platinum-based hydrogen fuel-cell vehides is premature. With the status quo technology, mass production of hydrogen fuel-cells will inevitably trigger a platinum crisis. Unless fuel-cell technology is revolutionized, platinum supply will remain a primary obstacle to a hydrogen economy. Governments should prioritize basic R&D on finding alternative catalysts to platinum over demonstrating commercial prototypes of fuel-cell vehides. Policymakers should weigh the energy security impacts of potential platinum mono¬poly and speculation.

A2: Other materials check / Platinum key

Platinum key – others fail

Yang, technology policy analyst with the Climate Change Policy Partnership (CCPP) at Duke University, 9

(Dr. Chi-Jen “An impending platinum crisis and its implications for the future

of the automobile.”*CCCP*, Volume 37, Issue 5, May 2009, Pages 1805-1808, http://www.sciencedirect.com/science/article/pii/S0301421509000457#secx1, AH)

Currently, there is no feasible substitute for platinum in hydrogen fuel-cells. All the demonstration projects of hydrogen fuel-cell vehicles are platinum-based. None of them will be commercially viable at large-scale deployment Although there is indeed research aimed at developing a non-precious-metal-based fuel-cell (Bashyam and Zelenay 2006). it is uncertain whether such research can be engineered into feasible devices, not to mention commercialization.

Hydrogen Econ solves oil dependence

Hydrogen economy Solves global conflict caused by Oil dependence and Global warming

Schwartz, partner in the Monitor Group and chair of Global Business Network, and Randall, senior practitioner at GBN, 3

(Schwartz and Randall Peter, Doug, *Wired*, “How Hydrogen Can Save America”, April 2003, http://www.wired.com/wired/archive/11.04/hydrogen.html, AH)

The cost of oil dependence has never been so clear. What had long been largely an environmental issue has suddenly become a deadly serious strategic concern. Oil is an indulgence we can no longer afford, not just because it will run out or turn the planet into a sauna, but because it inexorably leads to global conflict. Enough. What we need is a massive, Apollo-scale effort to unlock the potential of hydrogen, a virtually unlimited source of power. The technology is at a tipping point. Terrorism provides political urgency. Consumers are ready for an alternative. From Detroit to Dallas, even the oil establishment is primed for change. We put a man on the moon in a decade; we can achieve energy independence just as fast. Here's how. Four decades ago, the United States faced a creeping menace to national security. The Soviet Union had lobbed the first satellite into space in 1957. Then, on April 12, 1961, Russian cosmonaut Yuri Gagarin blasted off in Vostok 1 and became the first human in orbit. President Kennedy understood that dominating space could mean the difference between a country able to defend itself and one at the mercy of its rivals. In a May 1961 address to Congress, he unveiled Apollo - a 10-year program of federal subsidies aimed at "landing a man on the moon and returning him safely to the Earth." The president announced the goal, Congress appropriated the funds, scientists and engineers put their noses to the launchpad, and - lo and behold - Neil Armstrong stepped on the lunar surface eight years later. The country now faces a similarly dire threat: reliance on foreign oil. Just as President Kennedy responded to Soviet space superiority with a bold commitment, President Bush must respond to the clout of foreign oil by making energy independence a national priority. The president acknowledged as much by touting hydrogen fuel cells in January's State of the Union address. But the $1.2 billion he proposed is a pittance compared to what's needed. Only an Apollo-style effort to replace hydrocarbons with hydrogen can liberate the US to act as a world leader rather than a slave to its appetite for petroleum. Once upon a time, America's oil addiction was primarily an environmental issue. Hydrocarbons are dirty - befouling the air and water, possibly shifting the climate, and causing losses of biodiversity and precious coastal real estate. In those terms, the argument is largely political, one of environmental cleanliness against economic godliness. The horror of 9/11 changed that forever. Buried in the rubble of the World Trade Center was the myth that America can afford the dire costs of international oil politics. The price of the nation's reliance on crude has included '70s-style economic shocks, Desert Storm-like military adventures, strained relationships with less energy-hungry allies, and now terror on our shores. George W. Bush arrived in Washington, DC, as a Texan with deep roots in the oil business. In the days following September 11, however, he transformed himself into the National Security President. Today, his ambition to protect the United States from emerging threats overshadows his industry ties. By throwing his power behind hydrogen, Bush would be gambling that, rather than harming Big Oil, he could revitalize the moribund industry. At the same time, he might win support among environmentalists, a group that has felt abandoned by this White House. According to conventional wisdom, there are two ways for the US to reduce dependence on foreign oil: increase domestic production or decrease demand. Either way, though, the country would remain hostage to overseas producers. Consider the administration's ill-fated plan to drill in the Arctic National Wildlife Refuge. For all the political wrangling and backlash, that area's productivity isn't likely to offset declining output from larger US oil fields, let alone increase the total supply from domestic sources. As for reducing demand, the levers available are small and ineffectual. The average car on the road is nine years old, so even dramatic increases in fuel efficiency today won't head off dire consequences tomorrow. Moreover, the dynamism at the heart of the US economy depends on energy. Growth and consumption are inextricably intertwined. There's only one way to insulate the US from the corrosive power of oil, and that's to develop an alternative energy resource that's readily available domestically. Looking at the options - coal, natural gas, wind, water, solar, and nuclear - there's only one thing that can provide a wholesale substitute for foreign oil within a decade: hydrogen. Hydrogen stores energy more effectively than current batteries, burns twice as efficiently in a fuel cell as gasoline does in an internal combustion engine (more than making up for the energy required to produce it), and leaves only water behind. It's plentiful, clean, and - critically - capable of powering cars. Like manned space flight in 1961, hydrogen power is proven but primitive, a technology ripe for acceleration and then deployment. (For that, thank the Apollo program itself, which spurred the development of early fuel cells.) Many observers view as inevitable the transition from an economy powered by fossil fuels to one based on hydrogen. But that view presupposes market forces that are only beginning to stir. Today, power from a fuel cell car engine costs 100 times more than power from its internal combustion counterpart; it'll take a lot of R&D to reduce that ratio. More daunting, the notion of fuel cell cars raises a chicken-and-egg question: How will a nationwide fueling infrastructure materialize to serve a fleet of vehicles that doesn't yet exist and will take decades to reach critical mass? Even hydrogen's boosters look forward to widespread adoption no sooner than 30 to 50 years from now. That's three to five times too long. Adopting Kennedy's 10-year time frame may sound absurdly optimistic, but it's exactly the kick in the pants needed to jolt the US out of its crippling complacency when it comes to energy. A decade is long enough to make a serious difference but short enough that most Americans will see results within their lifetimes. The good news is that the technical challenges are issues of engineering rather than science. That means money can solve them. How much money? How about the amount spent to put a man on the moon: $100 billion in today's dollars. With that investment, the nation could shift the balance of power from foreign oil producers to US energy consumers within a decade. By 2013, a third of all new cars sold could be hydrogen-powered, 15 percent of the nation's gas stations could pump hydrogen, and the US could get more than half its energy from domestic sources, putting independence within reach. All that's missing is a national commitment to make it happen. It'd be easy - too easy - to misspend $100 billion. So the White House needs a plan. The strategy must take advantage of existing infrastructure and strengthen forces propelling the nation toward hydrogen while simultaneously removing obstacles. There are five objectives: 1. Solve the hydrogen fuel-tank problem. 2. Encourage mass production of fuel cell vehicles. 3. Convert the nation's fueling infrastructure to hydrogen. 4. Ramp up hydrogen production. 5. Mount a public campaign to sell the hydrogen economy. By pursuing all five at once, the government can create a self-sustaining cycle of supply and demand that gains momentum over the coming decade and supplants the existing energy market in the decades that follow. Rather than waiting to build a hydrogen infrastructure from scratch, the US can start building the new fuel economy immediately by piggybacking on existing petroleum-based industries. Once customers are demanding and producers are supplying, there will be time to create a cleaner, more efficient hydrogen-centric infrastructure that runs on market forces alone.

Oil dependency causes warming

Oil dependency kills the environment and causes warming – alternative energy solves

Reynolds, American Surveyor, 10

(Lewis , American Surveyor, “Seven Dangerous (and Surprising) Side Effects of US Dependence on Foreign Oil”, August 4th, http://www.amerisurv.com/content/view/7708/, accecessed 6-20-11, AH)

Yes, it’s a grim scenario. And one reason we’ve managed to get to this point without insisting on change is that most Americans don’t understand just how grim it is. To set the record straight, I provide an overview of just what foreign oil dependency has meant and continues to mean for the U.S. Read on for more information about why oil dependency is bad for America’s health: It’s harmful to the environment. Oil spills, global warming, carbon emissions, greenhouse gases—these are just a few of the hazards connected to our dependency on oil. Fossil fuels are dirty, nasty, icky substances, and the nature and scale of the international oil extraction effort guarantees that there will be accidents. Tankers leak, as was the case of the Exxon Valdez, and BP-style explosions happen. As serious as all of these accidents are, they could be minor compared to the potential impact from what is not an accident—the burning of fossil fuels. The total global emissions grew at 1.1 percent during the 1990s, but grew at the alarming rate of 3.3 percent between 2000 and 2004. This rapid increase in growth can be attributed in large part to the accelerating industrialization and economic growth in the developing world, China and India particularly. Whether you believe in global warming or not, one thing is indisputable: Global atmospheric concentrations of carbon dioxide have been increasing for over a century, and they will continue to increase as more fossil fuels are burned. Whether you choose to ignore well-established science that carbon dioxide is a greenhouse gas and that the greenhouse effect has the potential to affect global temperatures is your choice. I prefer to find alternatives to fossil fuels before the effect of global warming is so pronounced that even the skeptics start to believe it. The potential impacts are far too numerous and uncertain.

Oil Dependency Kills economy and heg

Oil dependency kills the economy, heg, and funds terrorism

Reynolds, American Surveyor, 10

(Lewis , American Surveyor, “Seven Dangerous (and Surprising) Side Effects of US Dependence on Foreign Oil”, August 4th, http://www.amerisurv.com/content/view/7708/, accessed 6-20-11, AH)

It causes ongoing damage to the American economy (and weakens our power in the world). Oil dependence is slowly eating away at the true source of American power (our economy) as each year the U.S. exports more and more of its wealth in exchange for oil. U.S. trade deficits have created a situation that forces reliance on overseas capital to support the economy. Much of that capital comes from the petroleum exporting countries that, in turn, get it from oil consumption by American businesses and consumers. Today the American economy is based less on producing either goods or services and more on consumption. This drives what is known as the “petrodollar” system. It begins with the purchase of oil by the U.S. consumer, which sends massive dollar-denominated cash flows to oil exporting countries. In addition, U.S. consumers buy imported goods resulting in flows of dollars to those countries. In turn, the manufacturing nations must purchase oil, which they accomplish with the dollars they obtained from selling products in the U.S. market. At this point, the oil exporters are awash in dollars, which they must either spend or invest. The consequence is that, to a large extent, governments in the Middle East are funded by American consumers. The same money you use to fill your gas tank is ultimately funding things like terrorist groups and the Iranian nuclear program, but, perhaps more importantly, it is being used to buy assets in the United States. At the end of 2008, foreigners owned $3.5 trillion more in assets in the U.S. than Americans owned abroad, and the bulk of that difference can be explained by the oil trade deficit. The petroleum trade deficit is a wealth transfer. In 2008 alone, Americans purchased $453 billion of foreign oil (which accounted for more than 65 percent of the total trade deficit). The oil we purchase quite literally goes up in smoke. When all is settled, Americans have swapped our equity for short-term consumption while the oil exporters have swapped their oil for long-term financial assets. I don’t think there is any question as to who is getting the better end of the deal. It’s leading to the decline of the dollar. Although, in previous decades, the Federal Reserve has viewed energy prices as a component of inflation and reacted to increasing oil prices using anti-inflationary measures, the modern Federal Reserve has feared that increasing oil prices are more likely to precipitate a recession. The Fed has responded to price shocks by increasing the money supply in hopes of stimulating aggregate demand. The long-term trend of the dollar is downward, which places upward pressure on oil prices. The Fed has responded to increasing oil prices by printing more money. Increasing the money supply makes a given dollar worth less, which means that more dollars are needed to buy a given quantity of oil. The falling dollar and the increasing price of oil have elicited policies from the Fed that cause the dollar to fall still further and the price of oil to increase even more, accelerating and intensifying the effects. The increasingly unstable fiscal situation in the U.S. is not only a concern for

Oil Dependency causes wars

Oil dependency causes wars – empirics

Reynolds, American Surveyor, 10

(Lewis , American Surveyor, “Seven Dangerous (and Surprising) Side Effects of US Dependence on Foreign Oil”, August 4th, http://www.amerisurv.com/content/view/7708/, accessed 6-20-11, AH)

It gets us into wars. Oil has been at the center of many (indeed most) major military conflicts in the world, particularly those involving the West. From providing the impetus for Hitler’s invasion of the Soviet Union and Japan’s attack on Pearl Harbor in World War II to Saddam Hussein’s invasion of Kuwait, the resulting Gulf War, and, most would admit, the U.S. return to Iraq in 2003, oil has bred a century of conflict.

Oil Dependency causes war with China and tanks foreign relations

Oil dependency makes war inevitable with China and tanks any hope of relations with other countries – alt. sources solve

Reynolds, American Surveyor, 10

(Lewis , American Surveyor, “Seven Dangerous (and Surprising) Side Effects of US Dependence on Foreign Oil”, August 4th, http://www.amerisurv.com/content/view/7708/, accessed 6-20-11, AH)

It creates strained foreign relations and sets the stage for an unstable future. The entire U.S.-Middle East foreign policy has been structured around the obvious importance of the region for the world’s oil supply. Policy makers don’t like to discuss it openly, but oil is always the elephant in the room when it comes to U.S. foreign relations—even with nations outside the Middle East. One of the great questions in the context of geopolitical struggle for oil is whether the great oil consuming nations—which will soon include the U.S., China, Russia—will view one another as allies, competitors, or some combination of both. The U.S. has love-hate relationships with both countries. There is historic rivalry between the U.S. and Russia leading back generations. The relationship with China is murky at best. Events are already in motion that could set the stage for a U.S.-Chinese confrontation. Oil consumption continues to grow modestly in the U.S., but in China it is exploding. On a global scale, oil consumption will certainly continue to grow into the foreseeable future, yet there are considerable questions as to whether global production can be increased much beyond current levels if at all. With both the U.S. and China needing oil, competition is inevitable. Responsibility lies with both sides to take actions to avoid the long progression toward a conflict. A Sino-American energy war is far too likely if both countries continue on their present courses without developing substantial alternative energy sources.

Deuterium key to nuclear fusion

**Deuterium is key to nuclear fission – it shortcuts environmental problems and is more sustainable**

Science Daily, editorial, 9

(ScienceDaily, “Ultra-dense Deuterium May Be Nuclear Fuel Of The Future.” May 12, 2009, Accessed 6-19-2011, http://www.sciencedaily.com­ /releases/2009/05/090511181356.htm, AH)

“One important justification for our research is that ultra-dense deuterium may be a very efficient fuel in laser driven nuclear fusion. It is possible to achieve nuclear fusion between deuterium nuclei using high-power lasers, releasing vast amounts of energy”, says Leif Holmlid. The laser technology has long been tested on frozen deuterium, known as “deuterium ice”, but results have been poor. It has proved to be very difficult to compress the deuterium ice sufficiently for it to attain the high temperature required to ignite the fusion. Energy source of the future Ultra-dense deuterium is a million times more dense than frozen deuterium, making it relatively easy to create a nuclear fusion reaction using high-power pulses of laser light. “If we can produce large quantities of ultra-dense deuterium, the fusion process may become the energy source of the future. And it may become available much earlier than we have thought possible”, says Leif Holmlid. “Further, we believe that we can design the deuterium fusion such that it produces only helium and hydrogen as its products, both of which are completely non-hazardous. It will not be necessary to deal with the highly radioactive tritium that is planned for use in other types of future fusion reactors, and this means that laser-driven nuclear fusion as we envisage it will be both more sustainable and less damaging to the environment than other methods that are being developed.”

Mars has more Deuterium than Asteroids and Earth

Mars has significantly more deuterium than earth and asteroids and the water that was need to generate it is still there

Science Daily, editorial, 2K

(ScienceDaily “Mars May Hold Twice As Much Water As Previously Thought”, 6-28-2000, http://www.sciencedaily.com/releases/2000/06/000627094127.htm, accessed 6-20-11, AH)

The crust of the planet Mars may hold two to three times more water than scientists had previously believed. This finding is based on a study by Dr. Laurie A. Leshin of Arizona State University, comparing the amount of deuterium, an isotope of hydrogen, found in a meteorite of martian origin to the amount found in the martian atmosphere. Her report will be published in Geophysical Research Letters on July 15. Deuterium, a heavier form of hydrogen, combines with oxygen to make "heavy" water. In today's thin Martian atmosphere, water has a deuterium-to-hydrogen ratio five times higher than is found in water on Earth. Previous research attributed this to the escape of hydrogen from the martian atmosphere over time. Because hydrogen is lighter than deuterium, it escapes more easily, leading to the high relative level of deuterium in the atmosphere of Mars today. Scientists had previously assumed that before the deuterium level was enhanced by the escape of hydrogen, martian water more closely resembled that on Earth, with a comparable ratio of deuterium to hydrogen. In order to reach the current value of five times higher than Earth's water, they calculated that around 90 percent of the water in the Martian atmosphere and upper crust had been lost over the planet's history. Leshin compared the deuterium level in the atmosphere with that in a meteorite known as QUE94201, found in Antarctica in 1994 and believed to have been blasted off Mars three million years ago. Tiny water-bearing crystals in the meteorite were analyzed by Leshin on the ion microprobe instrument at the University of California at Los Angeles. These crystals contain hydrogen from the martian interior, which was not affected by atmospheric escape. They revealed a smaller percentage of deuterium than current martian atmospheric measurements. But instead of this ancient water demonstrating the same deuterium-to-hydrogen ratio as Earth water, as had been assumed, Leshin's research shows that Mars had a deuterium-to-hydrogen ratio nearly double that of Earth before any atmospheric escape could have occurred. Leshin suggests that this could have resulted from loss of hydrogen very early in martian history as a result of extreme ultraviolet radiation from the young Sun, a mechanism different than the current escape process. Alternatively, she writes, it could imply that comets, which share the same deuterium to hydrogen ration as martian interior water, supplied most of the water found on Mars today. Since martian water originally contained higher deuterium levels than previously thought, Leshin concludes that the martian atmosphere has lost two to three times less water through the eons in order to arrive at the isotope's current atmospheric level. That water should still exist today on Mars, she says, located within the planet's crust. In fact, evidence from this and previous research on martian meteorites supports the idea that a significant martian groundwater reservoir currently exists.

Mars deuterium key

Mars deuterium key – Earth fails - its too hard to collect

Red Colony, editorial, 3

(“Why Colonize Mars? - Red Colony”, Nov 3, 2003, pg. 4, http://www.redcolony.com/features.php?name=whycolonizemars, AH)

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.

Fusion solves Energy Crisis

Fusion solves energy crisis – Deuterium specifically key

Thompson, The Australian, 9

(Angus, The Australian, Nuke fusion 'could solve energy crisis', Oct. 15, Accessed 6-20-11, <http://www.theaustralian.com.au/news/nuke-fusion-could-solve-energy-crisis/story-e6frg6o6-1225786864117>, AH)

Leading nuclear physicist Barry Green said nuclear fusion had the potential to produce enormous amounts of clean and affordable energy from an almost unlimited fuel base. "If harnessed on earth, fusion energy would provide millions of years of base-load energy, with zero greenhouse gas emissions," he said. "As Australia launches further into the nuclear power debate, the role of fusion as a power source should also be considered." Dr Green, who will today deliver a public lecture on fusion at the Australian Nuclear Science & Technology Organisation in Sydney, said Australia needed to commit to international research efforts. Nuclear fusion - as opposed to fission, where atoms are split - is the process where two atomic nuclei fuse together and release large amounts of energy. Fusion reactions produce far greater energies per unit of mass than fission, which is used to generate energy in nuclear power plants worldwide. Deuterium, the basic fuel for fusion, is a stable isotope of hydrogen with a natural abundance in the ocean, making it readily available and affordable. Dr Green also believes that radioactive waste produced as a result of nuclear fusion can endure a half-life of just 100 years, as opposed to thousands of years as a result of fission reactions. Research into the use of nuclear fusion as a viable form of commercial energy is being spearheaded by ITER, a multinational project. The ITER project, of which Dr Green was a part, aims to develop a greater understanding of the physics and technology involved to make nuclear fusion a competitive source of energy in the future. "The reality is that fusion energy can't make a significant impact on world energy production before about the middle or even three-quarters of the way through the century, so we're not talking about an immediate solution towards the world energy problems," he said. "But the potential is huge because fusion uses the basic isotopes of hydrogen as its basic fuel, and we have enough deuterium in sea water for it to be a sustainable fuel for a base-load power which is safe, affordable, and environmentally friendly."

Fusion solves Warming

Fusion solves global warming and world energy needs

Highfield, The Telegraph, 9

(Roger, The Telegraph, “Nuclear Fusion is the future”, 08 Dec 2009, Accessed 6-20-2011 http://www.telegraph.co.uk/science/6754237/Nuclear-fusion-is-the-future.html)

It's time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here." With that warning to the US Congress in June 1988, the Nasa climatologist James Hansen focused the minds of politicians on a danger that, until then, many of them had treated with scepticism. A few days later came the first international conference to discuss man's impact on the Earth's climate, in Toronto, to which I had been packed off by *The Daily Telegraph*'s then editor. I watched as scientists tried to persuade government representatives, legal experts, economists and industrialists that the time had come to take the threat seriously. Two decades later, the waffling goes on. Over the past few days, about 15,000 delegates have expended vast amounts of carbon dioxide to attend the giant climate-change jamboree in Copenhagen. Hansen himself says that any agreement likely to emerge will be so deeply flawed that it would be better to start again from scratch. Yet at a conference event I am chairing on behalf of the EU, to discuss research on low-carbon technologies, we will be hearing about a process that could allow us to escape the whole carbon trap. Prof Sir David King, a former chief scientist for the government, now of Oxford University, will remind us that the most radical solution to the underlying problem (and yes, climate-change deniers, there is one), remains the same as two decades ago: nuclear fusion. Sceptics joke that this is the fuel of the future – and always will be. Commercial fusion, they gleefully point out, is as far away now as it was in Toronto, and as it was half a century ago, when Sir John Cockcroft, one of the great nuclear pioneers, began an article in *New Scientist* with the words: "It has long been the ambition of scientists to emulate the Sun." Fusion is the process by which the Sun, and other stars, transmute matter, transforming hydrogen into helium to release colossal amounts of energy. The fused nuclei are a fraction lighter than their atomic ingredients, so – according to Einstein's famous equation E = mc² – that tiny loss of mass results in a colossal release of energy. Harness that release in an efficient way, and the world's energy needs are solved: near-infinite power, almost no harmful by-products. An international consortium known as ITER ("the way" in Latin), is about to start building a prototype fusion reactor in Cadarache, France, at a cost of £6 billion. Critics argue that given the difficulties involved, that sum could be better spent on solar power, using the fusion reactor that nature has already given us. The challenge is indeed vast: in the core of the Sun, huge gravitational pressure allows fusion to take place at about 15 million C. In man-made devices, the temperatures need to be above 150 million C, a temperature that no material on Earth could withstand. The solution came from the Soviet Union in the late 1950s: a doughnut-shaped device called a tokamak. This uses intense magnetic fields to hold the reacting plasma away from the furnace's walls. Prof Steven Cowley, director of the Culham Centre for Fusion Energy, home of one of the leading fusion test plants, says the biggest hurdle lies in creating the technology needed to use it, such as developing walls that can withstand unbelievable pummelling by subatomic particles and cutting the cost of the superconducting magnets that will confine plasma 10 times the temperature of the sun's core. At America's Tokamak Fusion Test Reactor in Princeton, the Joint European Torus in Culham, and the JT-60 in Japan, scientists have come tantalisingly close to the break-even point at which the device releases as much energy as is required to get the fusion going. Such is the cost of constructing a proper prototype, however, that the ITER Council includes all the world's leading powers: China, the EU, India, Japan, Korea, Russia and the United States. The research they are funding could transform the lives of billions of people, and of future generations. Will it work? Although the plan to put the experimental fusion plant into operation by 2018 looks unrealistic, and risks a costly overrun, we should, by February, have a date for it to burst into action. ITER's objective is to release 10 times as much energy as is used to initiate the reaction: if 50 MW is put in, ITER will generate 500 MW. The hope is that ITER will pave the way for a demonstration power plant in the 2030s, which will feed energy into the grid by the middle of this century. Meanwhile, research will continue in other installations worldwide. If the gamble pays off, the last quarter of this century will see the end of the age of carbon, and usher in a future of almost limitless potential.

Energy Crisis Kills Environment

Energy Crisis is unsustainable and “Wrecks the Planet” – global warming and environmental destruction

Klare 11 a professor of peace and world security studies at Hampshire College and the author of Numerous highly regarded books about international relations

(Michael, T., “How the global energy crisis will change our lives,” , June 6, Accessed 6-20-11, <http://www.salon.com/news/politics/war_room/2011/06/06/global_energy_crisis_worsens>, AH)

So now we enter June with continuing unrest in the Middle East, a grim outlook for nuclear power, and a severe electricity shortage in China (and possibly elsewhere). What else do we see on the global energy horizon? Despite the IEA's forecast of diminished future oil consumption, global energy demand continues to outpace increases in supply. From all indications, this imbalance will persist. Take oil. A growing number of energy analysts now agree that the era of "easy oil" has ended and that the world must increasingly rely on [hard-to-get "tough oil."](http://www.tomdispatch.com/post/175249/Michael_Klare_the_oil_rush_to_hell) It is widely assumed, moreover, that the planet harbors a lot of this stuff -- deep underground, far offshore, in problematic geological formations like Canada's tar sands, and in the melting Arctic. However, extracting and processing tough oil will prove ever more costly and involve great human, and even greater environmental, risk. Think: BP's Deepwater Horizon disaster of April 2010 in the Gulf of Mexico. Such is the world's thirst for oil that a growing amount of this stuff will nonetheless be extracted, even if not, in all likelihood, at a pace and on a scale necessary to replace the disappearance of yesterday's and today's easy oil. Along with continued instability in the Middle East, this tough-oil landscape seems to underlie expectations that the price of oil will only rise in the coming years. In a [poll](http://www.greencarcongress.com/2011/05/kpmg-20110512.html) of global energy company executives conducted this April by the KPMG Global Energy Institute, 64 percent of those surveyed predicted that crude oil prices will cross the $120 per barrel barrier before the end of 2011. Approximately one-third of them predicted that the price would go even higher, with 17 percent believing it would reach $131-$140 per barrel; 9 percent, $141-$150 per barrel; and 6 percent, above the $150 mark. The price of coal, too, has soared in recent months, thanks to mounting worldwide demand as supplies of energy from nuclear power and hydroelectricity have contracted. Many countries have launched significant efforts to spur the development of renewable energy, but these are not advancing fast enough or on a large enough scale to replace older technologies quickly. The only bright spot, experts say, is the growing extraction of natural gas from shale rock in the United States through the use of hydraulic fracturing ("hydro-fracking"). Proponents of shale gas claim it can provide a large share of America's energy needs in the years ahead, while actually reducing harm to the environment when compared to coal and oil (as gas emits less carbon dioxide per unit of energy released); however, an expanding [chorus of opponents](http://www.businessweek.com/magazine/content/11_11/b4219025777026.htm) are warning of the threat to municipal water supplies posed by the use of toxic chemicals in the fracking process. These warnings have proven convincing enough to lead lawmakers in a growing number of states to begin placing restrictions on the practice, throwing into doubt the future contribution of shale gas to the nation's energy supply. Also, on May 12th, the French National Assembly (the powerful lower house of parliament) [voted](http://www.france24.com/en/20110511-france-votes-ban-shale-gas-drilling-fracking-ump-sarkozy) 287 to 146 to ban hydro-fracking in France, becoming the first nation to do so. The environmental problems of shale gas are hardly unique. The fact is that all of the strategies now being considered to extend the life-spans of oil, coal, and natural gas involve severe economic and environmental risks and costs -- as, of course, does the very use of fossil fuels of any sort at a moment when the first IEA numbers for 2010 indicate that it was an unexpectedly record-breaking year for humanity when it came to dumping greenhouse gases into the atmosphere. With the easily accessible mammoth oil fields of Texas, Venezuela, and the Middle East either used up or soon to be significantly depleted, the future of oil rests on third-rate stuff like tar sands, shale oil, and extra-heavy crude that require a lot of energy to extract, processes that emit added greenhouse gases, and as [with those tar sands](http://www.tomdispatch.com/post/175376/ellen_cantarow_energy_is_ugly), tend to play havoc with the environment. Shale gas is typical. Though plentiful, it can only be pried loose from underground shale formations through the use of explosives and highly pressurized water mixed with toxic chemicals. In addition, to obtain the necessary quantities of shale oil, many tens of thousands of wells will have to be sunk across the American landscape, any of one of which could prove to be an environmental disaster. Likewise, the future of coal will rest on increasingly invasive and hazardous techniques, such as the explosive [removal of mountaintops](http://mountainjustice.org/facts/steps.php) and the dispersal of excess rock and toxic wastes in the valleys below. Any increase in the use of coal will also enhance climate change, since coal emits more carbon dioxide than do oil and natural gas. Here's the bottom line: Any expectations that ever-increasing supplies of energy will meet demand in the coming years are destined to be disappointed. Instead, recurring shortages, rising prices, and mounting discontent are likely to be the thematic drumbeat of the globe's energy future. If we don't abandon a belief that unrestricted growth is our inalienable birthright and embrace the genuine promise of renewable energy (with the necessary effort and investment that would make such a commitment meaningful), the future is likely to prove grim indeed. Then, the history of energy, as taught in some late twenty-first-century university, will be labeled: How to Wreck the Planet 101.

\*\*\*Adv 2 – Leadership\*\*\*

US Space Leadership Low

US Space primacy is on the decline- Massive funding shortages and absence of coherent strategies.

Cherry 5/29/11

(Mary Alys, Bay area news journalist, "Moon Men: U.S Space Leadership Slipping." Mary 29th, 2011. <http://www.yourhoustonnews.com/bay_area/news/article_9857fa1d-60e9-511c-81a7-e7eb08e87c1f.html>) AV

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 WAVES When 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 SLIPPING However, 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.”

US Space Leadership Low

US Science, tech and space leadership at an all time low- major budget deficiencies, limitations of commercial companies, and dependence on foreign spacecrafts.

Cunningham 2010

(Walter, retired Apollo 7 Astronaut, "Taking a Bite out of NASA", Houston Chronicle, February 6th, 2010. <http://www.chron.com/disp/story.mpl/editorial/outlook/6854790.html>) AV

President Barack Obama's budget proposal may not be a death knell for NASA, but it certainly would accelerate America's downward spiral toward mediocrity in space exploration. Now it's up to NASA's leaders to put the best face possible on this nail that the administration is trying to hammer into their coffin. This proposal is not a “bold new course for human spaceflight,” nor is it a “fundamental reinvigoration of NASA.” It is quite the opposite, and I have no doubt the people at NASA will see it for what it is — a rationalization for pursuing mediocrity. It mandates huge changes and offers little hope for the future. My heart goes out to those who have to defend it. NASA has always been a political football. The agency's lifeblood is federal funding, and it has been losing blood for several decades. The only hope now for a lifesaving transfusion to stop the hemorrhaging is Congress. It is hard to be optimistic. President Obama has apparently decided the United States should not be in the human spaceflight business. He obviously thinks NASA's historic mission is a waste of time and money. Until just two months before his election, he was proposing to use the $18 billion NASA budget as a piggybank to fund his favored education programs. With this budget proposal, he is taking a step in that direction. NASA is not just a place to spend money, or to count jobs. It is the agency that has given us a better understanding of our present and hope for our future; an agency that gives us something to inspire us, especially young people. NASA's Constellation program was not “over budget, behind schedule, and lacking in innovation due to a failure to invest in critical new technologies,” as stated in the White House budget plan. The program's problems were due to perennial budget deficiencies. It would have been sustainable for an annual increase equal to the amount thrown away on the “cash for clunkers” program, or just a fraction of the tens of billions of dollars expended annually on congressional earmarks. It's debatable whether Constellation was the best solution to President George W. Bush's vision of “Moon, Mars and Beyond,” but it was far better than the vacuum in which we now find ourselves, and without a viable alternative in sight. Yes, jobs will be lost and the local economy will suffer. This will hurt and be readily measured. In the long run, intangible losses (those on which we cannot put a price tag) will be far more devastating. The cancellation of Constellation will guarantee several things. Most important, strategically, is the gap, the period during which we will be dependent on Russia to carry Americans to our own space station. With the cancellation of Constellation, that gap will grow longer, not shorter. American astronauts will not travel into space on American-developed and -built spacecraft until at least 2016 or 2017. We are not trying to fix any deficiencies in Constellation; our fate will be in the hands of commercial companies with COTS (Commercial Orbital Transportation Services) program awards. They will attempt to regain our lost greatness with new capsules and new rockets or military rockets, after man-rating them. Supposedly, they will do this faster and cheaper than NASA. Cheaper, maybe; faster is not going to happen. These will be companies that have never made a manned rocket and have little idea of the problems they face trying to man-rate a brand new launch vehicle and space capsule. Even under the best of circumstances, humans will not be flying to the space station on COTS-developed vehicles before 2017. After 50 years and several hundred billion dollars, the accomplishments of NASA and the U.S. space program in science, technology and exploration are unchallenged. They are admired, respected and envied by people and countries around the world. Our space program has provided inspiration to the human spirit for young and old alike. It said proudly to the world that Americans could accomplish whatever they set their minds to. Look at the efforts of China and India in the past 30 years to emulate this success. Young people have always been inspired with talk of sending explorers to the planets. Do you think they will have the same reaction when we speak of the new plan for “transformative technology development”? NASA may have been backing away from the real challenge of human spaceflight for years, but in canceling Constellation and NASA manned vehicles we are, in effect, abdicating our role as the leading spacefaring nation of the world. America will lose its pre-eminence in space. The real economic impact will not be immediate. The public at large is not fully aware of NASA's role as a principal driver in our economy for the past 50 years. They forget that much of the technology we now take for granted either originated in the space program or was utilized and improved by the space program. That is NASA's real legacy. The investments we made in NASA in the 1960s are still paying off in technology applications and new businesses. The annual investment in NASA is not simply an expenditure; it is an investment — with a payback. The payback is generated because NASA operates at the frontiers of space, exploring the frontiers of our civilization. At the frontiers of space, be it going to Mars or constructing the most amazing engineering project in history — the International Space Station — huge obstacles, sometimes considered insurmountable, are encountered. NASA takes these obstacles as challenges that must be overcome to reach its goals. The solution may lie in new technology or a new application of existing technology. These solutions eventually make their way into the marketplace with applications we never even dreamed of. NASA has tens of thousands of examples of these spinoffs. Now, after spending $11 billion on the development and closeout of the Ares 1 launch vehicle and the Orion space capsule, we are eliminating them. Gone! And with them, most of NASA's human spaceflight program. In the ongoing struggle for leadership in science, technology and exploration, which was represented by America's pre-eminence in space, we have raised the white flag of surrender. Who will this proposed budget please? It will please those who have opposed the Constellation program and have a vested interest in an alternative plan; those who are against human space exploration and for unmanned exploration; and those who will benefit from the COTS program. None of this new vision sits very well with those of us who have known NASA at its best. From its inception, one of NASA's motivating forces was pride in being the very best, in displaying American leadership in human spaceflight, and maintaining the pre-eminence in space that derived from this attitude. It appears this attitude is foreign to a president who believes American pre-eminence should be avoided at all costs. President Obama, we do not want a space program that turns us into “just another country” among countries.

US Space Leadership Low

US space hegemony low- lack of government oversight and strategic gains made by competitors.

Morring 2010

(Frank, senior space technology editor for Aviation Week, "U.S Space Leadership Seen at Risk." Aviation Week, May 3rd, 2010. <http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/asd/2010/05/03/11.xml>) AV

A preliminary version of an upcoming report on the link between national security and U.S. commercial launch capabilities warns that U.S. leadership in space is threatened by poor coordination in setting space policy. The Center for Strategic and International Studies is seeking website comment on its report — “National Security and the Commercial Space Sector” — in the hope that several ongoing government space policy reviews will incorporate the best advice on sound commercial launch policy in their findings. “We do not have a very sophisticated approach to industrial security and technology,” said John Hamre, president of CSIS and a former deputy U.S. defense secretary, during an event in Washington April 30. Presenting what he said were his personal views on the subject, Hamre charged that export-control techniques set up to keep the Soviet Union from using valuable U.S. defense technology don’t work today, when modern communications make it much more difficult to contain industrial secrets. “We now have the most reliable commercial launch vehicle in China, and we thought we were going to freeze them out so they could never move forward,” Hamre said. David Berteau, director of the CSIS Defense-Industrial Initiatives Group that is preparing the report, said he could not validate Hamre’s charge about China’s Long March launcher reliability. But he and Gregory Kiley, a lead analyst on the report, cautioned that U.S. space policymaking is “stovepiped,” even though it affects the defense, civil, commercial and intelligence space sectors. While CSIS identified “as many as 29 recently completed or ongoing space launch studies within the U.S. government,” it found no one group within the government had oversight on them all. As an example, Berteau said, “we did not anticipate the president’s budget decision” on NASA, which could have significant impact on U.S. commercial launch capability if it is used to deliver crews to the International Space Station. Kiley noted that Defense Secretary Robert Gates has publicly stated that he was “not adequately” consulted on the policy shift at NASA. “Making a decision in one sector without thinking through the implications and ramifications for the others is not good policy,” Kiley said.

US space leadership back to square one- lack of planning and funding and unreliable reliance on Russian space technology.

Hawkins 3/7/2011

(William, consultant specializing in international economic and national security issues. and a former economics professor and Republican Congressional staff member, "Forfeiting U.S Leadership in Space." March 7th, 2011. <http://www.familysecuritymatters.org/publications/id.8906/pub_detail.asp>) AV

The National Aeronautics and Space Administration (NASA) has put out its [2011 Strategic Plan](http://www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf). 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.

US Space Leadership Low

Undeclared human space exploration goals undermine US space leadership

Cherry 11 (Mary, May 29, Houston News, “Moon men: U.S. space leadership slipping”, http://www.yourhoustonnews.com/bay\_area/news/article\_9857fa1d-60e9-511c-81a7-e7eb08e87c1f.html?mode=story) CH

However, 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.”

Constellation cuts put US space leadership is on the brink—low chance of comeback without exploration efforts

Wolf, U.S. House Appropriations commerce, justice, science subcommittee, 10

Frank, SpaceNews, “U.S. House Appropriations commerce, justice, science subcommittee”, 4-25-10, http://spacenews.com/commentaries/100425-dont-forsake-leadership-space.html, CH

Yet today our country stands at a crossroad in the future of U.S. leadership in space. President Barack Obama’s 2011 budget proposal not only scraps the Constellation program but radically scales back U.S. ambition, access, control and exploration in space. Once we forsake these opportunities, it will be very hard to win them back. As Apollo astronauts Neil Armstrong, Jim Lovell and Gene Cernan noted on the eve of the president’s recent speech at Kennedy Space Center, Fla.: “For The United States, the leading space faring nation for nearly half a century, to be without carriage to low Earth orbit and with no human exploration capability to go beyond Earth orbit for an indeterminate time into the future, destines our nation to become one of second or even third rate stature.” In terms of national security and global leadership, the White House’s budget plan all but abdicates U.S. leadership in exploration and manned spaceflight at a time when other countries, such as China and Russia, are turning to space programs to drive innovation and promote economic growth.

The US maintains hegemony in the status quo, but lack of funding and global rivalries threaten dominance

Kauffman 8

Mark, Washington Post, “US Finds It’s Getting Crowded Out There”, 7-9-08, http://www.washingtonpost.com/wp-dyn/content/article/2008/07/08/AR2008070803185.html, CH

China plans to conduct its first spacewalk in October. The European Space Agency is building a roving robot to land on Mars. India recently launched a record 10 satellites into space on a single rocket. Space, like Earth below, is globalizing. And as it does, America's long-held superiority in exploring, exploiting and commercializing "the final frontier" is slipping away, many experts believe. Although the United States remains dominant in most space-related fields -- and owns half the military satellites currently orbiting Earth -- experts say the nation's superiority is diminishing, and many other nations are expanding their civilian and commercial space capabilities at a far faster pace. "We spent many tens of billions of dollars during the Apollo era to purchase a commanding lead in space over all nations on Earth," said NASA Administrator Michael D. Griffin, who said his agency's budget is down by 20 percent in inflation-adjusted terms since 1992. "We've been living off the fruit of that purchase for 40 years and have not . . . chosen to invest at a level that would preserve that commanding lead."

One way key to Science Leadership

Only quick starting one-way missions able to maintain scientific leadership.

Tyson ’10 (Peter, 4/11/10, PBS Nova, “A One Way Trip To Mars?”) SW

Even in 50 years, Davies suspects, neither the financial nor the political wherewithal will exist to send astronauts to Mars to poke around for a short time and then whisk them home again, as we did with the Apollo astronauts. By 2012, Russia expects to launch a robotic mission to the Mars moon Phobos (seen here in an artist's depiction on a Hungarian stamp). Such missions worry Aldrin, for one, who fears the United States might start falling behind in space exploration. Aldrin worries that if the U.S. doesn't act soon, other countries may end up putting people on the Red Planet sooner than we do. In 2011, Russia plans to send a sample-collecting mission to Phobos, one of the moons of Mars (and, in Aldrin's opinion, the ideal staging point for a colonization of the planet). The so-called Phobos-Grunt mission includes a Chinese satellite. "If we don't shape up what we're doing," Aldrin told me, "we're going to find the Russians clearly leading missions to Mars."

One way key to US space leadership

NPR 10 (December 5, NPR, “The Final Frontier: A Mars Mission With No Return,” http://www.npr.org/2010/12/05/131815965/one-way-mission-to-mars) KA

Legendary astronaut Buzz Aldrin, who was the second person to step on the moon on the 1969 Apollo 11 mission, agrees with Davies, to a certain degree. Aldrin is not one of the many volunteers lining up for the one-way mission to Mars, but he feels that the trip is inevitable — and it's important for the U.S. to pave the way. "If we slow down now," Aldrin tells Cornish, "we will lose the opportunity for leadership in an international lunar development corporation." Earlier this year, President Obama addressed a roomful of astronauts and scientists at the John F. Kennedy Space Center in Florida. He spoke to them about the future of space exploration in the 21st century and affirmed his belief that NASA will be able to send astronauts to Mars and back by the mid-2030s. But if scientists like Davies have their way, we may actually be living on the red planet by then. "If Mars is worth going to," Davies says, "it's worth staying on."

Key to Economic Competitiveness

Spacepower is the linchpin of economic competitiveness

Hayes and Lutes 7

(Peter, Visiting Fellow and Colonel Charles, Senior Military Fellow, both at Institute for National Strategic Studies at National Defense University, Space Policy 23,“Towards a Theory of Spacepower”, 10-18-07, ScienceDirect, CH)

Superpower both influences and is influenced by an actor’s economic power. Space applications have facilitated globalization, created opportunities for development, and enhanced the global nature of the economy. In its current state, spacepower enables other economic enterprises. However, the potential for creating wealth from space suggests the likelihood of expanding development and economic competition at some point in the future. The point at which that potential is realized is greatly dependent on the factors that shape spacepower. Spacepower has been a major, underappreciated factor in enabling the globalization trend of' the past 20 years. The explosion in communication and information technology was made possible through the global view space provides. For developing areas of the world space assets offer ways to manage natural resources better and extend services to remote populations. Space applications played a major role in economic development through activities such as telecommunications, navigation, Earth observation and remote sensing, and meteorology.

US Leadership Adv—Econ Link

Apollo proves, a human exploration program would revitalize the economy through job creation

Anderson 11

Marc, The Daily Cougar, “Space exploration is our future”, 5-2-11, http://thedailycougar.com/2011/05/02/space-exploration-is-our-future/, CH

At its peak, the Apollo program directly and indirectly provided jobs for over 375,000 Americans. This was accomplished using less than 4% of the federal budget. Given the scientific advancements and specialization that has occurred since then, a similar program today would likely employ many more workers, with job openings ranging from construction to physics. This would go a long way in making a dent in the nation’s current unemployment rate, and the open ended nature of the current proposal ensures that it will have a sustained positive impact on the economy. In addition, a program of this size and scale will invariably produce technological innovations that have the potential to transform everyday life. Previous NASA developments have included the invention of the integrated circuit and fuel cells.

Loss of space leadership threatens the economy while competition rises

Ensinger 10

Dustin, Economy in Crisis, “NASA is Losing its Leadership Role in Space Exploration”, 4-15-10, http://www.economyincrisis.org/content/nasa-losing-its-leadership-role-space-exploration, CH

The budget cuts could provide an opening for an American rival to take the lead in the space exploration. At the same time that the U.S. is cutting its NASA budget, nations such as China, Russia, Brazil and India are ramping up their programs. The European Union also appears to be emerging as a worthy adversary as well. But, more than just national pride is at stake in the 21st Century space race. Being the leader in the field could pay huge economic dividends down the road. “Losing the lead in space has national-security and industrial consequences,” according to The Wall Street Journal. “Such industries as shipping, airlines and oil exploration depend on orbiting satellites to gather and send essential data. TV signals, cell phones, ATMs, some credit card machines and many Internet connections rely on space technology. Recent estimates peg global civilian and military spending on space and space-related technologies at more than $260 billion annually.”

New Mission key to Space Leadership

New space program necessary to avoid NASA budget cuts, economic downturn and injuries to space leadership

National Journal 11 (May 18, “As Shuttle Program Winds Down, Uncertainty Looms for NASA” <http://www.nationaljournal.com/tech/as-shuttle-program-winds-down-uncertainty-looms-for-nasa-20110518>)

As the space shuttle program nears its final mission, Congress is criticizing NASA for moving too slowly to take the next step. But in many ways, it’s still not entirely clear what that next step is. “I’m worried that NASA’s inaction and indecision in making this transition could hurt America’s space leadership—something that would cost us billions of dollars and years to repair,” Senate Commerce Chairman Jay Rockefeller, D-W.Va., said in an opening statement for a subcommittee hearing Wednesday. He said he is concerned that the agency is not effectively implementing legislation passed last year that outlined a new focus for NASA. Senate Commerce ranking member Kay Bailey Hutchison, R-Texas, also questioned the speed of NASA’s transition. “I think we are all concerned about how slow everything seems to be moving,” she told the hearing of the Senate Commerce Subcommittee on Science and Space, called to examine how space exploration aligns with national goals. Congress has yet to fully decide what that next step is. NASA often finds itself squeezed between competing interests in Washington. In 2009, President Obama halted a plan to send astronauts back to the moon, but this year Congress—with an eye to home-state jobs—appropriated $3.8 billion to fund a so-called "heavylift" rocket program for an undetermined destination. Obama has called for more spending on climate science, commercial rockets, the International Space Station, and a new generation of space-exploration technology. Congress has generally been skeptical of plans to use more commercial space services. The space shuttle Endeavour took off Monday; the last shuttle mission is scheduled for July. NASA could be vulnerable, as the end of the space shuttle program coincides with efforts to slash government spending. Lawmakers and witnesses at the hearing pointed fingers at congressional and White House proposals to cut NASA’s budget. Obama’s latest budget proposal froze NASA’s budget at 2010 levels while House Republicans called for up to $379 million in cuts. Reducing space budgets may be an attractive option, but in the long term it could hurt the U.S. economy, said Frank Slazer, vice president of the Aerospace Industries Association. “While cutting the federal deficit is essential to assuring our economic future, cutting back on exploration investments is a penny-wise but pound-foolish approach that will have infinitesimal impact on the budget deficit,” he said. “Cutting exploration further threatens our economic growth potential and risks our continued national technical leadership overall, even as emerging world powers increase their investments in this important arena.” Space exploration has real impact back on earth, said Republican Sen. Marco Rubio, who represents Florida, which hosts the Kennedy Space Center and other NASA facilities and space industries. “America’s space program is not something we simply do for fun,” he said. “Many industries exist because of the space program.” Rubio called for a better-defined goal for NASA. And losing the competitive edge in space could undermine American economic power and national security, said Elliot Pulham, CEO of the Space Foundation.

Space Exploration key to Leadership

US space leadership stems from risky missions and translates to its participation in the international sphere

Stone 11 (March 14, Christopher, Space Strategy Planner at [United States Air Force](http://www.linkedin.com/company/united-states-air-force?trk=ppro_cprof), The Space Review “American leadership in space: leadership through capability” <http://www.thespacereview.com/article/1797/1>) NS 5/26/11

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. 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. 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. 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. 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”.

Human Exploration Key

Without human exploration capability, the US will lose space leadership

Ensinger, writer for Economy in Crisis, 10

Dustin, Economy in Crisis, “NASA is Losing its Leadership Role in Space Exploration”, 4-15-10, http://www.economyincrisis.org/content/nasa-losing-its-leadership-role-space-exploration, CH

Having already been knocked off its perch as the world’s top manufacturer, soon to be surpassed as the world’s largest economy and rapidly ceding international political influence, the U.S. could also lose its leadership role in space exploration. President Barack Obama is traveling to the Kennedy Space Center in Cape Canaveral, Florida, Thursday to unveil his administration’s plans for the National Aeronautics and Space Administration’s human space flight program. After announcing steep cuts to some NASA programs in February, critics have assailed the plan, saying the cuts will devastate the space program. "For the United States, the leading space faring nation for nearly half a century, to be without carriage to low Earth orbit and with no human exploration capability to go beyond Earth orbit for an indeterminate time into the future, destines our nation to become one of second or even third rate stature," a group of former astronauts and NASA officials wrote to the president in a letter

Space Leadership key to Heg

US space leadership is essential to its foreign commitments and hegemony as well as putting space on the international agenda

Friedman 11 (February 14, Louis, astronautics enginer, space spokesperson and co-founder of [The Planetary Society](http://en.wikipedia.org/wiki/The_Planetary_Society), The Space Review “American Leadership” <http://www.thespacereview.com/article/1778/1>)

It is true that American leadership can be used as a nationalistic call to advance American interests at the expense of non-American interests. But more often it may be used as an international call for promoting mutual interests and cooperation. That is certainly true in space, as demonstrated by the International Space Station, Cassini-Huygens, the James Webb Space Telescope, the Europa Jupiter System Mission, Mars 2016/2018 and Earth observing satellites. These are great existing and proposed missions, which engage much of the world and advance the interests of the US and other nations, inspire the public, and promote cooperation among technical and scientific communities worldwide. Yet space exploration and development are often overlooked in foreign relations and geopolitical strategies. Sometimes, the connection between space exploration and foreign relations has even been belittled in the space community. I refer to the NASA administrator’s foray into the Middle East last year, promoting science, math, and technology as a way to reach out to Muslim nations. It is true that he used some unfortunate wording, such as “foremost purpose,” but it was great that the administration wanted the space program to be part of its overarching international efforts to engaging the Muslim community in peaceful pursuits. Apollo and the International Space Station were both accomplishments motivated more by international and geopolitical interests than they were by space enthusiasm. It’s my view that space ventures should be used to advance American engagement in the world. (For example, with China on the space station and Russia in Mars Sample Return.) 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. 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.) On a bigger stage I was struck by the demands of the Egyptian protesters over the past few weeks for American leadership and engagement in reforming their country, while at the same time strongly resenting any American interference in their country. This demand for American leadership and opposition to American hegemony may seem inconsistent. It is not: it only emphasizes the need to recognize the difference and use leadership for cooperation and engagement. If we Americans do this in the space program, we will accomplish more in our many Earth, space science, and exploration projects, and we will raise higher the importance of the space program on the national and international political agenda.

Space Leadership Key to Heg

Space leadership is critical to overall US hegemony- provides intelligence and warfighting capabilities.

Young 8 (Thomas, Chair for the Institute for Defense Analyses Research Group, “Leadership, Management, and Organization for National Security Space”. July 2008. [http://www.armyspace.army.mil/ASJ/Images/National\_Security\_S pace\_Study\_Final\_Sept\_16.pdf](http://www.armyspace.army.mil/ASJ/Images/National_Security_Space_Study_Final_Sept_16.pdf)) AV

Today, U.S. leadership in space provides a vital national advantage across the scientific, commercial, and national security realms. In particular, space is of critical importance to our national intelligence and warfighting capabilities. The panel members nevertheless are unanimous in our conviction that, without significant improvements in the leadership and management of NSS programs, U.S. space preeminence will erode to the extent that space ceases to provide a competitive national security advantage. Space technology is rapidly proliferating across the globe, and many of our most important capabilities and successes were developed and fielded with a government technical workforce and a management structure that no longer exist. *U.S. Leadership in Space is a Vital National Advantage* Space capabilities underpin U.S. economic, scientific, and military leadership. The space enterprise is embedded in the fabric of our nation’s economy, providing technological leadership and sustainment of the industrial base. To cite but one example, the Global Positioning System (GPS) is the world standard for precision navigation and timing. Global awareness provided from space provides the ability to effectively plan for and respond to such critical national security requirements as intelligence on the military capabilities of potential adversaries, intelligence on Weapons of Mass Destruction (WMD) program proliferation, homeland security, and missile warning and defense. Military strategy, operations, and tactics are predicated upon the availability of space capabilities.

Colonization key to Leadership

Commitment to human spaceflight alone is the key signal of American leadership

Vergano 10 (Dan, Jan 29, USA Today, “Has USA hit its final frontier in space?; Tight budgets and success of unmanned missions could shackle human exploration”, http://www.usatoday.com/tech/science/space/2010-01-19-space19\_CV\_N.htm) CH

In June, Obama appointed the Augustine committee to review the human spaceflight program. "Planning for a human spaceflight program should begin with a choice about its goals -- rather than a destination," the Augustine report said, laying out five options for NASA and calling for international colonization of the solar system as an ultimate goal. The first two options keep space agency budgets flat and essentially remove NASA from the astronaut exploration business (aside from trips to the ISS) for decades, which Bolden says isn't going to happen. The others require adding $3 billion to NASA's budget in 2011 and increasing the budget 2.4% every year. These options vary in how long they would keep the ISS operational and what rocket NASA develops as an alternative to launch astronauts beyond Earth orbit. In some options, commercial rockets would carry astronauts to the station. Instead of landing on the moon or Mars, astronaut "flybys" would visit asteroids, the moon and Mars' tiny moons, Phobos and Deimos. A question of reputation In a recent Space Policy journal, Robinson and astronomer Daniel Lester of the University of Texas noted that most scientists view the astronauts as unimportant, their achievements negligible compared with the Hubble space telescope or the Mars rovers. But they and others note that scientific results aren't the big reason for NASA's existence. "The space program was an important source of American soft power in the competition with the Soviet Union during the Cold War. Even today, with more competitors in space, American leadership conveys a sense of competence that attracts others," says international relations expert Joseph Nye Jr. of Harvard. "While it is difficult to put a dollar figure on it, a perception that the U.S. was falling behind in space would damage our reputation." So NASA faces hard choices. Dropping the astronaut program looks impossible, given Bolden's promise. And cutting pure science probes for the cash to build astronaut colonies would be difficult. But something has to give.

Mars mission is inevitable- the US must act now to retain leadership

NPR 10 (December 5, “The Final Frontier: A Mission to Mars with No Return” <http://www.npr.org/2010/12/05/131815965/one-way-mission-to-mars>) NS 5/26/11

Legendary astronaut Buzz Aldrin, who was the second person to step on the moon on the 1969 Apollo 11 mission, agrees with Davies, to a certain degree. Aldrin is not one of the many volunteers lining up for the one-way mission to Mars, but he feels that the trip is inevitable — and it's important for the U.S. to pave the way. "If we slow down now," Aldrin tells Cornish, "we will lose the opportunity for leadership in an international lunar development corporation." Earlier this year, President Obama addressed a roomful of astronauts and scientists at the John F. Kennedy Space Center in Florida. He spoke to them about the future of space exploration in the 21st century and affirmed his belief that NASA will be able to send astronauts to Mars and back by the mid-2030s. But if scientists like Davies have their way, we may actually be living on the red planet by then. "If Mars is worth going to," Davies says, "it's worth staying on."

NASA Leadership key to Global Space Exploration

NASA’s space leadership is key to global peaceful space exploration

Space Daily 10 (March 2, “The Free World Is Losing NASA's Space Leadership”<http://www.spacedaily.com/reports/The_Free_World_Is_Losing_NASA_Space_Leadership_999.html>) NS 5/26/11

As a consequence of the international financial crisis many countries around the world have decided to drastically reduce their budgets, cutting spending in a myriad of programs from small private activities to large public projects. In the United States, to the astonishment of the world, NASA's budget has been "redirected" to simple LEO applications and some inexpensive research programs. Can this be true? This is the agency that has contributed most to America's prestige with its innovative and extraordinary achievements in space, from the time of early explorations of the universe to today's highly advanced technological achievements. Is prestige important? Not only is prestige important, it is part of the American tradition, part of American life and by extension, America's preeminence lights the free world and provides hope and support that other nations, too, can shine and succeed. The budget is important for any administration. Traditionally, most countries around the world wait for a signal from America - the scientific and technological leader - and rely upon America to protect their freedoms. Until now, countries pursuing space programs have not competed against America or against each other, but they will now have to continue alone or somehow partner with other countries. Without NASA's leadership, who will guide the world in peaceful space applications? Without NASA there is a void of experienced leaders well grounded in science. Indeed, we are approaching a new era in which space will be exploited by private, political, economic and military interests - not only in LEO, but also in deep space exploration. Will countries continue along the moral high ground of benefiting all mankind with the fruits of exploration and innovation or will space become a battleground for national greed and gain? America should not decide NASA's future merely on the basis of budgetary expedience. Space exploration is a matter that affects the rights and freedoms of people around the world. The rights and the dreams of many countries are closely tied to NASA, ESA and other recognized space agencies. The rich history of NASA brought the world Voyager 1, Apollo, robots on Mars, Kepler, Cassini-Huygens, Curiosity and so many more.

NASA funding key to leadership

Landrith, President of the Frontiers of Freedom Institute, 10

George, Human Events, “America Belongs in Space”, 11-28-10, http://www.humanevents.com/article.php?id=40227, CH

Some might argue that in financially tight times, it is necessary to cut spending and thus kill planned missions to the moon and to Mars. But NASA’s budget hasn’t been cut—only its mission has but gutted and its vision clouded. That is a HUGE mistake. NASA should be working to keep the United States as the world leader in space exploration. There are billions of dollars spent on climate research, and NASA doesn’t need to duplicate those efforts. And the idea of making NASA an international counseling organization to help Islamic nations feel better about their lack of high-technology development is utterly silly. Since the last Apollo mission in the 1970s, our space exploration program has focused on low Earth orbit. The United States needs to get back into the business of looking farther into outer space. We need to develop a heavy lift launch capability. But NASA cannot do this job if the President’s foresight is so weak and unimaginative. President John F. Kennedy focused the nation on a bold vision that captured the American imagination. Obama would do well to follow his example. A failure of vision has real costs. Much of the advancement and growth in the economy the past three decades have their roots in the space program. Transistors, circuit boards, computerization and miniaturization technologies were all advanced at unprecedented rates by the space program, not to mention the marketability of Tang or Ziploc bags. Ask yourself, what would have happened had Queen Isabella turned Christopher Columbus down and refused to fund exploration to find alternative trade routes to the East? What would have happened if Sir Francis Drake or Ferdinand Magellan had not been sent out to explore? What if President Thomas Jefferson had decided to save money rather than to send Lewis and Clark out to explore and chart North America? NASA doesn’t spend very much money—a paltry $18 billion—but how that money is spent matters a great deal! Will it be spent to counsel Muslims who feel sad that they haven’t landed on the moon? Will it be spent to duplicate the billions already spent on climate research? Or will it be spent to explore the frontiers of space? Will it be spent doing amazing and inspiring things, or wasted doing mundane and unimportant things?

Mars Leadership

A mission to Mars would solidify the US’s position a leader in space

Kottcamp, Chairman of Space Florida, 10

(Jeff, St Petersburg Times, “Let’s Stay No.1 in Space Exploration”, 3-25-10, lexis, CH)

It is with the need for a defined space mission in mind, and the desire not only to save 7,000 to 19,000 jobs in Florida, but also to maintain our nation's position as the world's leader in space exploration, that I challenge the president to debate the need for the creation of the nation's next human space exploration program now. This is not the time for flowery speeches, it is the time for action. It is time to make a bold statement and give the American people another challenge (putting astronauts on Mars for starters), another purpose, with a defined time line (within the decade), to continue our nation's leadership in space exploration. Americans rise to the occasion every time we are challenged. Now is the time to take on a new challenge in space exploration - not to retreat from our history, our collective accomplishments and our position as the world leader in space.

Aerospace Industry

Space Missions key to US aerospace industry

Costlow 2 (Terry, has written about the electronics industry for more than 20 years, covering a wide range of technologies and topics, February, <http://www.todaysengineer.org/archives/te_archives/feb02/pp1.asp>)LK

America's aerospace industry has been phenomenally successful, but funding and research have been a hodgepodge of disjointed programs. The Commission on the Future of the U.S. Aerospace Industry hopes to change that by providing long-term direction and focus for civilian and military avionics as well as space programs.

Between now and November 2002, the Commission will hold a number of public meetings and solicit advice and data from industry, government and market researchers. Its goal is to determine how R&D funds are being spent and to set goals for the many fields that comprise aerospace**.** In particular, the Commission's central objective will be to devise reachable plans for commercial travel, defense flight systems and space travel. Through these plans, the Commission will address everything from the infrastructure — which includes air traffic control — to the possible privatization/commercialization of NASA. Another key objective is to provide direction for government spending, which historically has been disjointed and unfocused.

"One problem we have is that no one in the investor community or in government really knows how much we're investing in aerospace," said Commission Chair Robert Walker. "One of the first things we want to do is provide that information."

Strong aerospace sector is key to hegemony

Wright 93 - Major, USAF [Stephen, “AEROSPACE STRATEGY FOR THE AEROSPACE NATION”, <http://www.dtic.mil/doctrine/jel/research_pubs/p195.pdf>]LK

The ties linking the aerospace with its military counterpart were forged through two world wars, a cold war, Korea, Vietnam, and other lesser conflicts. Add to this crucible of the past the economic challenges of the future and one sees the desideratum of aerospace power. To achieve a position of predominance in aerospace, the U.S. requires a national aerospace strategy.

Whither the Aerospace Nation? {17}

If this paper serves no other purpose, it must serve as a wake-up call, a call to action for the aerospace nation. United States policy makers must view aerospace power as a national treasure. If economists like Robert Reich, Michael Porter and Lester Thurow, are correct, the aerospace industry will be critical to America’s future economic prosperity. Each argues that the future belongs to those nations with trained, skilled workers that add unique, high value to products. Each agrees that aerospace is one of those industries. Militarily we cannot operate without control of aerospace--all military strategies rely upon it. Aerospace dominance provides the capability for U.S. forces to win within the political imperatives of the future, especially with reference to casualties. Aerospace power, both its economic and military elements, is under great pressure to succeed in the future. To do so requires a national aerospace strategy.

Aerospace is vital to hegemony and the economy

Wright 93 - Major, USAF [Stephen, “AEROSPACE STRATEGY FOR THE AEROSPACE NATION”, <http://www.dtic.mil/doctrine/jel/research_pubs/p195.pdf>]LK

The transition and development of the U.S. into an aerospace nation underwent many starts and stops in both its economic and military elements. What this paper showed was the absolutely essential contribution aerospace power makes to the security and well-being, economically and militarily, of the United States. There can be no doubt that America is an aerospace nation. However, many problems cloud U.S. aerospace power necessitating a national strategy that encompasses both elements of its power. The aerospace industry provides the jobs, skills, and products that serve to increase the U.S. standard of living. It serves as a visible symbol of the technological expertise and economic power of America. Militarily, the U.S. faces uncertainty about potential threats; however, as long as she can control and exploit aerospace at will, her future is secure from hostile intent.

US Heg Adv—Human Exploration

The US has can maintain space dominance, but it’ll fade without a coherent plan for human space exploration

Armstrong et al, astronaut, 10

(Neil, Gene Cernan and Jim Lovell, USA Today, “Is Obama grounding JFK's space legacy?”, 5/24/11, <http://www.usatoday.com/news/opinion/forum/2011-05-24-Obama-grounding-JFK-space-legacy_n.htm>, CH)

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. *"We have a long way to go in this space race. But this is the new ocean, and I believe that the United States must sail on it and be in a position second to none."* *— President Kennedy* Kennedy launched America on that 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](http://content.usatoday.com/topics/topic/People/Historical%2BFigures/John%2BF.%2BKennedy) would have been sorely disappointed.

US Heg Adv—Space Technology

Space technology is the basis of US hard power

Roy, analyst of geopolitical and international affairs, 10

(Sourav, Afro-Middle East Centre, “Mission Absolute: American hegemony in space”, 2-7-10, http://amec.org.za/articles-presentations/war-on-terror/98-mission-absolute-american-hegemony-in-space, CH)

With the American appetite for global domination and military supremacy growing insatiably, and with an unrivalled edge provided by its space age ballistic defence warfare, satellite imagery and space based attack abilities, U.S. forces seem to have acquired an impenetrable armour of invincibility. Undoubtedly, America’s ability to exploit space and deploy cutting edge space warfare technologies imparts to it a momentum on battlefields that no other nation can match, barring – possibly – the Russians. Two of the fastest growing space-age nations, China and India, are – comparatively – new kids on the block, and almost their entire space technology has been developed relatively recently, as compared to the decades-old U.S. space plans which started being developed in the 1950s. American space technology allows the U.S. comfortably to dominate all warfare on earth and is meticulously coordinated by a highly specialized “Space Command”. The question is: what makes the U.S. an unchallenged leader in space warfare and how did it acquire such a devastating sting? The answer lies in a series of events immediately following World War II.

US Heg Adv—China—U/Q

US space influence stronger than China now, but waning

Hawkins, international economic and national security issues consultant for Family Security Matters, 11

William R., Family Security Matters, “Forfeiting US Leadership in Space, 3-7-11, http://www.familysecuritymatters.org/publications/id.8906/pub\_detail.asp, CH)

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.

Leadership Adv—China

China is the only feasible competition in a space race

Johnson-Freese, Professor at the Naval War College, 5

(Joan, “Maintaining US Leadership in Human Spaceflight”, May 2005, Space Policy, p.240, CH)

While many countries have shown interest over the years in developing autonomous human space programs, besides the USA only Russia and China, since the October 2003 launch of the first Chinese astronaut, have been successful. The Russian human space program was rescued from becoming moribund when it merged with NASA's human program to develop the International Space Station (1SS). Russia is still, however, unable to pursue new high-cost initiatives on its own, both for economic reasons and because it has learned that developing and maintaining support for a human space program is hard in democracies. While the European Space Agency (ESA) and countries like Japan and India doubtless have the technical wherewithal to have a successful human space program, they lack the requisite political will. In a catch-22 scenario, however, having to always play a supporting role to the USA makes it even more difficult to garner public support and political will for human space activity. While Japan has long talked about a human space program, being responsible to an electorate, bureaucratic politics, economics and a cultural aversion to risk will probably keep them Earthbound. India too, as a democracy, remains constrained by public perceptions of priorities lying elsewhere. It is only because China's program is driven from the top that it has successfully been carried to fruition. So why it China, a country with over 1.3 billion people, willing to devote significant resources to human spaceflight capability?

Human space leadership key to US world leadership, specifically versus China

Johnson-Freese, Professor at the Naval War College, 5

(Joan, “Maintaining US Leadership in Human Spaceflight”, May 2005, Space Policy, p.242, CH)

But the USA must not allow human space leadership to slip away. Human spaceflight requires pushing the envelop in areas of science and engineering—in medical fields and areas of life support systems engineering, for example— that could otherwise potentially be neglected. While direct benefits to the economy or defense from a particular program may not always be identifiable in advance, GPS, once a government program without a clear mission, has certainly demonstrated that we should not be bound by the limits of our imagination. The importance that space provides to building science capabilities generally is not unnoticed elsewhere. China is acutely aware that it has a long way to go toward becoming a science '"power' and it hopes human spaceflight will accelerate its movement up the learning curve. For the USA to maintain its leadership position, it is therefore imperative that it stays active in space as well. It is also important to remember that human spaceflight is part of the US space agenda, but not the entire agenda. We need to maintain a balance to assure continued pre-eminence in all aspects of science and engineering. Finally, space represents the future. It is imperative that the USA, as the world's leader, remains the world's leader into the future.

Mars Race – China/Russia

The US faces strong international competition in the race to Mars

Kaplan 10 (Jeremy, Oct 27, Fox News, “The Race to the Red Planet”, http://www.foxnews.com/scitech/2010/10/27/road-red-planet-mars-nasa-china/) CH

A 50-million-mile target has been set, a straight spaceshot with a clear (though distant) goal. But who will make the first footprint on Mars? Though both Russia and China have put men in space and say they hope someday to set foot on the moon, the United States remains the only country to do so. Yet Russia and China and some other countries have also publicly articulated a vision for manned space exploration that includes a more distant target: Mars.  Now reports of a new deep-space satellite suggest that China intends to launch toward Mars -- and as soon as 2013. It's too early to call it a race, says Henry Hertzfeld, research professor of space policy and international affairs in the Space Policy Institute at George Washington University. But China's Martian orbiter may indicate a second destination for the country's space program. "It's natural that if they are serious about space exploration (which, it is clear, they are), Mars is a challenge beyond the Moon. Just as it is for us," Hertzfeld told FoxNews.com in an e-mail.  The new project will make use of technologies developed for China's first lunar satellite, launched in 2007, according to a report from the [Xinhua news agency](http://news.xinhuanet.com/english2010/china/2010-10/22/c_13570443.htm). The plan was based on research conducted by the China Academy of Space Technology (CAST), said Huang Jiangchuan, an expert at a forum on China's space technology. He described the technologies likely to be used -- including ones to boost the satellite's payload capability and exploration accuracy -- as "already quite advanced," according to the report. Hertzfeld nevertheless cautioned that the differences between the 1960s and the 21st century make for a very different competitive landscape. There are more countries now with space capabilities and access to space; there is much more cooperation among nations; and the costs are astronomical. "I think it's too early to tell if we will engage in a true 'race' to Mars as we did with the USSR to the moon," he said.  But the official messages from governments seem to tell a different story, with the U.S., India, China, and Russia all declaring that they hope to reach Mars at around the same time.  "By the mid-2030s, I believe we can send humans to orbit Mars and return them safely to Earth," President Obama said this year when he announced America's new goal's for [NASA](http://www.foxnews.com/topics/scitech/space/nasa.htm#r_src=ramp). "And a landing on Mars will follow. And I expect to be around to see it." But will we be first? India has plans of its own for the Red Planet. Indian Space Research Organization ([ISRO](http://www.isro.org/)) chairman K. Radhakrishnan said Monday that Mars was on its radar as well. "A mission to Mars, for several reasons, has become a priority for us," Radhakrishnan said -- though he admitted that India would not build the lander that would take its Chandrayan 2 program to the surface. That vehicle is being developed by Russia, he explained, although a rover "is currently being fabricated in Indian laboratories."  Nevertheless, India has publicly stated that it intends to go to Mars by 2030.  So the race is on.Yet many rules and parameters governing the battle remain unresolved, Hertzfeld said.

China Challenging Space Leadership now

Competition with China rising now

BBC News 9 (Nov 4, “US praises China's space progress”, http://news.bbc.co.uk/2/hi/asia-pacific/8341710.stm)CH

Speaking to reporters, Gen Chilton said Beijing had made amazing progress in its space programme over recent years. But he added: "Where they're heading... is one of those things that a lot of people would like to understand better." Both countries have tried to improve military relations that were recently characterised as "on-again, off-again" by US Defence Secretary Robert Gates. Last week Gen Chilton hosted a visit to US Strategic Command by Chinese General Xu Caihou, vice-chairman of China's Central Military Commission, the country's military decision-making body. But while the trip was an effort to improve military ties, it is clear the two sides are also expanding their areas of competition into space. In 2007 China surprised the world by shooting down one of its own defunct weather satellites. And earlier this week Gen Xu Qiliang said competition in this area would continue. "Military competition has shifted towards space. Such a shift is a major trend now, and such expansion is a historical inevitability," he told state-run media. "To some extent, if you control space you can also control the land and the sea, and you will be in an advantageous position."

China developing technologies to challenge US dominance

Dowd 10 (Allen, July 1, American Legion Magazine, “The Ultimate High Ground”, http://www.alanwdowd.com/Articles.aspx?ArticleId=514 CH)

“Space capabilities are more important…than they were 10 years ago,”[v] says Gen. Kevin Chilton, commander of U.S. Strategic Command, who plans to devote more resources to new satellites—and understandably so. The Air Force reports that during Operation Iraqi Freedom commercial satellites—not military satellites—“provided over 80 percent of all satellite communications used by the U.S. military.”[vi] Satellites and other space assets are crucial to maintaining America’s military edge. China wants to cut into that military edge, and its leaders know that exploiting space—the ultimate high ground—is the key. “If you control space,” observes Gen. Xu Qiliang, commander of China’s air force, “you can also control the land and the sea.”[vii] In fact, the Chinese news agency Xinhua reported 10 years ago that China was “developing methods and strategies for defeating the U.S. military in a…space-based future war.”[viii] Toward that end, “China has accorded space a high priority for investment,”[ix] according to the Pentagon, which adds that “China is developing a multi-dimensional program to limit or prevent the use of space-based assets by its potential adversaries during times of crisis or conflict.”[x] In 2007, for instance, Beijing tested an anti-satellite missile (ASAT), demonstrating its ability to attack American satellites in low-earth orbit. A 2008 Pentagon report quotes Chinese military planners as envisioning a “space shock and awe strike…[to] shake the structure of the opponent’s operational system of organization and…create huge psychological impact on the opponent’s policymakers.”[xi] The Pentagon noted in 2009 that Chinese military “writings emphasize the necessity of ‘destroying, damaging, and interfering with the enemy’s reconnaissance/observation and communications satellites,’ suggesting that such systems, as well as navigation and early warning satellites, could be among initial targets of attack to ‘blind and deafen the enemy.’”[xii]

Space Leadership Solves Chinese Aggression

US space leadership key to check Chinese aggression in the Taiwan strait- weakness prompts Chinese attacks

Martel and Yoshihara 2003

(William, professor of national security affairs at the Naval War College, and Toshi, doctoral candidate at the Fletcher School of Law and Diplomacy, Tufts University, and a research fellow at the Institute for Foreign

Policy Analysis, "Averting a Sino-U.S Space Race." The Washington Quarterly, CSIS, Autumn 2003. <http://www.twq.com/03autumn/docs/03autumn_martel.pdf>) AV

These differing bilateral perspectives on space and security are contributing to the growing perception in both capitals that the other poses a significant military and strategic threat in space. The prevailing assessments in Beijing and Washington are notable for their unmistakable apprehension of each other. For example, annual Pentagon reviews of China’s military, which began in 1998, have produced an ominous picture of PRC space capabilities . Even while conceding that China’s technologies lag far behind those of the West, these reports argue that the exploitation of space is beginning to dominate Chinese military strategy. They also assert that the PRC has established key military programs for the specific purpose of denying the United States its use of space. For example, China is reportedly developing a high-energy laser that could temporarily dazzle or permanently blind the sensors on imaging satellites. Department of Defense assessments have also concluded that, by 2010, China will have indigenously developed advanced space technologies as well as imaging and communications satellites. Of particular concern and the subject of intense scrutiny by the Pentagon is China’s interest in developing antisatellite capabilities that would prevent the United States from using military and commercial satellites. A congressionally mandated bipartisan commission, which annually reviews security ties between the United States and China, concurs with the Pentagon’s conclusions. The U.S.-China Security Review Commission noted that China will need space-based reconnaissance to precisely target its new generation of ballistic missiles, land-attack cruise missiles, and antiship cruise missiles. The latter would be of decisive importance in military operations against U.S aircraft carriers in the Taiwan Strait. Arguing that China was devising strategies to counter U.S. space-based warfare, the Rumsfeld Commission also identified a conflict in the Taiwan Strait as a threat to U.S. space systems. China could, for example, preemptively attack U.S. assets in space prior to the outbreak of conflict in the Taiwan Strait in an effort to prevent the United States from coordinating military intervention. China could also disrupt commercial satellites upon which everyday American life depends in the hopes of dampening U.S. political will to intervene. Chinese officials and commentators have drawn similar conclusions about the United States. In a rather blunt article published in a Hong Kong–based newspaper, which reportedly enjoys close ties with the Chinese military establishment, Chinese analyst Gao Yan, argued that, because space power determines a nation's destiny, it is imperative for China to pursue military capabilities in space aggressively. He warned that, because of fundamental differences in ideology, national interests, geopolitics, and military strategies, the PRC must be prepared for the imminent strategic rivalry with the United States. 22 In remarks apparently made in response to a U.S. military space exercise conducted in early 2001 in Colorado Springs, in which China was the presumptive enemy, Teng Jianqun, the chief editor of China’s World Military Review and a member of China’ s Military science Academy echoed similar sentiments. He stated that, “[w]hen any country [in this case, the United States] is preparing a military confrontation with China in outer space, we have to pay close attention and prepare for what would happen.” 23 Furthermore, the director of the China Aerospace Corporation’s Science and Technology Committee, Zhuang Fengan, has argued that a major aim of China’s space program is to develop advanced weapons for space warfare. 24 Zhuang indicated that key areas for further development include reliability, precision strike ability, and stealth. During the next decade or so, the PRC will not likely be able to compete in every area of space technology with the United States at any level that even remotely resembles the intensity of the superpower rivalry during the Cold War. In addition, with the Bush administration’s defense transformation plans, U.S. investments in the next generation of leap-ahead technologies are likely to leave China even further behind. Over the next 5–10 years, however, Beijing may be able to pursue selective technological capabilities that can challenge U.S. interests in space. The fact that 95 percent of space technologies are dual-use in nature could both accelerate and conceal progress in China's space program. 2 5 For example, advances in China’s commercial launchers are likely to improve the range, accuracy, and payload of intercontinental ballistic missiles. As economic reforms accelerate, indigenous sources of innovation in civilian technologies could migrate into China’s military and space programs. Similarly, international ventures involving the transfer of technology and skills to China will likely find their way into military programs. Furthermore, the blurry—if existent—divisions between civil and military institutions in the Chinese space program make it easy to transfer technologies from the civilian sector to military programs. In any event, China does not need to reach parity with the United States to harm U.S interests in space. Some China scholars have argued that China could use a range of old and new technologies, including advanced space capabilities, to weaken the political will of superior adversaries who increasingly depend on space to fight wars. 26 Whether this approach will be successful is debatable, but U.S. vulnerabilities to disruptions in space might embolden China to attack U.S. space systems in the event of a military confrontation over Taiwan.

China Space Bad

China will use its space program for military purposes.

Space Daily, 8

(“China's space development can pose military threat: Japan,” 26 March 2008, p. <http://www.spacedaily.com/reports/Chinas_space_development_can_pose_military_threat_Japan_999.html>, Accessed: 20 June 2011, JT)

A Japanese defence ministry think-tank has warned that China's space programme could pose a military threat to other countries. The review, released on Thursday, also said China is likely to continue its space development programme "as a vital means of achieving military competitiveness against the United States." "The organisations engaged in China's space development have strong ties to the People's Liberation Army and a considerable number of its satellites are presumably intended for military purposes," the National Institute for Defence Studies said in an annual strategic review of East Asia. China launched a space probe in October as part of an ambitious exploration programme that has included successes with man-made satellites and [manned space](http://www.spacedaily.com/reports/Chinas_space_development_can_pose_military_threat_Japan_999.html) flights. The think-tank said the programme had the "effect of raising national prestige." It added that China's test in January last year to shoot down an object in space -- its own weather satellite -- had fueled military concerns. "Missiles can destroy not only US [artificial satellites](http://www.spacedaily.com/reports/Chinas_space_development_can_pose_military_threat_Japan_999.html) but also Japanese intelligence-gathering satellites," the review said. "The possibility has emerged that the cluster of satellites will come under a great threat when international tension heightens."

China will use its space program to overtake American dominance.

National Institute for Defense Studdies, 8 (East Asian Strategic Review 2008, “China’s Space Development—A Tool for Enhancing National Strength and Prestige,” <http://www.nids.go.jp/english/publication/east-asian/pdf/2008/east-asian_e2008_01.pdf>, p. 33, JT)

Today China appears determined to become a center of resistance against the United States, the post-Cold War world’s leader in many arenas. This opposition is seen in not only China’s economic activities, but also its national security efforts. Having minutely analyzed the United States’ current strengths and weaknesses, China is endeavoring to narrow its gap with US capabilities in established weapons systems by exploring such possibilities as construction of an aircraft carrier and reinforcement of its nuclear capabilities. At the same time, China is building up its cyber war capabilities. China is also countering US dominance in security-related space activities by developing technologies to exploit the vulnerabilities of US space assets. This capability was amply demonstrated by the success of the anti-satellite test described earlier. China’s resistance is further manifested in its proactive involvement in the Galileo Project, the European program aimed at developing a navigation satellite system that will not rely on the United States’ GPS. As such, the project serves as an opportunity for China to deepen its ties with Europe while challenging US supremacy. Moreover, China is carrying out its own initiatives, such as the Beidou system mentioned earlier. It also appears to be enhancing its optical reconnaissance satellites and developing SAR reconnaissance satellites; these projects, if successfully realized, will allow China to dramatically improve its capabilities in space asset use and space-based information gathering.

Beating China Good

Chinese space dominance would mean the United States would lose a war with China.

Zissis, Council on Foreign Relations, 7

(Carin, “China’s Anti-Satellite Test,” 22 February 2007, p. <http://www.cfr.org/china/chinas-anti-satellite-test/p12684#p8>, Accessed: 20 June 2011, JT)

 United States. The most likely conflict that would draw the United States into a war with China would be conflict between China and Taiwan. Washington would defend Taiwan, relying heavily on precision-guided weapons to attack Chinese military targets. The Achilles' heel of America's more technologically advanced military is the dependence on space-based satellites. “If China and the United States both took out each others' satellites in a conflict, the Americans would lose far more,” write Segal and Levi.

Chinese space dominance would allow them to weaken the U.S. military and economy.

MacDonald, senior director non-prolif and arms control@U.S. Institute of peace. 9

(Bruce, testimony before the strategic forces subcommittee, 18 March 2009, <http://i.cfr.org/content/publications/attachments/MacDonald_Testimony_031809.pdf>, p. 2, accessed: 20 June 2011, JT)

Our overall goal should be to shape the space domain to the advantage of the United States, and to do so in ways that are stabilizing and enhance U.S. security. The U.S. has an overriding interest in maintaining the safety, survival, and function of its space assets so that the profound military, civilian, and commercial benefits they enable can continue to be available to the United States and its allies. These vital space assets face three forms of threats, all of them worrisome and growing: With the proliferation of space and other technologies, and specifically with the anti-satellite (ASAT) capability China demonstrated two years ago, there is a risk that China or another adversary could exploit this fast-growing U.S. dependence on space in a war to greatly weaken U.S. military and economic power. China could do so and thus pose a serious threat to U.S. space assets within a decade if it chose to do so. China is also pursuing other programs that have important ASAT implications, and other nations are interested in ASAT as well. The 2008 U.S. shoot-down of an errant satellite demonstrated the ASAT capability inherent to missile defense systems, ours and others. Last week Russia indicated renewed interest in ASAT weapons when their deputy defense minister, General Valentin Popovkin, stated that Russia is working on ASAT.

Beating China Good

U.S. space primacy over China is key to deterring a Chinese attack on the United States.

MacDonald, senior director non-prolif and arms control@U.S. Institute of peace. 9

(Bruce, testimony before the strategic forces subcommittee, 18 March 2009, <http://i.cfr.org/content/publications/attachments/MacDonald_Testimony_031809.pdf>, p. 4-5, accessed: 20 June 2011, JT)

There is a sizable Chinese military (PLA) literature on space conflict, but it is unclear how well this reflects Chinese government thinking, any more than U.S. military journals reflect official U.S. policy. However, China’s ASAT test and this literature demonstrate a PLA awareness of the importance of offensive counterspace (OCS) capabilities and suggest that such capabilities are part of China’s larger plans for the future. It is also unclear whether this reflects PLA interest in OCS for warfighting or just for deterrence. Should China choose to deploy its demonstrated ASAT system, or a more advanced versions of it, U.S. space assets and the military and economic infrastructures they support will be in jeopardy. Furthermore, China reportedly has other offensive space programs under development, including lasers, microwave- and cyber-weapons. We also face the twin realities that defending space assets is more difficult than attacking them; and while advancing technology will help both defense and offense, the offense is likely to benefit more. One thing is certain – more clarity on PLA and Chinese government thinking on space deterrence, doctrine, space stability, and related issues – and Russian thinking, too -- are urgently needed and are important to U.S. security. Should the U.S. Have Offensive Space Capabilities? This is a question that lends itself to simplistic answers on both sides of the question. If it is possible to establish a space regime where no one had offensive space weapons, we should certainly do so. If we can maintain space deterrence by other than offensive means, we should certainly do so. We must think long and hard before we deploy a major offensive space capability. But if there are no feasible alternatives, then we should develop a limited offensive capability, in a deterrence context. Limited, tactical applications may also be possible but must be fully understood first. The U.S. and China have already crossed a space Rubicon of sorts. ASAT capabilities already developed cannot be un-invented, and missile defense, with inherent ASAT capabilities, is here to stay. This is reality. U.S. security crucially depends on space and will do so even more in the future, and such capabilities must be preserved. Defensive steps can help, but ultimately it is difficult to protect space assets. We also can and should decentralize our space assets, putting our space eggs in more baskets to reduce our vulnerability, which would help, but likely not resolve, our problem. Arms control and other diplomatic steps certainly have a larger role to play and can help limit some of these threats. But verification issues make a comprehensive diplomatic-only solution seem improbable at present, which means the U.S. may need at least some offensive space capabilities, though we should tread carefully and thoughtfully into this new, highly uncertain world. We need to know where the pitfalls are, and not just develop space weapons now and worry about the implications later. The real question is what kind abd level of offensive capability might we need, and to what purpose? Any offensive space capability should have at least seven characteristics:

Leadership Key to Int’l Cooperation

US Space leadership key to international space cooperation

Aerospace Industries Association, No Date

“U.S. Leadership in Space Exploration: Lessons from the International Space Station”, http://www.aia-aerospace.org/assets/International%20Co-op%20in%20Space%20Exploration%20FINAL.pdf, CH

 Space partnerships can be an important foreign policy tool. As the U.S. seeks ways to work with rapidly growing developing countries, and newly emerging democracies in the Middle East, space cooperation can be an important tool. As the world’s leading spacefaring nation, other countries look to U.S. leadership in moving forward in space. Additionally, new opportunities for international partnership in human exploration continue to emerge. Fledgling space programs in countries as diverse as India, South Korea and Brazil, are potential targets for international collaborative efforts in human exploration. International cooperation has been the key to successful exploration programs. Throughout its history, the U.S. space exploration program has had its foreign policy impact as one of its primary objectives. This was true from the Cold War race to the moon against the Soviets (which also sought to influence emerging nations in former colonies) to the multination space shuttle program with its Canadian telerobotic arm and the European Space Lab. Since the Apollo moon landings, efforts to proceed with an ambitious U.S. exploration program have foundered and no U.S. human space effort has been initiated and seen through to completion without significant international involvement. NASA leads the development of the international team and works to assure U.S. technical priorities are included in our exploration architecture. International cooperation provides greater program stability. It should be noted that the ISS partnership has continued for nearly twenty five years and is likely to continue through at least the end of this decade. Despite its obvious benefits, there were technical challenges that came with internationalization. Engineers were responsible for integrating all the elements, whether U.S. or foreign-made, and getting them ready for flight. Never-the-less, the ISS has largely been built as envisaged and has not only met its technical objectives; it also has had significant political accomplishments as well. This is exactly the type of commitment and tenacity that a program for human exploration of the solar system will need if it is to be successful. Encouraging international partnerships reaps benefits beyond space exploration. Learning to live and work together in space will invariably improve our ability to live and work together on Earth. Moving forward, it will show the children of the world that our success as a spacefaring civilization is tied to peaceful cooperation with other nations and respecting the agreed upon rules of the road. Exploration will eventually lead us to a destination – but the real benefits will begin while we are on our way. Beyond this new perspective, as with exploration programs to date, technology developed for exploration will have spinoff benefits for life on Earth.

International Coop Solves Climate

International co-op solves climate change

Repower America, No Date

“Solving the Climate Crisis: Around the World”, <http://www.repoweramerica.org/solutions/policies/international-action/>, CH

Climate change is a global problem with impacts that are already visible around the world. No single country can solve this crisis by itself. Our task is to work together to confront the reality of climate change and build a global clean energy economy. From China to Indonesia and from the European Union to the Maldives, many nations are already taking important steps to reduce the pollution that causes global warming. Nations are also working toward a global agreement to reduce global warming pollution and adapt to the impacts of climate change. From world leaders to ordinary citizens, everyone can play a role in solving the climate crisis. We encourage you to visit The Climate Project to learn more about our efforts to educate and engage people around the world. Nations Taking Action International efforts to date have been inadequate given the scale and scope of the challenge. Nonetheless, many countries are forging ahead with national policies and investments that limit global warming pollution and promote our transition to clean, renewable energy. What follows are just a few of the actions taking place around the globe.

International cooperation key to solve climate change

Winchester, Director of the Center for the Study of Global Change, Indiana University—Bloomington, 9

N.Brian, Project Muse, “Emerging Global Governance”, Feb 2009, <http://muse.jhu.edu/journals/indiana_journal_of_global_legal_studies/v016/16.1.winchester.html>, CH

While environmental values have steadily gained widespread, even global, acceptance, they are often in conflict with economic interests and international politics. Environmentalism is further challenged by scientific uncertainty involving effects that will in some cases only become manifest far into the future. Nonetheless, accompanying this global environmental awakening has been an extraordinary number of international environmental agreements. It is these international regimes, involving a variety of non-state actors, which suggest movement toward an evolving, complex form of global environmental governance. "One idea now gaining political currency is to upgrade the U.N. Environment Programme into a World Environment Organization (WEO) on a par with the WTO,"61 but what is clear is that this is no longer a matter simply for states or intergovernmental organizations. Private firms, NGOs, subunits of governments, and the transitional and transgovernmental networks that result all play a role.62 Whatever the eventual global political dispensation, there is likely to be wider participation and more transparency and accountability, and that should please democrats everywhere. To forge a more coherent global environmental management policy, governments must be persuaded that their national self-interest is inextricably tied to the global common good and to act accordingly.

Lack of international co-op creates an enduring threat to humanity

Davidson, Department of Mechanical Engineering, University of Sierra Leone, 10

Ungandle, UNEP Risoe Centre, “Strategies to mitigate climate change in a sustainable development framework”, <http://uneprisoe.org/copenhagenconf/davidson.htm>, 12-27-10, CH

The consensus among scientists world-wide that global climate instability may occur if the current rate of greenhouse gas (GHG) emissions is not reduced is strong enough for taken national and international actions. This view has been confirmed by United Nations Intergovernmental Panel on Climate Change (IPCC,1992), and they have called for rapid and immediate actions. Continued GHG emissions on its current accumulated stock so increasing the concentration will result in warming of the earth leading to unprecedented rise in global temperatures. Despite the extent of this warming, its local, regional and global impacts are uncertain, the rapid actions called for by IPCC must be adhered to. These uncertainties which are mainly due to limited knowledge of the earth's absorptive capacity for GHG and the extent of possible feedbacks to the atmosphere are not enough to support in-action. Likely impacts of global warming such as sea level rise, changes in storm activity, in vegetation distribution and in agronomic conditions can be dangerous to human existence and trans-boundary in nature. The lifetime of GHG is very long, 50-200 years, hence this problem can persist for very long periods. All the more reason for actions to stabilize GHG emissions.

Low Space Leadership => Hostile Challengers

Perception of US decline in space exploration emboldens adversaries.

Dowd 2009

(Alan, senior fellow with the Fraser Institute, "Surrendering Outer Space." Hoover Institution at Stanford, August 3rd, 2009. <http://www.hoover.org/publications/policy-review/article/5421>) AV

Surrendering the ability to carry astronauts into space promises to be a blow to America’s international stature. And in this age of global connectivity and global competition, what may seem like a marginal matter could become a serious problem. We already live at a time America is perceived as a nation in decline. Pierre Hassner of the Paris-based National Foundation for Political Science recently concluded, “It will not be the New American Century.” A 2005 piece in the Guardian dismissed America as “the hollow superpower.” It’s no wonder that Obama addressed the “nagging fear” of America’s decline in his inauguration speech, and Bush dismissed “the belief that America is in decline” in his 2006 State of the Union address. What’s relevant here is how America’s self-imposed absence from space could fuel the declinist fire, weaken America’s standing, and enhance the position of America’s enemies. Again, history is instructive: When Sputnik rocketed into orbit and Moscow triumphed, Senator Henry Jackson called it “a national week of shame and danger.” America’s attempt to match Moscow only highlighted the gap between the two superpowers when, weeks after Sputnik, America’s answer, Vanguard, exploded on takeoff. Leebaert writes that Moscow’s initial space superiority was “alarming because it was far more visible than anything else in science and technology.” Combined with America’s futility, the situation negatively impacted the country’s prestige and security, “the two in those days being habitually linked.

Hegemony Good - War

Maintaining U.S. hegemony is key to preventing nuclear war

Khalilzad, former U.S. ambassador to Iraq and probably the most read author in debate, 95

(Zalmay, “Losing the Moment? The United States and the World After the Cold War,” Washington Quarterly, Spring 1995, p. lexis, JT)

Under the third option, the United States would seek to retain global leadership and to preclude the rise of a global rival or a return to multipolarity for the indefinite future. On balance, this is the best long-term guiding principle and vision. Such a vision is desirable not as an end in itself, but because a world in which the United States exercises leadership would have tremendous advantages. First, the global environment would be more open and more receptive to American values -- democracy, free markets, and the rule of law. Second, such a world would have a better chance of dealing cooperatively with the world's major problems, such as nuclear proliferation, threats of regional hegemony by renegade states, and low-level conflicts. Finally, U.S. leadership would help preclude the rise of another hostile global rival, enabling the United States and the world to avoid another global cold or hot war and all the attendant dangers, including a global nuclear exchange. U.S. leadership would therefore be more conducive to global stability than a bipolar or a multipolar balance of power system.

Hegemony Good - War (1/2)

Loss of American dominance creates multiple scenarios for nuclear war.

Kagan, sr. associate@Carnegie Endowment for Peace, 7

(Robert, “End of Dreams; Return of History,” 17 July 2007, Policy Review, No. 144, p. <http://www.hoover.org/publications/policy-review/article/6136#n10>, Accessed: 20 June 2011, JT)

The jostling for status and influence among these ambitious nations and would-be nations is a second defining feature of the new post-Cold War international system. Nationalism in all its forms is back, if it ever went away, and so is international competition for power, influence, honor, and status. American predominance prevents these rivalries from intensifying —  its regional as well as its global predominance. Were the United States to diminish its influence in the regions where it is currently the strongest power, the other nations would settle disputes as great and lesser powers have done in the past: sometimes through diplomacy and accommodation but often through confrontation and wars of varying scope, intensity, and destructiveness. One novel aspect of such a multipolar world is that most of these powers would possess nuclear weapons. That could make wars between them less likely, or it could simply make them more catastrophic. It is easy but also dangerous to underestimate the role the United States plays in providing a measure of stability in the world even as it also disrupts stability. For instance, the United States is the dominant naval power everywhere, such that other nations cannot compete with it even in their home waters. They either happily or grudgingly allow the United States Navy to be the guarantor of international waterways and trade routes, of international access to markets and raw materials such as oil. Even when the United States engages in a war, it is able to play its role as guardian of the waterways. In a more genuinely multipolar world, however, it would not. Nations would compete for naval dominance at least in their own regions and possibly beyond. Conflict between nations would involve struggles on the oceans as well as on land. Armed embargos, of the kind used in World War i and other major conflicts, would disrupt trade flows in a way that is now impossible. Such order as exists in the world rests not merely on the goodwill of peoples but on a foundation provided by American power. Even the European Union, that great geopolitical miracle, owes its founding to American power, for without it the European nations after World War ii would never have felt secure enough to reintegrate Germany. Most Europeans recoil at the thought, but even today Europe ’s stability depends on the guarantee, however distant and one hopes unnecessary, that the United States could step in to check any dangerous development on the continent. In a genuinely multipolar world, that would not be possible without renewing the danger of world war. People who believe greater equality among nations would be preferable to the present American predominance often succumb to a basic logical fallacy. They believe the order the world enjoys today exists independently of American power. They imagine that in a world where American power was diminished, the aspects of international order that they like would remain in place. But that ’s not the way it works. International order does not rest on ideas and institutions. It is shaped by configurations of power. The international order we know today reflects the distribution of power in the world since World War ii, and especially since the end of the Cold War. A different configuration of power, a multipolar world in which the poles were Russia, China, the United States, India, and Europe, would produce its own kind of order, with different rules and norms reflecting the interests of the powerful states that would have a hand in shaping it. Would that international order be an improvement? Perhaps for Beijing and Moscow it would. But it is doubtful that it would suit the tastes of enlightenment liberals in the United States and Europe. The current order, of course, is not only far from perfect but also offers no guarantee against major conflict among the world ’s great powers. Even under the umbrella of unipolarity, regional conflicts involving the large powers may erupt. War could erupt between China and Taiwan and draw in both the United States and Japan. War could erupt between Russia and Georgia, forcing the United States and its European allies to decide whether to intervene or suffer the consequences of a Russian victory. Conflict between India and Pakistan remains possible, as does conflict between Iran and Israel or other Middle Eastern states. These, too, could draw in other great powers, including the United States. Such conflicts may be unavoidable no matter what policies the United States pursues. But they are more likely to erupt if the United States weakens or withdraws from its positions of regional dominance. This is especially true in East Asia, where most nations agree that a reliable American power has a stabilizing and pacific effect on the region. That is certainly the view of most of China ’s neighbors. But even China, which seeks gradually to supplant the United States as the dominant power in the region, faces the dilemma that an American withdrawal could unleash an ambitious, independent, nationalist Japan. In Europe, too, the departure of the United States from the scene — even if it remained the world’s most powerful nation — could be destabilizing. It could tempt Russia to an even more overbearing and potentially forceful approach to unruly nations on its periphery.

[Kagan Continued on next page…]

Hegemony Good - War (2/2)

[Kagan continued…no text removed]

Although some realist theorists seem to imagine that the disappearance of the Soviet Union put an end to the possibility of confrontation between Russia and the West, and therefore  to the need for a permanent American role in Europe, history suggests that conflicts in Europe involving Russia are possible even without Soviet communism. If the United States withdrew from Europe — if it adopted what some call a strategy of “offshore balancing” — this could in time increase the likelihood of conflict involving Russia and its near neighbors, which could in turn draw the United States back in under unfavorable circumstances. It is also optimistic to imagine that a retrenchment of the American position in the Middle East and the assumption of a more passive, “offshore” role would lead to greater stability there. The vital interest the United States has in access to oil and the role it plays in keeping access open to other nations in Europe and Asia make it unlikely that American leaders could or would stand back and hope for the best while the powers in the region battle it out. Nor would a more “even-handed” policy toward Israel, which some see as the magic key to unlocking peace, stability, and comity in the Middle East, obviate the need to come to Israel ’s aid if its security became threatened. That commitment, paired with the American commitment to protect strategic oil supplies for most of the world, practically ensures a heavy American military presence in the region, both on the seas and on the ground. The subtraction of American power from any region would not end conflict but would simply change the equation. In the Middle East, competition for influence among powers both inside and outside the region has raged for at least two centuries. The rise of Islamic fundamentalism doesn ’t change this. It only adds a new and more threatening dimension to the competition, which neither a sudden end to the conflict between Israel and the Palestinians nor an immediate American withdrawal from Iraq would change. The alternative to American predominance in the region is not balance and peace. It is further competition. The region and the states within it remain relatively weak. A diminution of American influence would not be followed by a diminution of other external influences. One could expect deeper involvement by both China and Russia, if only to secure their interests. [18](http://www.hoover.org/publications/policy-review/article/6136%22%20%5Cl%20%22n18) And one could also expect the more powerful states of the region, particularly Iran, to expand and fill the vacuum. It is doubtful that any American administration would voluntarily take actions that could shift the balance of power in the Middle East further toward Russia, China, or Iran. The world hasn ’t changed that much. An American withdrawal from Iraq will not return things to “normal” or to a new kind of stability in the region. It will produce a new instability, one likely to draw the United States back in again. The alternative to American regional predominance in the Middle East and elsewhere is not a new regional stability. In an era of burgeoning nationalism, the future is likely to be one of intensified competition among nations and nationalist movements. Difficult as it may be to extend American predominance into the future, no one should imagine that a reduction of American power or a retraction of American influence and global involvement will provide an easier path.

Hegemony Good – War

United States Hegemony is key to preventing power wars.

Brooks and Wohlforth, Brooks is assistant prof. government@Dartmouth and Wohlforth is associate prof. government@Darthmouth, 2

(Stephen and William, “American Primacy in Perspective,” *Foreign Policy*, 81(4), p. ebsco, JT)

Two of the prime causes of past great-power conflicts -- hegemonic rivalry and misperception -- are thus not currently operative in world politics. At the dawn of the twentieth century, a militarily powerful Germany challenged the United Kingdom's claim to leadership. The result was World War I. In the middle of the twentieth century, American leadership seemed under challenge by a militarily and ideologically strong Soviet Union. The result was the Cold War. U.S. dominance today militates against a comparable challenge, however, and hence against a comparable global conflict. Because the United States is too powerful to balance, moreover, there is far less danger of war emerging from the misperceptions, miscalculations, arms races, and so forth that have traditionally plagued balancing attempts. Pundits often lament the absence of a post-Cold War Bismarck. Luckily, as long as unipolarity lasts, there is no need for one.

U.S. hegemony deters all great power wars

Walt, IR@Harvard, 2

(Stephen, “American Primacy: Its Prospects and Pitfalls,” Naval War College Review, Spring 2002, LV(2), <http://belfercenter.ksg.harvard.edu/files/american_primacy_prospects_pitfalls.pdf>, p. 12-13, JT)

A second consequence of U.S. primacy is a decreased danger of great-power rivalry and a higher level of overall international tranquility. Ironically, those who argue that primacy is no longer important, because the danger of war is slight, overlook the fact that the extent of American primacy is one of the main reasons why the risk of great-power war is as low as it is. For most of the past four centuries, relations among the major powers have been intensely competitive, often punctuated by major wars and occasionally by all-out struggles for hegemony. In the first half of the twentieth century, for example, great-power wars killed over eighty million people. Today, however, the dominant position of the United States places significant limits on the possibility of great-power competition, for at least two reasons. One reason is that because the United States is currently so far ahead, other major powers are not inclined to challenge its dominant position. Not only is there no possibility of a “hegemonic war” (because there is no potential hegemon to mount a challenge), but the risk of war via miscalculation is reduced by the overwhelming gap between the United States and the other major powers. Miscalculation is more likely to lead to war when the balance of power is fairly even, because in this situation both sides can convince themselves that they might be able to win. When the balance of power is heavily skewed, however, the leading state does not need to go to war and weaker states dare not try.

Hegemony Good – Economy

American primacy is key to economic growth

Walt, IR@Harvard, 2

(Stephen, “American Primacy: Its Prospects and Pitfalls,” Naval War College Review, Spring 2002, LV(2), <http://belfercenter.ksg.harvard.edu/files/american_primacy_prospects_pitfalls.pdf>, p. 13-14, JT)

By facilitating the development of a more open and liberal world economy, American primacy also fosters global prosperity. Economic interdependence is often said to be a cause of world peace, but it is more accurate to say that peace encourages interdependence—by making it easier for states to accept the potential vulnerabilities of extensive international intercourse. 10 Investors are more willing to send money abroad when the danger of war is remote, and states worry less about being dependent on others when they are not concerned that these connections might be severed. When states are relatively secure, they will also be less fixated on how the gains from cooperation are distributed. In particular, they are less likely to worry that extensive cooperation will benefit others more and thereby place them at a relative disadvantage over time. 11 By providing a tranquil international environment, in short, U.S. primacy has created political conditions that are conducive to expanding global trade and investment. Indeed, American primacy was a prerequisite for the creation and gradual expansion of the European Union, which is often touted as a triumph of economic self-interest over historical rivalries. Because the United States was there to protect the Europeans from the Soviet Union and from each other, they could safely ignore the balance of power within Western Europe and concentrate on expanding their overall level of economic integration. The expansion of world trade has been a major source of increased global prosperity, and U.S. primacy is one of the central pillars upon which that system rests. 12 The United States also played a leading role in establishing the various institutions that regulate and manage the world economy. As a number of commentators have noted, the current era of “globalization” is itself partly an artifact of American power. As Thomas Friedman puts it, “Without America on duty, there will be no America Online.”

\*\*\*Solvency\*\*\*

Solvency [One- Way, Tech. Feasibility, Cost, more]

One-way to Mars is cheap, quick, survivable, technologically feasible, and key to stopping extinction of the human race.

Geranios ’10 (Nicholas, MSNBC, 11/15/2010, “Scientists propose one-way trips to Mars”, http://www.msnbc.msn.com/id/40194872/ns/technology\_and\_science-space/t/scientists-propose-one-way-trips-mars/) SW

Invoking the spirit of "Star Trek" in a scholarly article entitled "To Boldly Go," two scientists contend human travel to Mars could happen much more quickly and cheaply if the missions are made one-way. They argue that it would be little different from early settlers to North America, who left Europe with little expectation of return. "The main point is to get Mars exploration moving," said Dirk Schulze-Makuch of Washington State University, who wrote the article in the latest "Journal of Cosmology" with Paul Davies of Arizona State University. The colleagues state — in one of 55 articles in the issue devoted to exploring Mars — that humans must begin colonizing another planet as a hedge against a catastrophe on Earth. 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."

Solvency

A colony on Mars is technologically, financially, and humanly possible because of resources and one-way trip

Ferri 10 (Alex, October 28, statepress.com, “One-way ticket Mars mission possible professor,” http://www.statepress.com/2010/10/28/one-way-ticket-makes-mars-mission-possible-says-professor/) KA

The road to Mars is a one-way street, says an ASU professor. In a paper published in the latest edition of the Journal of Cosmology, professor Paul Davies along with Washington State University professor Dirk Schulze-Makuch advocated for a manned, one-way mission to colonize the red planet. Davies is the director of ASU’s Beyond Center for Fundamental Concepts in Science. For the paper, he collaborated with Schulze-Makuch primarily through e-mail over the past six months. It is the first scientific paper published on the topic, although Davies wrote an article about it for The New York Times in 2005. “It has long been a dream of humanity to go to Mars,” Davies said. While a manned mission to Mars is technologically feasible, it would be astronomically expensive, Davies said. However, Schulze-Makuch said most of the expense associated with a trip to Mars comes from the effort to bring the astronauts safely home, which means a one-way trip would be significantly less costly. “It would reduce the cost by 80 percent,” Schulze-Makuch said. He added that the cost would still be approximately $50 billion. While that would still be very expensive, Davies said, the money could be gathered over a number of years from various sources, possibly including private donors. The proposed trip would send two to four astronauts to the red planet where they would establish a small colony, Davies said. He added that supplies, such as a nuclear reactor, food, solar panels and instruments, would be sent to Mars prior to their arrival. After landing, the astronauts would become largely self sufficient without many additional supplies being sent because of cost concerns, Davies said. The astronauts would be supplied with the means to gather water from deposits beneath Mars’ surface and purify it for drinking, Schulze-Makuch said. He added that the colonists would also be able to gather oxygen from the water, since water is composed of hydrogen and oxygen gas. Astronauts would volunteer for the mission with the knowledge that they might never return to Earth, and that their life expectancy on Mars might only be 10 years, due to the effects of space radiation and the general rigors of life on another planet, Davies said. “They would not be abandoned,” Schulze-Makuch said. He added that the colonizers would be in constant contact with Earth through radio transmissions. Mars was chosen for colonization over the moon because it has more Earth-like qualities than the moon — temperatures on Mars reach as high as 68 degrees Fahrenheit. Mars also has more abundant natural resources, Schulze-Makuch said. The project would look for astronauts advanced in age, possibly near 60, since their change in life expectancy would not be as drastic, Davies said. They would still be required to be in excellent shape to participate. Even with the knowledge that they might never return, Davies believes there would be no shortage of volunteers. “There are lots of people who take crazy risks on Earth,” Davies said. He added that he believes the same spirit that drives people to go river rafting, sky diving and rock climbing would also drive them to explore the red planet. “They would be the founders of a new planet,” he said. “Think of the adventure.” Davies said he’s received much interest in the project from people of all ages. Kelsey Young, a second-year doctorate student studying planetary field geology, is wary of the psychological effects of the proposed journey. She spent one week living confined in a space rover with just one other person through NASA’s Desert Research and Technology Studies program. Teams of two participate in the simulation program and drive around the Arizona desert, living in space exploration vehicles for a week to two weeks at a time, Young said. “Will the astronauts be effective commanders and pilots?” she said. “No one knows for sure.” Despite her concerns, Young said she would consider making the trek herself, citing humankind’s natural spirit of exploration. “If they offered me the chance, I would probably take it,” she said. Sending additional astronauts to Mars after a colony has been established is also a possibility, Davies said. At this stage, the proposal is just that: a plan for a possible trip to Mars. “At the end of the day, it’s about where the money is,” Davies said. “But a two-way trip will never happen.” Earth is vulnerable, Schulze-Makuch said, and if there were a catastrophic event, having a Mars colony could be useful far in the future. “If we want to survive long- term, we have to expand to other places, and Mars is a logical stepping stone,” Schulze-Makuch said. “We’re getting one step closer to Star Trek.”

Solvency

One way mission technically feasible now, and solves extinction

Discovery News 10 (November 1, Journeying to Mars—On a One Way Ticket <http://news.discovery.com/space/human-space-settlement-mars.html>) NS 5/26/11

Scientists Dirk Schulze-Makuch and Paul Davies figure that sending astronauts -- particularly ones past their reproductive years -- on one-way journeys to Mars is the most economical way to pioneer the space frontier and establish humans as a multi-planet species. "This is not a suicide mission. The astronauts would go to Mars with the intention of staying for the rest of their lives, as trailblazers of a permanent human Mars colony," Schultz-Makuch, with Washington State University, and Davies, at Arizona State, write in this month's Journal of Cosmology. "Their role would be to establish a base camp to which more colonists would eventually be sent, and to carry out important scientific and technological projects," the scientists wrote. Because of the harsh radioactive environment in space, the authors propose people in in their mid-50s or 60s would be the right age to go, Schultz-Makuch told Discovery News. The lifestyle would be tough, but the authors figure the space pioneers would have about a decade to work on a settlement. The mission would begin with robotic ships, stocked with about two year's worth of food, agricultural kits and tools. The robots' first job would be to get some power flowing, most likely a small nuclear reactor, supplemented with solar energy. A steady stream of freighters would keep the outpost resupplied until it was able to become self-sufficient, Schultz-Makuch added. The scientists suggest an initial group of four people be sent to Mars, and had no recommendations about gender. "I suppose two men and two women would be good," Schultz-Makuch said. The plan would cut sharply cut the cost of a human mission to Mars -- the authors estimate not needing fuel and supplies for a return trip to Earth could save about 80 percent -- while paving the way for future colonization. An outpost on Mars (eventually colonized by younger people) would also be a way to preserve the human species should an asteroid impact or some other disaster wipe out life on Earth, they point out. "There are many reasons why a human colony on Mars is a desirable goal, scientifically and politically. The strategy of one-way missions brings this goal within technological and financial feasibility," the scientists wrote. The plan is likely to raise some ethical issues, but the scientists said sending people to live on Mars "would really be little different from the first white settlers of the North American continent, who left Europe with little expectation of return."

A one-way mission would cost less than $10 billion and take four months

Firth, Science Editor at Daily Mail, 10

Niall, The UK Daily Mail, “The Hundred Year Starship: The Nasa mission that will take astronauts to Mars and leave them there forever”, 10-29-10, http://www.dailymail.co.uk/sciencetech/article-1324192/Hundred-Year-Starship-Mars-mission-leave-astronauts-planet-forever.html, CH

Worden said he has discussed the potential price tag for one-way trips to Mars with Google co-founder Larry Page, telling him such a mission could be done for $10 billion. He said: ‘His response was, “Can you get it down to $1 [billion] or $2billion?” So now we're starting to get a little argument over the price.’ Depending on the position of Mars in its orbit around the sun, its distance from Earth varies between 34million and 250million miles. The most recent unmanned mission there was Nasa’s Phoenix lander, which launched in August 2007 and landed on the planet’s north polar cap in May the following year. Experts say a nuclear-fuelled rocket could shorten the journey to about four months. Of all the planets in the solar system, Mars is the most likely to have substantial quantities of water, making it the best bet for sustaining life. But it is a forbidding place to set up home.

Only a One-Way Trip

One-way is the only way: It’s cheaper, faster, cements scientific leadership, and is safer.

Tyson ’10 (Peter, 11/4/10, PBS Nova,“A One Way Trip To Mars?”, http://www.pbs.org/wgbh/nova/space/human-mars-mission.html) SW

A One-Way Trip to Mars? By Peter TysonPosted 11.04.10NOVA Initial shock aside, some space scientists argue this is the only way to go. "...I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the Earth." —President Kennedy, in a speech to Congress, May 25, 1961 These words of Kennedy's, arguably the most famous ever uttered about space exploration, have been on my mind lately. Not because last year marked the 40th anniversary of the magnificent achievement of Kennedy's goal. Nor because Congress, at President Obama's request, just canceled NASA's plans to return to the moon. No, it's that phrase "returning him safely to the Earth" that I've been ruminating over—in relation to Mars. Most experts agree that, because of the astronomical cost, which one expert put in the hundreds of billions of dollars, landing a man on Mars and returning him safely to the Earth is not going to happen anytime soon, much less, if we decided now, before the decade is out. But what if we didn't return him safely to the Earth? What if we gave the first astronauts dispatched to land on Mars a one-way ticket? Some experts feel the only way we'll get people on Mars in the near future, rather than just robots as with the Viking landers (seen here on a 1970s postage stamp), is to contemplate a human mission that is not round-trip. "People who have never heard about this say, 'That is absolutely crazy,'" former NASA engineer Jim McLane, a leading advocate of the idea, told me. "And then after they think about it a little bit, they say, 'Well, maybe that would work.'" In fact, a number of space scientists, aerospace engineers, and astronauts have supported the notion. Their reasoning might convince you. Or not. NOT A SUICIDE MISSION Proponents wish to get one thing straight. "Most people misunderstand and think that we're talking about a suicide mission," says Paul Davies, a physicist at Arizona State University and one of the strongest voices stumping for one-way. "You know, we'll transport you there, you've got supplies for a week or something, and then you just slowly die. And that all seems grotesque. But, of course, that's not what we're talking about. We're talking about: You'll live out the rest of your days on Mars in discomfort but excitement." "I just think we're not going to do it—simply for reasons of cost—without making it a one-way mission." Even calling it a one-way mission rubs some advocates the wrong way. "I wish you wouldn't call it that," Buzz Aldrin told me as soon as we got on the phone recently. "At first glance, it's a turnoff. I think we should call it 'establishing human permanent presence at Mars.'" "In other words, a one-way mission means a colonization mission," says Robert Zubrin, an aerospace engineer and codesigner of a well-regarded plan for a human mission called Mars Direct. "It's Plymouth Rock. You keep on reinforcing them with more people, more equipment, more of everything until you have a substantial settlement." Plenty of historical precedent exists for one-way, colonizing missions, advocates say—from the ancient, seafaring Polynesians who discovered Hawaii, to the Pilgrims who arrived in the New World in 1620 set to stay. In Zubrin's vision, following several robotic missions to deliver equipment and supplies, the initial astronauts would set up an embryonic colony—a basic habitat with greenhouses, water supplies, power systems. Every two years—the launch window for trips to Mars—more astronauts would arrive to join and resupply them. "By mission number five, you're sending teachers and pediatricians, because this thing is turning from a field outpost into a human settlement," Zubrin says. Eventually, in the best of all possible new worlds, the colony would become self-sufficient, no longer needing any help from Mother Earth. CHEAPER Permanent colony or not, what advantages does one-way have over round-trip, according to supporters? Above all, it's not nearly as pricey as two-way. "I would say three or four times as expensive to provide return capability," Aldrin says. Chris Kraft, the legendary NASA flight director, has estimated 10 times more costly, Aldrin told me. Much of that expense would lie in launching to Mars a return spacecraft and all the propellant needed for the months-long flight back to Earth. Even if the fuel could be manufactured on Mars—a key component of Zubrin's Mars Direct scheme—the cost would be much greater than if the crew just stayed put, backers contend. "You could say the cost-benefit of a Mars exploration program would be measured by, say, person-days on Mars divided by ton launched into Earth orbit," Zubrin says. "Well, if they stay on Mars, it's going to get a lot more person-days. Instead of staying for a year and a half, they stay for the rest of their lives." FASTER More affordably means sooner, endorsers say. McLane insists that one-way is the only approach that offers the chance that we in the current generation could see it happen. Davies agrees: "I just think we're not going to do it—simply for reasons of cost—without making it a one-way mission." Even in 50 years, Davies suspects, neither the financial nor the political wherewithal will exist to send astronauts to Mars to poke around for a short time and then whisk them home again, as we did with the Apollo astronauts. By 2012, Russia expects to launch a robotic mission to the Mars moon Phobos (seen here in an artist's depiction on a Hungarian stamp). Such missions worry Aldrin, for one, who fears the United States might start falling behind in space exploration. Aldrin worries that if the U.S. doesn't act soon, other countries may end up putting people on the Red Planet sooner than we do. In 2011, Russia plans to send a sample-collecting mission to Phobos, one of the moons of Mars (and, in Aldrin's opinion, the ideal staging point for a colonization of the planet). The so-called Phobos-Grunt mission includes a Chinese satellite. "If we don't shape up what we're doing," Aldrin told me, "we're going to find the Russians clearly leading missions to Mars." SAFER One-way would actually be safer for the astronauts than round-trip, Zubrin maintains. "All of the risk associated with the return flight—taking off from Mars, interplanetary flight, then entering [our atmosphere] and landing on Earth—are no longer in the mission," he says. "I think people would be standing in line to do this." The interplanetary-flight part includes prolonged exposure to zero gravity, cosmic radiation, and perhaps solar flares. Doubling these impacts, proponents stress, could leave returning astronauts more susceptible to contracting cancer or other illnesses down the road than if they'd remained in secure habitats on Mars. DOABLE NOW Another advantage is we could achieve a one-way mission with current know-how, enthusiasts assert. We'd have to develop a sufficiently large launcher, but we wouldn't have to clear any great technological hurdles, Davies says. The same can't be said about round-trip, some argue, including launching off Mars. As McLane wrote in a 2006 paper, "Return to Earth from the Martian surface is a daunting technical problem for which current technology offers no obvious solution." Zubrin thinks that, from a technical standpoint, we are actually much closer today to being able to send humans to Mars than we were to sending men to the moon in 1961, and we were there only eight years later. When I asked him if we should, to paraphrase Kennedy, go to Mars in this decade, he said, "I think that's exactly what we should do." Just six and a half decades separated the first powered flight at Kitty Hawk in 1903 from the first moon landing in 1969. Could a similar stretch of time separate the first moon walk from the first permanent base on Mars? Aldrin, while agreeing that we have "quite a good idea of how to do it," envisions a longer timeframe, more on the order of three decades. "It was 66 years from the Wright Brothers at Kitty Hawk to landing at Tranquility Base," he says, referring to the Apollo 11 landing site. Seventy years from that landing to establishing the beginnings of a permanent settlement on Mars sounds about right, he told me. But we should start now, he says, by proclaiming a "global space doctrine" on the 50th anniversary of Kennedy's speech in 2011, with a Mars colonization mission as its chief element. VOLUNTEERS APLENTY Even if we committed ourselves to achieving the goal, to borrow Kennedy's words, who would go on such a lopsided mission? Would there be any takers? Aldrin believes that, for the chance to settle on Mars, there would be no shortage of volunteers among the astronaut corps. Davies says he has found the same at lectures he's given on the subject, where he typically asks who would like to sign up. "You'd think nobody would put their hand up, but it's surprising how many people do," he told me. Scientists, too, are intrigued. Davies recalls discussing the concept a number of years ago with Martin Rees, President of the Royal Society and England's Astronomer Royal, and Rees said he himself would volunteer. "I think people would be standing in line to do this," Jim McLane says. "They would be more than heroes—they'd be like Adam and Eve in the Bible. They would become legend." "I think what people are not keeping in mind is what a truly horrible place Mars is." Just think, supporters say: The first martians would be instantly renowned. The very fact that he, she, or they wouldn't return would keep people around the world riveted by their story—the ultimate reality show. The pioneers would be on the greatest journey of exploration ever undertaken, a trip that might make Columbus's voyages feel strictly local. Every step on Mars would be the first ever taken there, something that can no longer be said for virtually anywhere on our "initial" planet. They would do groundbreaking science from the get-go, making discoveries of the caliber that entire careers are made of back on Earth. Who knows? They might even uncover that holy grail of exobiologists—life beyond our world—a find that most would hail as one of the most significant in history. Compared to human exploratory missions to Mars, which is about 35 million miles away at its closest approach to Earth, Columbus's forays might seem almost provincial. "There will always be people who want to have an opportunity to take part in the creation of something grand and new, to be the creators of their own civilization, not just the inhabitants of one that already exists," Zubrin says. "This would give them that chance." Davies thinks such a mission would serve as a valuable unifying influence for humanity at a difficult time in the 21st century. "A mission like this, I think, would be a wonderful emblem for all of mankind," he says, "something for us to all get behind as a sort of joint project for everybody." WHOA... All the glorifying aside, what would settling on Mars actually be like for those who did it? I turned to a man who knows as much as anyone can about that subject—Steve Squyres, the Cornell planetary scientist in charge of the Mars rovers, which have now spent over six years exploring the surface. "I think what people are not keeping in mind is what a truly horrible place Mars is," Squyres told me. "And you're hearing this from a guy who loves Mars and has devoted his career to trying to explore the place. It's horrifyingly cold. It's dusty. It's bleak. It's barren. It's desolate. And it's incredibly far from home." In short, he takes "a very skeptical view of the whole Mars colonization thing." Steve Squyres sees Antarctica's research stations, which scientists and support staff visit only temporarily before returning to warmer continents, as models for human stations on Mars. One-way may even be more difficult and more expensive than two, Squyres says. "If you're talking about colonization in the sense that we're establishing a true permanent outpost of civilization on another world, that's a lot harder than a round trip," he says. "The amount of infrastructure, the amount of support that you have to put in place on the surface to sustain people indefinitely, I think may be prohibitively expensive." Altogether, he feels a one-way mission is "totally unrealistic." Squyres is not against humans going to Mars, nor does he think robots can do as good a job. On the contrary. "The science you can do with robots pales in comparison to what human explorers can do," he says. "I mean, what Spirit and Opportunity have done in six and a half years on Mars, you and I could have done in a good week or 10 days. But you don't need to make them live the rest of their lives and raise their children there in order for them to do the science." For his part, Squyres suspects that eventually we may do with Mars what we've done with Antarctica—establish permanent bases where scientists can go and do research, then rotate out and come home. "You have to say, 'Look, we're going to Mars in eight years. Let's figure out how to do this.'" In the end, if there's one thing on which everyone, backers and detractors alike, would agree, it's what a hard sell one-way would be politically. McLane remembers about 10 years ago asking the speaker at a NASA presentation whether the agency was studying one-way missions. "He laughed at me, and ridiculed me, for even suggesting such a thing," McLane says. NASA has never forgotten Kennedy's insistence, in that 1961 speech, on the "one purpose which this nation will never overlook: the survival of the man who first makes this daring flight." Putting men on the moon took a presidential giant leap. Putting humans on Mars might require the same, Zubrin and others contend. Enlarge THE ONLY WAY Ironically, only one step might sway NASA, and perhaps Congress and the American people, to consider one-way: a decision from the top a la Kennedy's of four decades ago. "Every NASA mission design [for Mars] I've ever seen has been a two-way mission, but if there was presidential leadership that redesigned it as a colonization effort, then NASA certainly would do that," Zubrin says. "Really, the way you have to do this is you have to say, 'Look, we're going to Mars in eight years. Let's figure out how to do this.'" Kennedy himself might have applauded the notion—all save that part about not returning the astronauts safely to the Earth.

Solvency

One-way mission ensures human survival but avoids threat of program and funding cuts

Gott, Professor of astrophysical sciences at Princeton, 97

J. Richard, New Scientist, “A Grim Reckoning”, 11-15-97, http://pthbb.org/manual/services/grim/, CH

This a pretty grim reckoning, but we can see where our chances lie. If we plant self-supporting colonies in the Solar System, we will have an insurance policy against catastrophe. If something happens to us on Earth, some colonists night even eventually return and repopulate it. But we had better move quickly because the Copernican principle also implies that we may not have the capacity for space travel for very long. In my 1993 *Nature* paper I estimated how long the human space programme, then 32 years old, would last. Since my paper was not likely to fall either in the first 2.5 percent or the last 2.5 per cent of the programme, I predicted with 95 per cent confidence that its future duration would be more than 10 months but less than 1248 years. The upper limit of 1248 years is the total number of future years of human space flight, regardless of how many periods of inactivity occur. You might argue that here is no hurry to colonise space within the next century. Why not wait a few centuries until technology has become so advanced that colonising becomes easy? But if we lose the capacity for spaceflight before we've colonised--by the collapse of civilisation, loss of technology or diminished economic ability--then we've missed our chance. It's good that we went to the Moon in the 1960s. If we'd waited another 30 years hoping for an easier time of it, we might never have made it, as we now seem to have less money for such ventures. [Inset 2](http://pthbb.org/manual/services/grim/#in2) Unfortunately, I believe that we are likely to make precisely this kind of mistake. In 1969, Wernher von Braun had plans to send astronauts to send astronauts to Mars by 1982; in 1989 George Bush proposed sending people there by 2019. This is an unfortunate trend, and I'm worried that the day may come when there is no one left alive who can say "I walked on the Moon". People who realise that colonising the Galaxy would be very beneficial to our survival have generally regarded such as inevitable. But it is not. Since you are still on your home planet, the Copernican principle tells you that a significant fraction of all intelligent observers must also still be on their home planets (otherwise you would be special). This explains why we have not been colonised by extraterrestrials--a significant fraction of them are still sitting at home. I would be more confident about the future if we were members of a billion-year-old civilisation which had already colonised is galaxy. But our chance of colonising the entire Galaxy, increasing our current population by about a factor of a billion, is about one in a billion. Why? Because it would mean that you were born within the first billionth of all humans, which is exceedingly unlikely (my colleagues Brandon Carter, John Leslie and Holgar Nielson have reached similar conclusions). The fraction of all civiliastions that achieve galactic colonisation is likely to be small --otherwise, you would likely be living in such a civilisation now. But that doesn't mean that we can't at least get off the planet and plant some colonies that will greatly enhance our survival chances. Colonisation, starting with Mars, should be our first goal. Space experiments could be geared towards making this possible. And if colonisation were the goal you would not have to bring the astronauts back from Mars--after all, that is where we want them. Instead, we could equip them to stay ("Escape from Mars", *New Scientist*, 28 June, p 24) and establish a colony at the outset--a good strategy if one is worried that funding for the space programme may not last.

Other missions get Cut

NASA’s agenda is dependent on the budget – major missions will be cut.

Overbye, New York Times, 6

(Dennis, “Budget Cuts Back Much-Promoted NASA Missions,” 2 March 2006, p. <http://www.nytimes.com/2006/03/02/science/space/02nasa.html>, JT)

Some of the most highly promoted missions on NASA's scientific agenda would be postponed indefinitely or perhaps even canceled under the agency's new budget, despite its administrator's vow to Congress six months ago that not "one thin dime" would be taken from space science to pay for President Bush's plan to send astronauts to the Moon and Mars. The cuts come to $3 billion over the next five years, even as NASA's overall spending grows by 3.2 percent this year, to $16.8 billion. Among the casualties in the budget, released last month, are efforts to look for habitable planets and perhaps life elsewhere in the galaxy, an investigation of the dark energy that seems to be ripping the universe apart, bringing a sample of Mars back to Earth and exploring for life under the ice of Jupiter's moon Europa — as well as numerous smaller programs and individual research projects that astronomers say are the wellsprings of new science and new scientists.

NASA is politically motivated and doesn’t stay committed to policies

Heritage Foundation, 99

(“NASA Needs Course Correction to Revive U.S. Space Program, Analyst Says,” 27 August 2011, p. <http://www.heritage.org/Research/Reports/1999/08/NASA-Needs-Course-Correction-to-Revive-US-Space-Program-Analyst-Says>, JT)

WASHINGTON, AUG. 27, 1999-Thirty years after Apollo 11 carried the first astronauts to the Moon, NASA has drifted far from the course charted by space pioneers of lunar bases, manned flights to Mars and space tourism. As Congress prepares to reauthorize funding for NASA, critics ask: Can the promise of space exploration be restored? It can, but Congress needs to take steps aimed at creating "a more coherent space policy" for the United States, says a new paper from The Heritage Foundation. According to policy analyst Bryan T. Johnson, these steps include: Refocusing NASA's priorities. In the 1960s, the agency succeeded in part because it had one goal: Beating the Soviets to the Moon. Today, NASA has all but abandoned space exploration in favor of "politically motivated" missions, such as studying the Earth's climate, building advanced airplanes and subsidizing Russia's role in the International Space Station. These activities drain much-needed funds and can be easily handled by other government agencies, Johnson says. Requiring NASA to pursue fully reusable rockets. The rockets used to launch payloads into space today resemble the Saturn V rockets used by the Apollo astronauts: Each can be used only once, making launch costs prohibitively high. These costs must be brought under control before NASA can revive its mandate to explore space, Johnson writes. The Space Shuttle is partially reusable but remains too expensive. Congress should direct NASA to build a fully reusable rocket based on designs the agency has already developed.

Other missions Get Cut

Political opposition and skepticism will kill other major exploration policies

Dittmar, senior consultant@Dittmar associates, 4

(Mary, “The Politics of Space Economics”, <http://dittmar-associates.com/Publications/The%20Politics%20of%20Space%20Economics.pdf>, p. 1, accessed: 21 June 2011, JT)

THE Vision for Space Exploration proposed by President Bush in January 2004 calls for humans to return to the Moon, establish a presence there, and use the capabilities developed on the lunar surface as a stepping-off point for further exploration of the Solar System, with Mars as the initial destination. Specific milestones include the launch of robotic missions to the lunar surface by 2008, human arrival on the Moon between 2015 and 2020, and the execution of a human Mars mission sometime thereafter. As noted in NASA’s roadmap for the Vision for Space Exploration (VSE) published in February 2004 1 , a number of technical and programmatic challenges are inherent in such a far-flung enterprise. None is more critical in both the short and long-term than the question of sustainability. Succinctly put, how can a program of the Vision’s size and scope be promoted, funded, developed, matured and maintained over a time span of 30 to 40 years, at minimum? To date, the answer is not forthcoming. In the United States, the VSE has engendered a good deal of political skepticism from a Congress that is apparently not yet convinced of NASA’s ability to manage a program of such duration and complexity. Political debate will and should continue. However, unless a majority political coalition of some type can be forged, the Vision may die in Congress. No single argument or approach is likely to succeed. A well-planned approach that is flexible enough over time to respond to changes in the political and economic environment is needed.

Other missions Get Cut

Politics and funding restrictions ensures that other methods of exploration are killed.

Carreau, The Houston Chronicle, 8

(Mark, “Is NASA able to take that next giant leap?; Political brawls ahead on funding and whether to go to moon or Mars,” 16 March 2008, p. 1, LexisNexis, JT)

Four years ago, in the aftermath of the shuttle Columbia disaster, [President Bush](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12206809458&returnToId=20_T12206817803&csi=8380&A=0.902279682889786&sourceCSI=9369&indexTerm=%23PE0009XP1%23&searchTerm=President%20Bush%20&indexType=P) triumphantly unveiled a sweeping plan to return American astronauts to the moon by 2020 and eventually to more distant destinations where no human has explored before. But as Bush's term draws to an end, NASA faces one of the greatest challenges in its 50-year history. As it prepares to retire the space shuttle in two years and launch a new moonship by 2015, the space agency finds itself hobbled by chronic underfunding, presidential politics and a new debate in the scientific community over whether explorers should aim for Mars instead of the moon. "There is value in going back to the moon as an outpost, as a research area," said former astronaut Kathy Thornton, a University of Virginia engineering professor who helped host an invitation-only forum at Stanford University regarding the agency's direction. But "we ought to move on (to Mars) and not get bogged down (on the moon) for all eternity." The cost of the Bush venture is steep: an estimated $230 billion over the next two decades, according to the Government Accountability Office, the congressional audit agency. And the space agency faces a personnel shake-up as well when the last of a dozen remaining shuttle missions concludes and the program's $3.2 billion annual budget is shifted to the development of the new moonship - the Orion crew capsule and its Ares I and Ares V rockets. About 17,200 workers employed in the shuttle program in Houston, Huntsville, Ala., and Cape Canaveral, Fla., or about 20 percent of NASA's entire federal and contractor work force, will see their jobs come to an end, forcing layoffs or retirements for those unable to move on to the moonship project, now in its infancy. Just over 25 percent of the shuttle's force, or about 4,700 people, are employed at NASA's Johnson Space Center. Most of the agency personnel whose jobs appear in jeopardy work at the Kennedy Space Center in Florida, where the shuttle is serviced between missions, and NASA's Michoud Assembly Facility, east of New Orleans, where the shuttle's fuel tanks are manufactured. Reassessing plans The moon venture is pushing NASA into a financial bind, forcing it to shoulder more than its $17.3 billion-a-year budget can afford, said Howard McCurdy, a space policy expert at American University in Washington, D.C. Faced with the high cost of wars in Iraq and Afghanistan and the growing pressures on social programs by retiring baby boomers, McCurdy believes the winner of the November presidential election will be forced to reassess NASA's exploration plans. "I think we reach a point where some transition team of space experts will be called together in November or December to try to resolve this difficulty," said McCurdy, who was not a participant in the Stanford gathering. After the Columbia broke apart in the atmosphere as it attempted re-entry in February 2003, claiming the lives of all seven astronauts aboard, investigators blamed the loss in part on a failure by policymakers to agree on long-term national goals worthy of the cost and risk of spaceflight. The Columbia Accident Investigation Board traced the legacy of neglect to the end of NASA's Apollo era, the Cold War period in which America raced the former Soviet Union to land a dozen men on the moon over a three-year stretch ending in 1972. The trend of demanding more from the space program while essentially shortchanging it is proving difficult to discard. The White House has underfunded its own initial spending commitments by more than $4 billion, according to an assessment of the president's 2009 NASA budget proposal now before the House Science and Technology Committee. "It's clear there is a bipartisan agreement that what NASA is asked to do is not properly matched with NASA funding," said Rep. Bart Gordon, D-Tenn., who chairs the House oversight panel. "We have to deal with that reality." In a controversial response to the shortfall, NASA has slowed the growth of spending on other science missions, including those focused on the Earth and climate change. Congress has imposed its own spending restrictions on NASA, including a prohibition against expenditures on any effort directly related to the human exploration of Mars.

Other missions Get Cut

Ineffectiveness and lack of support ensures cutting programs.

Newstex, 8

(“The Candidates on NASA,” TalkLeft the Politics of Crime, 9 March 2008, LexisNexis, JT)

In a little reported difference between Hillary Clinton and Barack Obama that was highlighted Friday in Wyoming , Obama said he proposes cutting NASA's budget to fund things like education, while Hillary has a plan to strengthen it. 2:40 p.m. A question about the space program is next. "Why are you pitting the space program against education?" Obama says he wants to defer the program "because we're not producing enough engineers to support the space program." He said he grew up in the '60s and remembered the days when the space program captured the public's imagination.  Including his. "I grew up on Star Trek," he said. "I believe in the Final Frontier."  Another reporter [had more](http://weblogs.baltimoresun.com/news/politics/blog/2008/03/obama_a_little_confused_of_w_s.html):  [Obama](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12206809458&returnToId=20_T12207088037&csi=156289&A=0.3645645854139443&sourceCSI=9369&indexTerm=%23PE000A0BO%23&searchTerm=Obama%20&indexType=P)said he does not agree with the way the space program is now being run and thinks funding should be trimmed until the mission is clearer.  "NASA has lost focus and is no longer associated with inspiration," he said. "I don't think our kids are watching the space shuttle launches. It used to be a remarkable thing. It doesn't even pass for news anymore."

NASA has lost direction and political support for human exploration.

Space Daily, 10

(“The Fading Final Frontier,” 2 November 2010, p. <http://www.space-travel.com/reports/The_Fading_Final_Frontier_999.html>, JT)

To answer these let's consider the history of the space age from its beginnings. On that October day in 1957, when the USSR launched Sputnik I, the western world was hit by shock and awe. This was definitely a wake up call and it certainly got our attention. The next response was determination. The U.S. had the will and public support for an unlimited-budget, all-out space race. Apollo was the result and the race was over by 1969. The pressure was off and no one was in a space race anymore. [NASA](http://www.space-travel.com/reports/The_Fading_Final_Frontier_999.html) was 12 years old and still lean and mean, but had no mandate to continue to wow the world. Bureaucratic creep slowly took over, and soon programs were being designed by political committees and bean counters. The public lost interest in human space flight and NASA lost congressional support for exploration, except when [jobs](http://www.space-travel.com/reports/The_Fading_Final_Frontier_999.html) in districts were at stake. NASA has now become a mature and politically driven government agency. Human space exploration programs are essentially jobs programs. For example, Constellation has been cancelled, but congress is yelling for a new large booster, an example of a solution looking for a problem. Frankly, there is nothing wrong with a jobs program. Let's just not call it something that it is not. For example, call NASA's human space exploration activities a research program that will assure the availability of top technical talent for future programs.

Commitment Key

Consistent political support is key for NASA programs to continue

Space and Missile Defense Report, 9

(“Griffin, Scolese, Warn Against Volatile Cuts In NASA Budget; Predictability Needed; Vital To Preserve Vision For Space Goals,” 20 April 2009, 32(16), LexisNexis, JT)

NASA requires [President Obama](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12206809458&returnToId=20_T12207006914&csi=299488&A=0.7422439680394844&sourceCSI=9369&indexTerm=%23PE000A0BO%23&searchTerm=President%20Obama%20&indexType=P) to reaffirm explicitly that the space agency must remain on course to exploring the cosmos beyond low Earth orbit, former NASA Administrator Mike Griffin stated. He and the current Acting Administrator Chris Scolese wrote separately that the space agency needs to avoid volatile, roller-coaster peaks and valleys in funding, support and direction for the overarching goals of the largest space agency. Griffin referred to the ongoing vision for space exploration that was enunciated by then-President Bush in his 2004 State of the Union address, a strategic plan that Griffin said must be reaffirmed by each new president entering the White House, including [Obama.](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12206809458&returnToId=20_T12207006914&csi=299488&A=0.7422439680394844&sourceCSI=9369&indexTerm=%23PE000A0BO%23&searchTerm=Obama.&indexType=P) Space programs aren't brief tasks easily and quickly finished, but rather are years-long or decades-long programs of vast complexity and planning that require steadfast support and stability, Griffin wrote. "We need to stay the course on [space] exploration strategy," he wrote. Similarly, Scolese cited an urgent requirement for the United States to persevere steadfastly with a "commitment to a continued human presence in space including a path out of low Earth orbit to the Moon and Mars." As [Obama](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12206809458&returnToId=20_T12207006914&csi=299488&A=0.7422439680394844&sourceCSI=9369&indexTerm=%23PE000A0BO%23&searchTerm=Obama%20&indexType=P) works on his federal budget proposal going to Congress next month, NASA needs at least about $3 billion a year more than its current funding levels, increased funds sorely required to support "research and technology development efforts, and robustly execute those programs with which we are already charged," Griffin observed. "This would be without substantial additions to programmatic content. If new programmatic content is desired, then more money is necessary."

Only One-Way Solves long term Commitment

Only a one-way mission will solve.

Schulze-Makuch, and Davies, environmental science@Washington State, Beyond Center@ASU,10

(Dirk and Paul, “[To Boldly Go: A One-Way Human Mission to Mars](http://www.amazon.com/Human-Mission-Mars-Colonizing-Planet/dp/0982955235/ref%3Dsr_1_3?s=books&ie=UTF8&qid=1287364920&sr=1-3),”Journal of Cosmology, Vol. 12, p. <http://journalofcosmology.com/Mars108.html>, accessed: 20 June 2011, JT)

The exploration of Mars has been a priority for the space programs of several nations for decades, yet the prospect of a manned expedition continually recedes in the face of daunting and well-recognized challenges. The long travel time to Mars in zero gravity and high radiation conditions would impose a serious health burden on the astronauts. The costs of developing the launch vehicle and assembling the large amount of equipment needed for the astronauts to survive the journey and their long sojourn on the Martian surface, together with a need to send all the fuel and supplies for a return journey make a manned Mars expedition at least an order of magnitude more expensive than the Apollo program. In our view, however, many of these human and financial problems would be ameliorated by a one-way mission. It is important to realize that this is not a "suicide mission." The astronauts would go to Mars with the intention of staying for the rest of their lives, as trailblazers of a permanent human Mars colony. They would be resupplied periodically from Earth, and eventually develop some "home grown" industry such as food production and mineral/chemical processing (Zubrin and Baker 1992; Zubrin and Wagner 1997). Their role would be to establish a "base camp" to which more colonists would eventually be sent, and to carry out important scientific and technological projects meanwhile. Of course, the life expectancy of the astronauts would be substantially reduced, but that would also be the case for a return mission. The riskiest part of space exploration is take-off and landing, followed by the exposure to space conditions. Both risk factors would be halved in a one-way mission, and traded for the rigors of life in a cramped and hostile environment away from sophisticated medical equipment. On the financial front, abandoning the need to send the fuel and supplies for the return journey would cut costs dramatically, arguably by about 80 percent. Furthermore, once a Mars base has been established, it would be politically much easier to find the funding for sustaining it over the long term than to mount a hugely expensive return mission.

Technical Feasibility

Have the tech—just needs the go-ahead from Obama

Zubrin 11 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, “How We Can Fly to Mars in This Decade -- And on the Cheap”, May 14 2011 in the Wall Street Journal, proquest, IWren)

SpaceX, a private firm that develops rockets and spacecraft, recently announced it will field a heavy lift rocket within two years that can deliver more than twice the payload of any booster now flying. This poses a thrilling question: Can we reach Mars in this decade? It may seem incredible -- since conventional presentations of human Mars exploration missions are filled with depictions of gigantic, futuristic, nuclear-powered interplanetary spaceships whose operations are supported by a virtual parallel universe of orbital infrastructure. There's nothing like that on the horizon. But I believe we could reach Mars with the tools we have or soon will. Here's how: SpaceX's Falcon-9 Heavy rocket will have a launch capacity of 53 metric tons to low Earth orbit. This means that if a conventional hydrogen-oxygen chemical rocket upper stage were added, it could send 17.5 tons on a trajectory to Mars, placing 14 tons in Mars orbit, or landing 11 tons on the Martian surface. The company has also developed a crew capsule, known as the Dragon, which has a mass of about eight tons. While its current intended mission is to ferry up to seven astronauts to the International Space Station, the Dragon's heat shield system is capable of withstanding re-entry from interplanetary trajectories, not just from Earth orbit. It is rather small for an interplanetary spaceship, but it is designed for multiyear life, and it should be spacious enough for two astronauts with the right stuff. Thus a Mars mission could be accomplished with three Falcon-9 Heavy launches. One would deliver to Mars orbit an unmanned Dragon capsule with a kerosene/oxygen chemical rocket stage of sufficient power to drive it back to Earth. This is the Earth Return Vehicle. A second launch would deliver to the Martian surface an 11-ton payload consisting of a two-ton Mars Ascent Vehicle employing a single methane/oxygen rocket propulsion stage, a small automated chemical reactor system, three tons of surface exploration gear, and a 10-kilowatt power supply, which could be either nuclear or solar. The Mars Ascent Vehicle would carry 2.6 tons of methane in its propellant tanks, but not the nine tons of liquid oxygen required to burn it. Instead, the oxygen could be made over a 500-day period by using the chemical reactor to break down the carbon dioxide that composes 95% of the Martian atmosphere. Using technology to generate oxygen rather than transporting it saves a great deal of mass and provides power and unlimited oxygen once the crew arrives. The third launch would then send a Dragon capsule with two astronauts to Mars. The capsule would carry 2,500 kilograms of consumables -- sufficient, if water and oxygen recycling systems are employed, to support the two-person crew for up to three years. Given the payload capacity, a light ground vehicle and several hundred kilograms of science instruments could be taken along as well. The crew would reach Mars in six months and land their Dragon capsule near the Mars Ascent Vehicle. They would spend the next year and a half exploring. Using their ground vehicle for mobility and the Dragon as home and laboratory, they could search the Martian surface for fossil evidence of life that may have existed when the Red Planet featured standing bodies of water. They could also assemble drilling rigs to bring up samples of subsurface water, within which native microbial life may persist. Finding either would prove that life is not unique to Earth, answering a question that mankind has wondered about for millennia. At the end of their 18-month stay, the crew would transfer to the Mars Ascent Vehicle, take off and rendezvous with the Earth Return Vehicle in orbit. This craft would then take them on a six-month flight back to Earth, splashing down to an ocean landing.Nothing in this plan is beyond our current technology, and the costs would not be excessive. Falcon-9 Heavy launches are priced at about $100 million each, and Dragons are cheaper. With this approach, we could send expeditions to Mars at half the cost to launch a Space Shuttle flight. There is no question that this plan involves considerable risk, and a variety of missions, technology developments and testing programs in advance might reduce that risk. But if we try to do even a significant fraction before committing to the mission, we will never get to Mars. Is it responsible to forgo any expenditure that might reduce the risk to the crew? I believe so. The purpose of the space program is to explore space, and its expenditures come at the cost of other national priorities. If we want to reduce risk to human life, there are vastly more effective ways of doing so than by spending $10 billion per year for the next two or three decades on a human spaceflight program mired in low Earth orbit. We could spend the money on childhood vaccinations, fire escape inspections, highway repairs, better body armor for the troops -- take your pick. For NASA managers to demand that the mission be delayed for decades while hundreds of billions are spent to marginally reduce the risk to a handful of volunteers, when the same funds spent on other priorities could save the lives of tens of thousands, is narcissistic in the extreme. The Falcon 9 Heavy is scheduled for its first flight in 2013. All of the other hardware elements in this plan could be made ready for flight within the next few years. NASA's astronauts have gone nowhere new since 1972, but these four decades of wasteful stagnation need not continue. If President Obama were to act decisively and embrace this plan, we could have our first team of human explorers on the Red Planet by 2016.

Technical Feasibility

Mars mission possible now

ASU 11 (March 10, “Time Is Now for Human Mission to Mars Say Book Contributors” <http://www.asuchallenges.com/blog/time-now-human-mission-mars-say-book-contributors>) NS 5/25/11

"The time for a human mission to Mars is now," write the editors of "A One Way Mission to Mars: Colonizing the Red Planet," a collection of articles published in book form this month by the Journal of Cosmology. "The overall message of this volume is not just that going to Mars is a worthwhile scientific program and a great adventure worthy of Homo sapiens. It is that we can begin the project now," write the editors, astrobiologists Paul Davies of Arizona State University and Dirk Schulze-Makuch of Washington State University. "I truly believe that the exploration and eventual colonization of Mars is a critical step toward the long-term survival of our species, and this book, laying out the plan toward this endeavor, is a significant move in the right direction," said professor Schulze-Makuch, director of the Laboratory for Astrobiological Investigations and Space Mission Planning in the School of Earth and Environmental Sciences at Washington State University. "This book provides us with a road map for how we can accomplish one of the major upcoming challenges for humankind," Schulze-Makuch said. This is not the first collaboration by Schulze-Makuch and Davies. The two authored "To Boldly Go: A One-Way Human Mission to Mars," which appeared last October in the Journal of Cosmology. Their article attracted massive interest worldwide and launched the idea for a smaller sequel to the journal's 970-page volume "The Human Mission to Mars: Colonizing the Red Planet." "The dream of humans going to Mars is a recurring theme of the scientific age," said professor Davies, founding director of the BEYOND Center for Fundamental Concerts in Science at Arizona State University, where he teaches in the Department of Physics in the College of Liberal Arts and Sciences. "To make this dream a reality requires an audacious plan: to send humans with a one-way ticket," Davies said. "We are not talking about a suicide mission. Our plan is to put four astronauts on Mars to do great science, and build a base camp for others to follow. "These trailblazers will be resupplied from Earth, and eventually joined by additional colonists. It will be the first step in building a permanent human presence on the Red Planet," said Davies. According to Davies and Schulze-Makuch, the huge advantage of a one-way mission is the enormous savings in costs and the long-term commitment required to space exploration, particularly Mars exploration. They write that by cutting out the return journey, the budget can be slashed by 80 percent, bringing a Mars mission within the reach of a consortium of space agencies and private operators. "The lure of possible microbial life on Mars, which could have stunning consequences for our science and our understanding of our place in the universe is a major motivation for such a mission," said Davies. "But the ultimate goal is to create a self-sustaining human colony on another planet as a safeguard for humanity should a mega-disaster occur on Earth."

Have the tech now

MyFoxOrlando 10 (October 28, “NASA plots one-way mission to Mars,” http://www.myfoxorlando.com/dpp/news/offbeat/102810-nasa-one-way-trip-to-mars-ncx) KA

NEWSCORE - NASA scientists were aiming to launch the flight of a lifetime -- with astronauts making a one-way trip to set up a human colony on Mars or its moons, The Sun reported Thursday. The ambitious plan was being championed by S. Pete Worden, director of NASA's Ames Research Center, which received a $1.6 million grant to research the project. Worden -- whose dream is dubbed the Hundred Years Starship -- was already holding talks with potential donors to fund the program, including Google co-founder Larry Page. Worden told Page that a mission to Mars would cost no more than $10 billion. "The human space program is now really aimed at settling other worlds," Worden said. The NASA team believes it could send a team of astronauts to settle on Mars by 2030. The journey could take between six and nine months. NASA envisions a one-way mission to Mars, since it would be too expensive to fly people back and forth. Instead, the astronauts would establish a colony on the red planet and be sent regular supplies until they could become self-sufficient. Experts believe the necessary technology for the mission already exists. "A one-way human mission to Mars would not be a fixed duration project, as in the Apollo program, but the first step in establishing a permanent human presence," wrote Dirk Schulze-Makuch and Paul Davies in the current edition of the Journal of Cosmology.

Technical Feasibility

Falcon 9 heavy rocket can get us there

Zubrin, President of Pioneer Astronautics and of the Mars Society, 11,

(Robert, Wall Street Journal, “How We Can Fly to Mars in This Decade—And on the Cheap”, http://online.wsj.com/article/SB10001424052748703730804576317493923993056.html?mod=googlenews\_wsj, accessed 5-31-11, JG)

SpaceX, **a private firm that develops rockets and spacecraft, recently announced it will field a heavy lift rocket within two years that can deliver more than twice the payload of any booster now flying**. This poses a thrilling question: Can we reach Mars in this decade? It may seem incredible—since conventional presentations of human Mars exploration missions are filled with depictions of gigantic, futuristic, nuclear-powered interplanetary spaceships whose operations are supported by a virtual parallel universe of orbital infrastructure. There's nothing like that on the horizon. But I believe **we could reach Mars with the tools we have or soon will. Here's how: SpaceX's Falcon-9 Heavy rocket will have a launch capacity of 53 metric tons to low Earth orbit. This means that if a conventional hydrogen-oxygen chemical rocket upper stage were added, it could send 17.5 tons on a trajectory to Mars, placing 14 tons in Mars orbit, or landing 11 tons on the Martian surface**. The company has also developed a crew capsule, known as the Dragon, which has a mass of about eight tons. While its current intended mission is to ferry up to seven astronauts to the International Space Station, the Dragon's heat shield system is capable of withstanding re-entry from interplanetary trajectories, not just from Earth orbit. It is rather small for an interplanetary spaceship, but it is designed for multiyear life, and it should be spacious enough for two astronauts with the right stuff. **Thus a Mars mission could be accomplished** with three Falcon-9 Heavy launches. One would deliver to Mars orbit an unmanned Dragon capsule with a kerosene/oxygen chemical rocket stage of sufficient power to drive it back to Earth. This is the Earth Return Vehicle. A second launch would deliver to the Martian surface an 11-ton payload consisting of a two-ton Mars Ascent Vehicle employing a single methane/oxygen rocket propulsion stage, a small automated chemical reactor system, three tons of surface exploration gear, and a 10-kilowatt power supply, which could be either nuclear or solar. The Mars Ascent Vehicle would carry 2.6 tons of methane in its propellant tanks, but not the nine tons of liquid oxygen required to burn it. Instead, the oxygen could be made over a 500-day period by using the chemical reactor to break down the carbon dioxide that composes 95% of the Martian atmosphere. Using technology to generate oxygen rather than transporting it saves a great deal of mass and provides power and unlimited oxygen once the crew arrives. The third launch would then send a Dragon capsule with two astronauts to Mars. The capsule would carry 2,500 kilograms of consumables—sufficient, if water and oxygen recycling systems are employed, to support the two-person crew for up to three years. Given the payload capacity, a light ground vehicle and several hundred kilograms of science instruments could be taken along as well. **The crew would reach Mars in six months** and land their Dragon capsule near the Mars Ascent Vehicle. They would spend the next year and a half exploring. Using their ground vehicle for mobility and the Dragon as home and laboratory, they could search the Martian surface for fossil evidence of life that may have existed when the Red Planet featured standing bodies of water. They could also assemble drilling rigs to bring up samples of subsurface water, within which native microbial life may persist. Finding either would prove that life is not unique to Earth, answering a question that mankind has wondered about for millennia. At the end of their 18-month stay, the crew would transfer to the Mars Ascent Vehicle, take off and rendezvous with the Earth Return Vehicle in orbit. This craft would then take them on a six-month flight back to Earth, splashing down to an ocean landing. **Nothing in this plan is beyond our current technology, and the costs would not be excessive. Falcon-9 Heavy launches are priced at about $100 million each, and Dragons are cheaper. With this approach, we could send expeditions to Mars at half the cost to launch a Space Shuttle flight**. There is no question that this plan involves considerable risk, and a variety of missions, technology developments and testing programs in advance might reduce that risk.

Technical Feasibility

Going to Mars is technologically and humanly feasible

Smith 10 (Sandy, Oct 28, HULIQ, “NASA contemplates manned mission to Mars – one-way,” http://www.huliq.com/8738/nasa-contemplates-manned-mission-mars-one-way) KA

Recent research has shown that a one-way mission to Mars is technologically feasible and would cost less than a round-trip voyage. The astronauts who would volunteer to be left on the planet would receive supplies from Earth periodically but would be expected to become self-sufficient as soon as they could. Of all the other planets in the solar system, only Mars is believed to have sufficient quantities of water to sustain life. But even with the water, doing so would still be difficult. The planet is forbiddingly cold, with temperatures well below freezing in places, and its atmosphere is mostly carbon dioxide, which would mean oxygen supplies would have to be furnished. Worden suggested in his talk that things like synthetic biology and alterations to the human genome could be explored ahead of the mission as ways to make the project humanly feasible. He also said he believed that the first stop for the manned mission should be one of Mars' moons, where scientists could conduct telerobotic explorations of possible landing sites. Worden said that NASA could put people on Mars' moons by 2030.

Feasibility- Timeframe

Trip to Mars will take 4 months

Smith 10 (Sandy, Oct 28, HULIQ, “NASA contemplates manned mission to Mars – one-way,” http://www.huliq.com/8738/nasa-contemplates-manned-mission-mars-one-way) KA

Depending on Mars' position in its orbit around the sun, the distance between it and Earth varies from 34 million to 250 million miles. NASA's last unmanned Mars mission, the Phoenix lander mission of 2007, took nine months to reach the planet; scientists say that nuclear-powered rockets could make the trip in four months.

One Way Best – Cost

Mars to Stay costs significantly less than a round trip

Berger 9 (Eric, October, 19, Houston Chronicle, “Travel to Mars – on a one-way ticket?”, http://www.chron.com/disp/story.mpl/nation/6673981.html)KA

A blue-ribbon panel on human spaceflight recently declared Mars to be NASA's ultimate objective, but admitted humans aren't going there any time soon. In fact, the Augustine panel appointed by President Barack Obama said that without a substantial infusion of cash, NASA couldn't even send humans back to the moon in the next few decades. Depressing news, indeed, for the city that trains and houses astronauts. But what if NASA could land astronauts on Mars in a decade, for not ridiculously more money than the $10 billion the agency spends annually on human spaceflight? It's possible, say some space buffs, although there's a catch. The astronauts we'd send would never come home. The concept of a one-way mission to Mars has circulated among space buffs for years, with a Houston-based former NASA engineer, James C. McLane III, among its chief champions. Apollo 11 astronaut Buzz Aldrin has endorsed the plan. Relieving NASA of the need to send fuel and rocketry to blast humans off the Martian surface, which has slightly more than twice the gravity of the moon, would actually reduce costs by about a factor of 10, by some estimates.

A one-way trip would cost 80% less than a round trip

Lamb 10 (Gregory M., November 17, CSMonitor, “One-way ticket to Mars?,” http://www.csmonitor.com/Innovation/One-way-ticket-to-Mars) KA

Humans could be walking on Mars within the next couple decades, for only a fraction of the cost the [United States](http://www.csmonitor.com/tags/topic/United%2BStates) has already budgeted for space exploration. How? The answer is simple, say a pair of Mars researchers: Give the explorers a one-way ticket. The most costly and tricky part of any manned space mission is providing life-support for its human crew: food, oxygen, and protection from radiation and other hazards of space travel. On a human mission to Mars, most of the cost – some 80 percent of it – would involve returning the crew to Earth, say [Dirk Schulze-Makuch](http://www.csmonitor.com/tags/topic/Dirk%2BSchulze-Makuch) and [Paul Davies](http://www.csmonitor.com/tags/topic/Paul%2BDavies) in the October-November issue of the Journal of Cosmology. Rather than quintuple the cost, those funds could go toward building a permanent settlement, the two scientists argue.

One-way trip is the only way to make it finically feasible

NPR 10 (December 5, NPR, “The Final Frontier: A Mars Mission With No Return,” http://www.npr.org/2010/12/05/131815965/one-way-mission-to-mars) KA

As the nation attempts to go on a debt diet, the cost of federally funded space missions, like the long-awaited manned mission to Mars, is being questioned. But two scientists are recommending a different approach that could change space exploration forever: leaving the astronauts there. In their article from the Journal of Cosmology, scientists Dirk Schulze-Makuch of Washington State University and Paul Davies of Arizona State University propose making the mission to Mars a one-way trip. "The purpose of doing this is to save money, to put it bluntly," Davies tells NPR's Audie Cornish. "I think we've all had this dream of going to Mars — it has been something that has, for decades, been proposed — but it's one of these on-again-off-again projects because it is so phenomenally expensive. But by making the trip one way, you cut the cost dramatically, not just 50 percent, probably about as much as 80 percent. Then it becomes feasible."

One Way Best – Cost

One-way saves money, already have some money now

Hoffer 10 (Steven, October 27, Huffington Post, “NASA Planning One-Way Manned Mission to Mars,” http://www.aolnews.com/2010/10/27/nasa-planning-one-way-manned-mission-to-mars/) KA

We are going to Mars and not coming back. At a recent event in San Francisco, NASA Ames Research Center Director [Pete Worden](http://en.wikipedia.org/wiki/Pete_Worden) introduced the [Hundred Year Starship](http://www.dailymail.co.uk/sciencetech/article-1324192/Nasa-plan-Hundred-Year-Starship--mission-astronauts-Mars-leave-forever.html) initiative, a project to embark on a one-way mission from Earth to Mars by 2030 and permanently settle the red planet. "The human space program is now really aimed at settling other worlds," Worden said. "Twenty years ago you had to whisper that in dark bars and get fired." One of NASA's main research centers has already received approximately $1.5 million to being working on the project -- a fine sum of money but space peanuts compared with what is required. Luckily, private investors like Google co-founder Larry Page are interested in contributing. Worden, who says that the project will cost an estimated $10 billion, described his conversation with a seldom stingy Page. "His response was, 'Can you get it down to $1 [billion] or $2 billion?' So now we're starting to get a little argument over the price," said Worden. So if you are a billionaire and interested in contributing to this initiative, you can probably get a hold of Worden's phone number. A one-way ticket to Mars is a heavily debated resolution to concerns involving returning astronauts to Earth, and even more often the cost of doing so. Writing for [The New York Times](http://www.nytimes.com/2009/09/01/opinion/01krauss.html), Lawrence Krauss asked the question, "Why are we so interested in bringing the Mars astronauts home again?" more than a year ago. Astronauts might have supplies periodically sent, but they would also be expected to become generally self-sufficient. The Mars initiative is in many respects the direct opposite of a [Russian initiative](http://www.aolnews.com/world/article/were-off-to-mars-in-a-down-to-earth-way/19502122) to [simulate](http://www.politicsdaily.com/2010/06/03/fake-mars-voyage-to-test-limits-of-stamina/) the experience of visiting the red planet without ever leaving our green one (though clearly, it is an advisable prerequisite for any sort of eventual extraterrestrial colonization mission). The six participating scientists, stationed in a Moscow warehouse, are in month six of the [18-month experiment](http://www.aolnews.com/science/article/fake-mars-voyage-to-test-limits-of-psychological-stamina/19408982) that replicates every aspect of a mission to Mars, set aside the lack of gravity.

The cost of the plan is feasible; it’s only half a percent of the US military budget

Zubrin 10 (Robert, President of the Mars Society, “Human Mars Exploration: the Time Is Now”, *Journal of Cosmology*, volume: 12, p. 3549-3557, http://journalofcosmology.com/Mars111.html) EK

Such is the basic Mars Direct plan. In 1990, when it was first put forward, it was viewed as too radical for NASA to consider seriously, but over the next several years with the encouragement of then NASA Associate Administrator for Exploration Mike Griffin, the group at Johnson Space Center in charge of designing human Mars missions decided to take a good hard look at it. They produced a detailed study of a Design Reference Mission based on the Mars Direct plan but scaled up about a factor of 2 in expedition size compared to the original concept. They then produced a cost estimate for what a Mars exploration program based upon this expanded Mars Direct would cost. Their result; $50 billion, with the estimate produced by the same costing group that assigned a $400 billion price tag to the traditional cumbersome approach to human Mars exploration embodied in NASA's 1989 "90 Day Report." I believe that with further discipline applied to the mission design, the program cost could be brought down to the $30 to $40 billion range. Spent over ten years, this would imply an annual expenditure on the order of 20% of NASA’s budget, or about half a percent of the US military budget. It is a small price to pay for a new world.

One Way Best – Cost

One-way trip to Mars is technologically and finically feasible – already have some money and donors now

Hough 10 (Andrew, October 28, The Telegraph, “NASA unveils bold plans to send humans ‘one-way to Mars to colonise planet’,” http://www.telegraph.co.uk/science/space/8091965/Nasa-unveils-bold-plans-to-send-humans-one-way-to-Mars-to-colonise-planet.html) KA

Space agency officials confirmed feasibility studies were under way to asses whether astronauts could be permanently sent to the red planet, or its moons, to establish human colonies. The multi-billion pound mission, titled Hundred Years Starship, is being spearheaded by the [Ames Research Centre](http://www.nasa.gov/centers/ames/home/index.html), one of Nasa’s main research centres, based in Moffett Field, California. Officials from the Pentagon's Defence Advanced Research Projects Agency (DARPA) are also heavily involved in turning the science fiction idea into a reality. Early estimates put the cost of such a mission, which has “just started” at more than £7 billion and could be achieved by 2030. Scientists have been given £600,000 government grant – including £100,000 from Nasa – to start research into the idea, [according to US reports.](http://www.kurzweilai.net/nasa-ames-worden-reveals-darpa-funded-hundred-year-starship-program) The world’s billionaire’s, including Larry Page, Google’s co-founder, have been asked to help fund the project. Pete Worden, the Ames director, confirmed the plans to a conference in San Francisco at the weekend. “You heard it here. We hope to inveigle some billionaires to form a Hundred Year Starship fund,” he told [the Long Conversation event](http://longnow.org/seminars/02010/oct/16/long-conversation/) at the Contemporary Jewish Museum. “The human space program is now really aimed at settling other worlds. Twenty years ago you had to whisper that in dark bars and get fired. “Within a few years we will see the first true prototype of a spaceship that will take us between worlds.” Such a space journey would take up to nine months with volunteers embarking on the mission knowing they would never return to earth. This is because the cost of returning astronauts to earth would make the project prohibitively expensive. Supplies would be sent to make them self-sufficient. Such a mission would be grueling for humans with forbidding conditions including sub-zero temperatures and a thin atmosphere. Mr Worden said Mr Page was keenly interested in the project. “Larry asked me a couple weeks ago how much it would cost to send people one way to Mars and I told him $10 billion and his response was, ‘can you get it down to 1 or 2 billion’,” he said. “So now we’re starting to get a little argument over the price.” But he admitted that he did not know how such a mission would work in reality. "How do you live in another world? I don't have the slightest idea," he said. "If you're a conservative, you worry about it killing us; if you're a liberal, you worry about us killing it. “I think things like synthetic biology have lot of potential for that. I think rather than make an environment on Mars like Earth, why don't we modify life ... including the human genome ... so it's better suited to [Mars]?" A DARPA spokesman [later confirmed details of the mission](http://www.cbsnews.com/8301-501465_162-20020658-501465.html). "A key element of the study is exploring models by which sustained co-investment by the private sector in these areas can be incentivised,” he said. “The study is currently in the early formulation stage, but will be entirely open and unclassified, with more details forthcoming in early 2011." It comes as researchers claimed such a human mission was technologically feasible and was cheaper returning astronauts to earth. Their new study, in the [Journal of Cosmology,](http://journalofcosmology.com/Mars108.html) found the costs of safely returning a crew would eat up the majority of such a mission’s budget. Dirk Schulze-Makuch, from Washington State University and Paul Davies, from Arizona State University, said four volunteer astronauts could undertake the first mission to permanently colonise Mars. “A one-way human mission to Mars would not be a fixed duration project as in the Apollo program, but the first step in establishing a permanent human presence on the planet,” they said. “There are many reasons why a human colony on Mars is a desirable goal, scientifically and politically. “The strategy of one-way missions brings this goal within technological and financial feasibility.”

Mars Direct Solves

We can use Mars’ resources for water, fuel, construction, and more. This also means a faster timetable.

Mars Society, No Date (The Mars Society/Dr. Robert Zubrin, no date given [between ’05 and ‘07], “Mars Direct”, <http://www.marssociety.org/home/about/mars-direct>) SW

Mars Direct is a sustained humans-to-Mars plan developed by Dr. Robert Zubrin that advocates a minimalist, live-off-the-land approach to exploring Mars, allowing for maximum results with minimum investment. Using existing launch technology and making use of the Martian atmosphere to generate rocket fuel, extracting water from the Martian soil and eventually using the abundant mineral resources of the Red Planet for construction purposes, the plan drastically lowers the amount of material which must be launched from Earth to Mars, thus sidestepping the primary stumbling block to space exploration and rapidly accelerating the timetable for human exploration of the solar system. The general outline of Mars Direct is simple. In the first year of implementation, an Earth Return Vehicle (ERV) is launched to Mars, arriving six months later. Upon landing, a rover is deployed that contains the reactors necessary to generate rocket fuel for the return trip. After 13 months, a fully-fueled return vehicle will be sitting on the surface of Mars. During the next launch window, 26 months after the ERV was launched, two more craft are sent up: a second ERV and a habitat module (hab), the astronauts' ship. This time the ERV is sent on a low-power trajectory, designed to arrived at Mars in eight months -- so that it can land at the same site as the hab if the first ERV experiences any problems. Assuming that the first ERV works as planned, the second ERV is landed at a different site, thus opening up another area of Mars for exploration by the next crew. After a year and a half on the Martian surface, the first crew returns to Earth, leaving behind the hab, the rovers associated with it and any ongoing experiments conducted there. They land on Earth six months later to a hero's welcome, with the next hab/ERV already on course for Mars. With two launches during each launch window -- one ERV and one hab -- more and more of Mars will be opened to human exploration. Eventually multiple habs can be sent to the same site and linked together, allowing for the beginning of a permanent Mars base.

AT: No Volunteers/Suicide Mission

Mission to Mars is not a suicide mission

NPR 10 (December 5, NPR, “The Final Frontier: A Mars Mission With No Return,” http://www.npr.org/2010/12/05/131815965/one-way-mission-to-mars) KA

As the nation attempts to go on a debt diet, the cost of federally funded space missions, like the long-awaited manned mission to Mars, is being questioned. But two scientists are recommending a different approach that could change space exploration forever: leaving the astronauts there. In their article from the *Journal of Cosmology*, scientists Dirk Schulze-Makuch of Washington State University and Paul Davies of Arizona State University propose making the mission to Mars a one-way trip. "The purpose of doing this is to save money, to put it bluntly," Davies tells NPR's Audie Cornish. "I think we've all had this dream of going to Mars — it has been something that has, for decades, been proposed — but it's one of these on-again-off-again projects because it is so phenomenally expensive. But by making the trip one way, you cut the cost dramatically, not just 50 percent, probably about as much as 80 percent. Then it becomes feasible." Not A Suicide Mission Davies envisions the astronaut who will travel to Mars to be in his or her 60s, with enough life experience and training to willingly take the journey into space. They would live off of a power source of some kind, ideally a nuclear reactor, and take enough medical and food supplies to sustain themselves through the rest of their life. Davies stresses that the journey would not be a suicide mission — more like the opportunity of a lifetime. "If you send a scientist to Mars, it's like a kid in a candy store," he says. His mailbox is already overflowing with volunteers ready for their final frontier. "Really, this isn't a joy ride," says Davies. "You have to understand that the motivation for doing this is to not only open up a human presence on another planet, but to provide the opportunity to do some fantastic, groundbreaking science."

AT: No Volunteers

People want to go to Mars – over 400 volunteers

Lott 11 (Maxim, January 10, FoxNews.com, “To Boldy Go: What Made 400 People Volunteer for a One-Way Mission to Mars?,” http://www.foxnews.com/scitech/2011/01/10/space-volunteer-way-mission-mars/) KA

An interplanetary trip to Mars could take as little as 10 months, but returning would be virtually impossible -- making the voyage a form of self-imposed exile from Earth unlike anything else in human history. What would inspire someone to volunteer? We've just found out. A special edition of the Journal of Cosmology details exactly how a privately-funded, one-way mission to Mars could depart as soon as 20 years from now -- and it prompted more than 400 readers to volunteer as colonists. "I've had a deep desire to explore the universe ever since I was a child and understood what a rocket was," Peter Greaves told FoxNews.com. Greaves is the father of three, and a jack-of-all-trades who started his own motorcycle dispatch company and fixes computers and engines on the side. "I envision life on Mars to be stunning, frightening, lonely, quite cramped and busy," he told FoxNews.com. "Unlike Earth I wouldn't be able to sit by a stream or take in the view of nature's wonder, or hug a friend, or breath deeply the sweet smell of fresh air -- but my experience would be so different from all 6 to 7 billion human beings ... that in itself would make up for the things I left behind." The psychological effect of space travel Other volunteers include a 69-year old computer programmer, a college student at Texas A&M, and a 45-year-old nurse. Reverend Paul Gregersen, pastor of the Clarno Zion United Methodist Church, also said he would be willing to travel off-planet -- permanently. "As the human race continues to expand, it only make sense to explore opportunities for human life out in the cosmos," Gregersen told FoxNews.com. "Also, I have the feeling that spiritual issues would come up among the crew. The early explorers on Earth always took clergy with them." But more than spiritual issues will arise, warn psychologists who have worked with NASA. "It's going to be a very long period of isolation and confinement," said Albert Harrison, who has studied astronaut psychology since the 1970s as a professor of psychology at UC Davis. He also warned that life on Mars wouldn't be as romantic as it sounded. "After the excitement of blast-off, and after the initial landing on Mars, it will be very difficult to avoid depression. After all, one is breaking one’s connections with family, friends, and all things familiar," he told FoxNews.com. "Each day will be pretty much like the rest. The environment, once the novelty wears off, is likely to be deadly boring. Despite being well prepared and fully equipped there are certain to be unanticipated problems that cannot be remedied. One by one the crew will get old, sick, and die-off." All communications with Earth would also come with a delay of about 45 minutes. The volunteers said they are aware of the psychological issues, but believe they would be able to handle them. "I've spent an inordinate amount of time with myself and my own thoughts, and am happy to do so till the end of days," Greaves said. Are they qualified? Volunteering is all well and good, but would Greaves or Gregersen have a chance of being selected? NASA spokesman James Hartsfield referred to the astronaut application guidelines posted on the agency's website. Currently, the requirement of a college degree in science, engineering, or math -- followed by years of professional experience -- would probably disqualify most, he said. However, the mission in question is not intended to be sponsored by NASA. Harrison said he was more upbeat about the volunteers. “The people within this group show high interest and would bring varied backgrounds and experiences to the mission,” he said. “Also, there will be spiritual issues to address, and it would not surprise me at all if the mission would benefit from someone who served as a chaplain.” Currently, NASA astronauts must complete at least 4 to 5 years of training before going on long-duration missions. The training includes intense physical tests. “Astronaut Candidates are required to complete military water survival before beginning their flying syllabus, and become SCUBA qualified to prepare them for spacewalk training,” the guidelines read. Harrison said that he was sure good colonists could be found, but that political and regulatory hurdles would be a tougher issue. "There will be tremendous public and political opposition from many members of the public to a mission which can only end in death ... There are people who can do the job, but the question is, will the public let them do it? I think to sell the missions, there has to be at least some chance of the astronauts returning." The journey home Harrison's comments raise an important issue: Why must this be a one-way mission? Why couldn't the brave few come back home? “We prefer the one-way mission as it would drastically reduce costs,” said Dirk Schulze-Makuch, a professor at Washington State University who contributed to the Journal. His plan involves sending supplies to Mars as necessary, but not a return vehicle. "The astronauts would be re-supplied on a periodic basis from Earth with basic necessities, but otherwise would be expected to become increasingly proficient at harvesting and utilizing resources available on Mars. Eventually the outpost would reach self-sufficiency, and then it could serve as a hub for a greatly expanded colonization program." Given the difficulties of the mission, Lana Tao, the editor of the Journal, said she was surprised by the response. "The e-mails volunteering were a complete surprise. At first we thought the e-mails were a joke, that volunteers were not serious. Then we received more and more with men giving their reasons and qualifications, and we realized they were completely serious." Pasha Rostov, the 69-year old computer programmer, is serious about it. "I do VERY well with solitude," he wrote of his qualifications. "I am handy with tools, very good at making things work, have generated my own solar energy, built three houses (with my own hands) and am quite sane and stable." "And, I am ready to go to Mars. Sign me up," he wrote.

Nuclear Propulsion Good

Nuclear Propulsion solves fundamental problems like energy use

Lemos 7 (Robert Lemos, 09-20-07, Senior writer at WIRED, “Space Industry Wants Nuke Power, but Public Fear Persists”, http://www.wired.com/science/space/news/2007/09/space\_nukes, AH)

We need to restart development into nuclear propulsion," said Maureen Heath, vice president of Northrup Grumman's Civil Space division. "This is an area where we need to spend more resources to enable the next era of exploration." Nuclear power and propulsion for spacecraft are nothing new. Since the 1960s, the United States has had the capabilities to launch vehicles powered by radioactive materials. Experiment packages on many of the Apollo missions used nuclear power systems as well. In 2006, NASA shut down most of its research into nuclear propulsion technologies, a project the agency had dubbed Prometheus. The agency had contracted with Northrup Grumman, Boeing and Lockheed Martin to propose future propulsion systems based on nuclear power. Nuclear propulsion encompasses any technology that uses a nuclear reactor to provide the energy for a rocket engine. The best-known engines are nuclear-thermal rockets, which use nuclear energy to heat a rocket propellant, and nuclear-electric propulsion, which uses the generator to ionize a propellant. Both outperform current chemical-based rockets and are currently under consideration only for spaceflight, not for lifting a rocket from the ground to orbit. Using a nuclear reactor for propulsion also solves energy problems for missions to the outer planets. Getting power from solar energy becomes increasingly problematic the farther the probe travels from the sun. Nuclear power would allow probes to stay active through planetary nights and not be threatened by any loss of light -- as happened during the recent sandstorms on Mars that almost doomed the two Martian rovers. "When people go to Mars, there is not enough sunlight" to satisfy the power requirements, said Scott Horowitz, associate administrator for NASA's Exploration Systems Mission Directorate. "You are in a place where you need nuclear." NASA's latest probe, the Dawn mission to the asteroids Vesta and Ceres in the asteroid belt, uses a solar-powered ion drive for propulsion. By using a nuclear version, the probe could get to the asteroids more quickly and have better and more-powerful scientific instruments, industry experts said. "Mapping missions that explore multiple celestial bodies like comets, asteroids and moons are made possible by the highly efficient use of propellant that nuclear propulsion offers," Northrup Grumman said in a statement sent to Wired News. "The available electrical power used for propulsion can also operate vastly more complex scientific instruments and return hundreds to thousands of times more scientific data than other technologies." Yet, concerns that an accident at launch would expose people to radioactivity have caused some citizens to staunchly oppose the technology. In 1997, public outcry over the use of 73 pounds of plutonium almost scrapped the Cassini mission, a probe which is now delivering stunning vistas and scientific data from Saturn. In 2006, NASA launched the New Horizons mission to Pluto and the outer solar system, but the radioactive material required to power the probe resulted in a lot of political hand-wringing, said Todd May, deputy associate administrator for NASA's Science Mission Directorate, who worked on the New Horizons mission. "The stack of documents that it took to launch that small amount of plutonium on the New Horizons mission was enormous," May said. May underscored the public-relations nightmare that the space industry has to look forward to in selling nuclear propulsion to the general population. "I went down to get a cup of coffee at a cafe before the New Horizons mission, and the lady behind the counter wanted to know what time she should get underneath the table," May said. Both the Cassini and New Horizons probes get power from a technology known as radioisotope thermoelectric generation (RTG), which utilizes radioactive decay to generate heat and electricity. Most scientists consider the technology to be extremely safe, but more care would have to be taken with a nuclear-powered system. Because of the concerns, as well as funding cutbacks, NASA has refocused its Prometheus nuclear program to concentrate on creating a power generator that would satisfy the needs of the first lunar outpost. Advancing the technology of nuclear propulsion will have to wait, said NASA's Horowitz. "Right now, it's not in the budget, because we don't have the budget to do it," he said. "But they (the scientists) are working on an important piece, so they are still engaged."

Nuclear Propulsion Good

Extinction possible – we need a backup on mars but the only way to do that is through nuclear technology

Ragheb 11 (Magdi, May 5, Associate Professor at the University of Illinois specializing in Nuclear Engineering, “Nuclear and Plasma Propulsion” https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Nuclear%20and%20Plasma%20Space%20Propulsion.pdf, AH)

Life can be subject to extinction on Earth either from within through volcanic eruptions or viral epidemics or from astral assailants as asteroid or comets impacts from space, as we know has happened in the past. It is urgent to keep backup copies of life, like we keep for files on computers, on the moon and Mars protected from the possible unexpected calamities that could extinguish life on Earth. Large amounts of chemical energy must be used in space travel to propel the space vehicle, especially out of the main pull of the Earth's gravity. The first stage of the Saturn V rocket used in the Moon missions Apollo program generated as much energy as 1 million automobile engines. The rocket engine as well as the propellant fuel must also be compact and lightweight, before the space vehicle can carry them. The power requirements versus the length of mission stay times away from Earth favor solar and nuclear energy means. As shown in Fig. 1, for large power needs, nuclear propulsion becomes the only alternative, particularly in the deep reaches of space where solar radiation is not even available.

Nuclear Propulsion key to Mars Exploration

Nuclear Power especially key for Mars – solves spending, time, space cycles, weight, and other fundamental issues – it’s the only way to solve

Ragheb 11 (Magdi, May 5, Associate Proffessor at the University of Illinois specializing in Nuclear Engineering, “Nuclear and Plasma Propulsion” https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Nuclear%20and%20Plasma%20Space%20Propulsion.pdf, AH)

The true potential of a nuclear rocket is not just for providing power for observation satellites and anti ballistic weapon systems, but for a possible space mission to Mars. The higher specific impulse of the nuclear rocket can reduce the mission time for a Mars mission from about a year for a chemical rocket, to about 2-3 weeks in the case of a nuclear rocket. This may be crucial to avoid the effects of space radiation from solar flares on the astronauts, as well as avoiding the effects of gravity's absence on the muscular bone, and other bodily functions from exposure to space radiation and solar flares in long duration space missions. Figure 11 compares the chemical and nuclear fission vehicles required to perform a manned Mars exploration mission. Assuming that the space vehicle has been assembled in an Earth orbit, with the components supplied by a space transport vehicle, or reusable rockets, the all-chemical vehicle would have an initial weight in Earth orbit of almost 10 million pounds. The nuclear vehicle weight would be about 1/10 this value, at about 950 thousand pounds. The weight advantage is here clear. A nuclear rocket would be crucial for the return of the astronauts. The USA NERVA reactor as well as Russian designs used U235 as the fuel. New fuels consisting of tricarbide fuel: (U235, Zr, Nb)C. The use of Pu239 is precluded by United Nations agreements on the use of space. The use of a nuclear rocket cannot be used for landing and return from Mars. Because of its radioactive exhaust, and the added need for surrounding, rather than just shadow shielding of the crew, the landing and return must use chemical rockets, with the nuclear rocket left in orbit around Mars. This is necessary, since the effective dose rate from an unshielded NERVA engine after being fired can be in the range of 10,000 rem/hr, so that the crew cannot stay close to it, should it be landed on Mars. As an illustration, the fission product activity produced from a run lasting 1,000 seconds from a 2,000 MWth nuclear rocket would produce more than 109 Curies (Ci) of fission products, which is 1/10 what is produced over two year operational period for a typical land-based 3,411 MWth nuclear power plant. The Orbitech company developed in-situ resource utilization systems to exploit the Martian atmosphere for ground transportation, flight propulsion, and power. Solid CO and C are used as fuels in hybrid rocket propulsion systems. Small-scale solid C0/02 hybrid motors, cryogenic solid hybrid rocket engines, vortex combustion ramjets, scramjets, and solid oxygen/liquid hydrogen hybrid engines were pursued. Because of planetary alignments a window of opportunity for a trip to Mars opens every 26 months, with some windows being better than others. The year 2016 offers a good window. NASA's Johnson Space Center estimates the cost of a mission including 3 trips to Mars at $50 billion. A scaled down approach could be done for 20-30 billion in 2000 dollars. On Mars, nuclear power would be needed. Because of dust storms and high wind speeds, a Mars colony would have to be sheltered underground, and need a reliable power supply for heat, transportation, food production, water supply, communications and other life supporting measures. The environment on Mars is very harsh. Temperatures average at below 273 K, and are at 148 K at the Polar Regions. The climate is dry and hostile, threatening the astronauts at every turn. Providing energy, particularly heating for the astronauts cannot depend on solar energy or on radioisotope generators, and needs a nuclear reactor source. A mission composed of 4 astronauts would need a power supply of about 140 kWe. Most radioisotope generators have used plutonium238, and assuming a dynamic conversion system's efficiency of 30 percent, the thermal energy needed for the astronauts is 140 x (100 / 30) = 466.66 kWth. One needs about 1.8 kg of PU238 per kWth produced. Thus one needs: 1.8 x 466.66 = 840 kgs of PU238. This amount is beyond any possible existing supply, and suggests that such a mission, for reliability reasons, would require at least two nuclear reactors producing a thermal power of 0.5 MWth each, for a total of 1 MWth of power. During the Martian day, three solar power systems at 10 kWe each may supplements their needs.

Water Propulsion Good

We have technology the almost in place – and its cheaper

Wall 11, Senior Writer at Idaho National Laboratory, SLACNAL, and Wired Magazine, PhD

(Mike, Space.com, “Water-Powered Spaceship Could Make Mars Trip on the Cheap.” 25 March 2011, http://www.space.com/11230-water-powered-spaceship-mars-solar-system.html, AH)

Spaceships powered primarily by water could open up the solar system to exploration, making flights to Mars and other far-flung locales far cheaper, a recent study has found. A journey to Mars and back in a water-fueled vehicle could cost as little as one space shuttle launch costs today, researchers said. And the idea is to keep these "space coaches" in orbit between trips, so their relative value would grow over time, as the vehicles reduce the need for expensive one-off missions that launch from Earth. The water-powered space coach is just a concept at the moment, but it could become a reality soon enough, researchers said. "It's really a systems integration challenge," said study lead author Brian McConnell, a software engineer and technology entrepreneur. "The fundamental technology is already there."

Water tech spills over and we basically already have it

Wall 11, Senior Writer at Idaho National Laboratory, SLACNAL, and Wired Magazine, PhD

(Mike, Space.com, “Water-Powered Spaceship Could Make Mars Trip on the Cheap.” 25 March 2011, http://www.space.com/11230-water-powered-spaceship-mars-solar-system.html, AH)

"If one party decides to do this, I think it would spur a lot of other activity," McConnell said. "I think countries wouldn't want to get left behind." From vision to reality No huge technological leaps are required to make the space coach a reality, McConnell said. Bigelow's expandable habitats are already space-tested, for example, as are several varieties of electrothermal engine. "There's not a lot of new technology that needs to be built," McConnell said. Electrothermal engines that use water as fuel, however, have not been flight-tested, so some work needs to be done on the propulsion system. McConnell envisions holding a design competition for the engines, as well as one for the overall ship design — cash-reward contests that would be like smaller versions of the Google Lunar X Prize, which is a $30 million private race to the moon. Once winners of these competitions emerge, ground-testing and, eventually, flight-testing would follow. McConnell declined to put forth any specific timelines, but he's optimistic about the possibilities. "I think things could happen very quickly," he said. "It's really just a matter of convincing decision-makers that this is worth getting into."

Water Tech Cheaper / Good

30 times cheaper than a chemical rocket and more efficient – 1 Billion for trip to Mars’ moon

Wall 11, Senior Writer at Idaho National Laboratory, SLACNAL, and Wired Magazine, PhD

(Mike, Space.com, “Water-Powered Spaceship Could Make Mars Trip on the Cheap.” 25 March 2011, http://www.space.com/11230-water-powered-spaceship-mars-solar-system.html, AH)

The dependence on water as the chief propellant would make the space coach a relatively cheap vehicle to operate, researchers said. That's partly because electrothermal engines are so efficient, and partly because the use of water as fuel makes most of the ship consumable, or recyclable. Because there are fewer single-use materials, there's much less dead weight. Water first used for radiation shielding, for example, could later be shunted off to the engines. Combined, these factors would translate into huge savings over a more "traditional" spacecraft mission to Mars using chemical rockets, according to the study. "Altogether, this reduces costs by a factor of 30 times or better," McConnell told SPACE.com. He estimates a roundtrip mission to the Martian moon Phobos, for example, could be made for less than $1 billion. A space coach journey would also be more comfortable, McConnell added. The ship would carry large quantities of water, so astronauts could conceivably grow some food crops and — luxury of luxuries — even take hot baths now and again.

This technology is key to shield radiation and is extremely efficient

Wall 11, Senior Writer at Idaho National Laboratory, SLACNAL, and Wired Magazine, Phd

(Mike, Space.com, “Water-Powered Spaceship Could Make Mars Trip on the Cheap.” 25 March 2011, http://www.space.com/11230-water-powered-spaceship-mars-solar-system.html, AH)

The space coach concept vehicle is water-driven and water-centric, starting with its solar-powered electrothermal engines. These engines would super-heat water, and the resulting steam would then be vented out of a nozzle, producing the necessary amount of thrust. Electrothermal engines are very efficient, and they're well-suited for sustained, low-thrust travel, researchers said. This mode of propulsion would do the lion's share of the work, pushing the space coach from Earth orbit to Mars. Smaller chemical rockets could be called into service from time to time when a rapid change in velocity is needed, McConnell said. The space coach's living quarters would be composed of a series of interconnected habitat modules. These would be expandable and made of fabric, researchers said — much like Bigelow Aerospace's inflatable modules, which have already been deployed and tested in low-Earth orbit. Water would be a big part of the space coach's body, too, according to the study. Packed along the habitat modules, it would provide good radiation shielding. It could also be incorporated into the fabric walls themselves, freezing into a strong, rigid debris shield when the structure is exposed to the extreme cold of space. Rotating the craft could also generate artificial gravity approximating that of Earth in certain parts of the ship, researchers said.

Astronauts > Robonauts

Astronauts are comparatively better for obtaining data – robonauts fail

MIT 2K (Massachussets Inst. Of Technology, “Manned or Unmanned”, 12/10/4, http://web.mit.edu/12.000/www/finalpresentation/mission/manned.html) JPG

The difficulty, and intricacy of data collection on Mars are such that the mission's goal would be best met with a manned mission. Only humans are flexible, adaptable, and autonomous enough to respond to the numerous uncertainties, and surprises that would be encountered on a mission so far away from Earth in space, and time. While it is true that the addition of men to an already complex mission to explore Mars introduces many new risks, problems, and disadvantages, it is also clear that the missions complexity calls for the presence of humans to maximize the likelihood that the mission objective will be met. The ultimate objective of this mission is to find "evidence" of life. However, the mission must also be completed via a "viable mission plan." For the purpose of this mission, a "viable mission plan” can be defined as a plan that maximizes the efficiency of the mission, and the likelihood of achieving success. Considering the difficulty of acquiring funding for an expensive mission such as this, it can be concluded that an unmanned mission would be a better choice. It is undoubtedly less expensive, and is more familiar both to the public, and to scientists, and engineers. Certainly, an unmanned mission seems much more practical than the "romantic" concept of sending people to Mars.  However, the exact concept of efficiency must be outlined in order to accurately assess which is the best method. Does efficiency necessarily always mean the less expensive, and more familiar method? For the purpose of this mission, we decided that efficiency is best defined as how well resources (manpower, and money) are utilized while taking into account the magnitude, and importance of the consequences of the possible courses of action, and possible methods. From this definition, now consider an unmanned mission. It is more likely that several moderately priced unmanned missions could be sent to Mars, but with potentially less than desirable results returned to Earth. It seems clear that the difficulty of designing complicated automated systems to analyze a wide variety of samples, and respond to the many uncertainties that would be encountered on the surface of Mars is so great that the probability of achieving successful results from purely automated missions would be low. This is true purely based on the fact that current technology is not good enough to allow the precision, and versatility necessary to meet the mission's goal. In contrast, the results obtained from a manned mission can be optimized because humans will be immediately available to assess samples, data, and adjust any necessary equipment, etc. In short, humans will be present to adapt to any situation, and examine a much larger quantity of data, and samples with a minimum of cumbersome automation. This reasoning can be supported further by the fact that in the past many automated missions to Mars have proven to be fallible, and the results returned to Earth were far from optimal. A manned mission, while more expensive, and risky, provides extra security, and versatility that is absolutely necessary for this mission.

Astronauts gather comparatively more useful data with a better success rate

Rahls 5 (Chuck, science writer @ Physorg.com, “Manned vs. Unmanned Space Exploration (Part 2)”, 11/25/5, http://www.physorg.com/news8479.html) JPG

While no scientist can deny the value of robotic space exploration, many feel the need for complementary manned programs. Most agree that, for basic survey missions, robotic probes produce dramatic results. It’s in field study that scientist crewed missions could do better. Ironically, it is the same people who run the unmanned space missions that are clamoring for human crewed missions to follow them up. Part of the problem is the limited abilities and scope of each robotic mission. To save money and reduce failure rates to a minimum, robotic probes are stripped down to essentials. Although these probes gather important data, much of it is ambiguous for lack of the probe’s ability to do follow up tests. Today’s robots cannot start up new lines of investigation. Raw data is useful but often raises more questions. Even worse, the data is often completely unexpected leaving the scientists at a loss to explain the results. They need further missions to run different tests and, the cornerstone of all good science – verification by repeatedly testing the same area over time. This repeated testing of results becomes difficult with unmanned mission failure rates. Take the Mars exploration programs: out of 31 missions by the USSR, Russia, the US and Japan since 1960, all but 10 failed and only 5 met their original goals. Compare that to the high success rates of astronaut crewed missions – almost 90%.

Astronauts> Robonauts

Specifically astronauts are better for Mars

Rahls 5 (Chuck, science writer @ Physorg.com, “Manned vs. Unmanned Space Exploration (Part 2)”, 11/25/5, http://www.physorg.com/news8479.html) JPG

Crewed missions are more costly, but also more effective. Human calibrated experiments setup up on the moon by Apollo missions functioned perfectly for 8 years until shut down for fiscal reasons in 1977. Robotic missions, while they may carry similar instruments, are incredibly difficult to place and calibrate. Ruggedness wins over accuracy so instruments are less sensitive and deliver fewer details in the data they collect. Robots must rely on redundancy to deal with any problems while astronauts can creatively solve almost any problem. The Hubble Space telescope was repaired by teams from the Space Shuttle making it one of the most successful missions ever. Geologists make up the most vocal group of proponents for manned missions. While probe data is useful, they contend one mission with a live geologist could answer all their questions in a few weeks, while endless robotic probes may never be able to provide a clear picture of Mars. A geologist can apply all his or her senses to quickly make determinations as to what to study and what to ignore. Robotic probes could easily miss important clues and waste time on unproductive lines of exploration and study. A human still has much acuter vision than even the best video cameras and, more importantly, can process data with to the solar system’s best supercomputer – the human brain – on the spot.

Astronauts are key to solvency – most qualified ev

DailyGalaxy.com 9 (Staff, “Stephen Hawking: Manned vs Robotic Space Missions?”, 6/16/9, http://www.dailygalaxy.com/my\_weblog/2009/06/robotic-missions-are-much-cheaper-and-may-provide-more-scientific--information-but-they-dont-catch-the-public-imagination-in.html) JPG

What is not commonly known however is that many of NASA's leading scientists also champion human exploration as a worthy goal in its own right and as a critically important part of space science in the 21st century. In a past issue of Scientific American Jim Bell, an astronomer and planetary scientist at Cornell University, and author of “Postcards from Mars,”  notes that “…you might think that researchers like me who are involved in robotic space exploration would dismiss astronaut missions as costly and unnecessary.” But he then he goes on, “Although astronaut missions are much more expensive and risky than robotic craft, they are absolutely critical to the success of our exploration program."

\*\*\*Answers 2\*\*\*

OST peace (Article 3 answer)

Mars colonization creates peace and security

Jess, Digital Journal, 9

(Kevin, “Mars colony 'will make the world a better place”, Sept. 9 2009, http://www.digitaljournal.com/article/278997, accessed 6-21-11, AH)

Prominent world thinkers were recently asked for their ideas on what would make the world a better place. Ideas ranged from choosing to drink organic shade-grown coffee to establishing a human colony on Mars. Their suggestions paint a bleak picture of the world's current situation. Some of the concerns addressed were environmental destruction, inequalities in health care and the money driven selfishness of the Western world. The thinkers included such notable people as Richard Dawkins, the evolutionary biologist and prominent atheist, author Margaret Atwood, and Sir Richard Branson, the Virgin entrepreneur. The group did find reasons for hope even if some suggestions were a little far-fetched reports the Telegraph. J. Richard Gott, professor of astrophysical sciences, Princeton University said, "We should establish a self-supporting colony on Mars. That would make us a two-planet species and improve our long-term survival prospects by giving us two chances instead of one. It would change the course of world history - you couldn't even call it world history any more." And he added, "We should do this before money for the space program runs out." Sir Richard Branson agreed with Gott's suggestion saying, "If we are going to survive as a civilisation we need low energy and environmental access to space on an industrial scale." Richard Dawkins said, "The world would be a better place if everybody learned to think like scientists. I don't mean they should know more science, although that would be nice too. I mean that everybody should base their beliefs upon evidence, and be highly suspicious of any beliefs that are not based on evidence."

Exploration legit as long as it maintains peace

Gorove, Chairman of the Graduate Program of the School of Law and Professor of Law,

University of Mississippi, School of Law. 69

(Stephen, “Interpreting Article II of the Outerspace treaty”, *The Fordham Law School Institutional Repository*, Vol.37 issue 3/2, 1-1-69,http://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1966&context=flr, accessed 6-21-11, AH)

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

OST Invalid Already

OST Already invalid -  Vienna law of treaties allows for nation not to be held by treaty if there has been fundamental changes which there has

Quinn, University of Minnesota Law School and Carlson School of Management, 8

(Adam G. “The New Age of Space Law: The Outer Space Treaty and the Weaponization of Space.” *Minnesota Journal of International Law*, 17 Minn. J. Int'l L. 475, Summer 2008, lexis, AH)

While the Outer Space Treaty allows signatories to withdraw on one year's notice, the Treaty itself may actually be invalid under the Vienna Convention on the Law of Treaties. The Treaty Convention recognizes that states ought not to be held by a treaty when there has been a fundamental change in circumstances. A fundamental change is defined as a shift in an expectation closely linked to the purpose of the treaty that was not foreseen by the parties. While international tribunals have been strict in finding a fundamental change of circumstances the Outer Space Treaty would likely be found to have undergone a fundamental change because of the circumstances surrounding its creation, the changes in its interpretation, and because the usage of outer space today is a far cry from what was planned for in the 1960s. "While ... space activities have grown exponentially," space law has remained stagnant.

Politics- Plan Popular (Public)

Mars mission and colonization popular with public

Telecomworldwire 02 (February 2, “Nasa questionnaire finds the public is most interested in missions to Mars” Nexis) NS 5/25/11

Following the posting of an online survey Nasa has found that a majority of respondents considered missions to Mars to be one of the top five priorities. In total, 90% of all those filling in the online questionnaire claimed that exploring Mars was in their top five list of mission priorities. The next most popular destinations were the Moon and Jupiter's moon Europa. Nasa also found that a quarter of all those surveyed said it should look for any potential danger to Earth from space while the same figure would like missions to find out which planets would be suitable for colonisation. The online survey was posted on the Planetary Society web site in order to find out what the general public considered to be the main priorities of Nasa's planetary exploration programme. Over 54,000 people took part in the research in just two weeks.

Americans support manned space missions to maintain leadership

Ron Sachs Communications, 11

AP News, “Poll: Americans Want Space Program to Continue”, 6-7-11, http://www.wctv.tv/APNews/headlines/Poll\_Americans\_Want\_Space\_Program\_to\_Continue\_123358308.html, CH

In a dramatic new Sachs/Mason-Dixon poll, an overwhelming majority of Americans say they don’t want America’s manned space program to end and they believe the United States should continue to be a global leader in space. The results of the poll follow the recent return of the Space Shuttle Endeavour – the penultimate NASA Space shuttle mission. “Human space flight symbolizes American ingenuity, innovation and imagination and any effort to ensure our nation remains at the forefront of manned space flight is strongly supported by the American people,” said Ron Sachs, President of Ron Sachs Communications. “The American people are emotional about maintaining our nation’s leadership in this important scientific endeavor.” Sachs added, “More than two generations after President John F. Kennedy challenged our nation to go ‘to the moon,’ rather than competing, the United States is ceding its leadership to space competitors such as Russia and China.”

AT: Politics—Plan Pop (Congress)

Congress will support anything that bolsters US space leadership—Constellation proves

Whitell, writer for The Times (London), 10

(Giles, The London Times, “A blow to US pride, but the economy is more important”, 6-14-10, lexis, CH)

According to polls, fewer than a third of voters think state-funded human missions back to the Moon and then to Mars and beyond are justifiable in the current economic mess. Yet Congress cannot bear to let Nasa relinquish its global leadership in manned space exploration, which is why it is using every legal tool available to block the plan to force Nasa's contractors to stop building hardware for Constellation. Much of the congressional case rests on one Earthly concern: jobs. More than 2,000 skilled staff depend on Constellation contracts at the Marshall Space Flight Centre in Alabama alone. Thousands more jobs are at risk in Texas, Louisiana, Mississippi and Florida. In Florida, the congressional delegation includes powerful Democrats that Mr [Obama](http://www.lexisnexis.com/lnacui2api/search/XMLCrossLinkSearch.do?bct=A&risb=21_T12163770703&returnToId=20_T12163777463&csi=10939&A=0.9768351258041527&sourceCSI=9369&indexTerm=%23PE000A0BO%23&searchTerm=Obama%20&indexType=P) would prefer not to confront in a midterm election year. There are stronger strategic arguments for maintaining America's lead beyond Earth's orbit.

AT: Econ

Many economic benefits of Mars mission

Livingston 10 (March, Dr. David M., Former member of Board of Directors for the Space Frontier Foundation, founding member of the Mars Society and doctorate in Business Administration, “From Earth to Mars: A Cooperative Plan” Mars Society V. 10) NS 5/24/11

The Benefits of a Mars Mission Despite the problems associated with putting humans on Mars, there are also benefits to be realized from such a mission. Both the public sector and the private sector have unique ways of benefiting from a manned voyage to Mars. Public-sector benefits include increased employment, the allocation of resources away from weapons to a space project, new technologies, scientific discoveries, and higher tax revenues. Some of the private-sector benefits include goodwill and a favorable public image as well as increased revenues and opportunities for corporate growth. High-paying jobs and employment opportunities will result from a Mars project. For example, maintaining and flying the Space Shuttle involves five NASA centers and approximately 25,000 high-paying jobs. A manned Mars mission has equal or greater potential for similar employment opportunities within both the public and private sectors. Another important benefit would be the probable allocation of resources away from military and weapons projects to the Mars project. Resources and talent will be dedicated to designing and developing the Mars mission. New technologies and scientific discoveries, including medical discoveries will certainly result from the Mars mission. Many of these benefits will flow into the commercial sector worldwide. With the private sector involved in this mission, there will be a high incentive to incorporate these developments into new products as soon as possible. There are also advantages that would accrue to a country on the leading edge of this type of technology and science. Not only do its businesses become the first to benefit from developments and discoveries, but as profits are realized tax revenues would increase. The possibility then exists for using these new tax revenues to produce social benefits. The discoveries made and the knowledge learned from having humans on Mars would help us to understand, protect, and control our planet. We certainly gather valuable information from missions that utilize robots, but such missions cannot accomplish what properly trained humans can learn by going to Mars and exploring the planet firsthand. For the private-sector companies participating in the manned mission to Mars, the government can initiate policies that provide them with noncash tax and other incentives, which can certainly minimize or buy down the risk and add to the expected rate of return for their investment. Such use of economic incentives to support private-sector investment has long been a tradition in opening up new industries-the development of the railroads and civil aviation are primary examples. Laws or policies should be adopted which provide private-sector companies with limited exclusive use of the technologies derived from the Mars mission. This type of licensing might be controversial. Some would argue that technologies and products partially funded by public monies belong to everyone, not just certain private-sector companies. Limited licensing would, however, be an important incentive for a company to make an investment in the Mars mission. In a similar context, exclusive media, entertainment, advertising, and sponsorship rights should be granted to those in the private sector who invest in Mars missions, both the initial mission and a subsequent mission There are intangible benefits for private-sector participants as well. A favorable public image and goodwill are important for companies in today's economy. Also, there would be numerous public service opportunities for the companies involved in the Mars mission to make presentations to schools and to use college-level presentations for important job recruiting. People everywhere would have a positive impression of companies helping to send a manned mission to Mars. Most companies could not afford to buy the type of goodwill and image-producing advertisements that would accrue to participants in the Mars mission. Such important benefits can readily be understood by the corporate decision makers.

AT: Too Expensive—History

Their authors flawed—history proves

Zubrin 95 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, “The Economic Viability of Mars Colonization”, http://www.aleph.se/Trans/Tech/Space/mars.html, IWren)

A frequent objection raised against scenarios for the human settlement and terraforming of Mars is that while such projects may be technologically feasible, there is no possible way that they can be paid for. On the surface, the arguments given supporting this position appear to many to be cogent, in that Mars is distant, difficult to access, possesses a hostile environment and has no apparent resources of economic value to export. These arguments appear to be ironclad, yet it must be pointed out that they were also presented in the past as convincing reasons for the utter impracticality of the European settlement of North America and Australia. It is certainly true that the technological and economic problems facing Mars colonization in the 21st century are vastly different in detail than those that had to be overcome in the colonization of the New World in the 17th century, or Australia in the 19th century. Nevertheless, it is my contention that the argument against the feasibility of Mars colonization is flawed by essentially the same false logic and lack of understanding of real economics that resulted in repeated absurd misevaluations of the value of colonial settlements (as opposed to trading posts, plantations, and other extractive activities) on the part of numerous European government ministries during the 400 years following Columbus. During the period of their global ascendancy, the Spanish ignored North America; to them it was nothing but a vast amount of worthless wilderness. In 1781, while Cornwallis was being blockaded into submission at Yorktown, the British deployed their fleet into the Caribbean to seize a few high-income sugar plantation islands from the French. In 1802, Napoleon Bonaparte sold a third of what is now the United States for 2 million dollars. In 1867 the Czar sold off Alaska for a similar pittance. The existence of Australia was known to Europe for two hundred years before the first colony arrived, and no European power even bothered to claim the continent until 1830. These pieces of short-sighted statecraft, almost incomprehensible in their stupidity, are legendary today. Yet their consistency shows a persistent blind spot among policy making groups as to the true sources of wealth and power. I believe that it is certain that two hundred years from now, the current apathy of governments towards the value of extraterrestrial bodies, and Mars in particular, will be viewed in a similar light.

AT: Spending

Their claims are hyperbolic- One-way trips can be done with existing technology at low cost.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Q: How much will sending humans to Mars cost? A: Estimates of the cost of a human Mars exploration program over the years have been wildly disparate, leaving much confusion in their wake. On the high end of the scale was the Space Exploration Initiative proposed by President George H. W. Bush in 1989 at $450 billion; Mars Direct occupies the low end of the scale at roughly $30 billion. Q: Why are cost estimates for a Mars mission so different? A: The differences in cost estimates are mainly due to the amount of new hardware which must be developed and used under any given proposal. Some Mars exploration programs have advocated assembly of large spacecraft either in orbit or on the Moon, while others have called for advanced propulsion systems such as nuclear engines. Developing these new technologies and the infrastructure necessary to support them drives costs up rapidly. Mars Direct achieves its low cost in two ways: by using only existing technologies, adapted for the specifics of a Mars mission, and by generating rocket fuel for the return mission -- by far the largest mass component, and therefore most costly non-development expense of any Mars mission -- on the surface of Mars. Q: Sending humans to Mars is a waste of taxpayer dollars. A: If done in a cost-effective manner such as Mars Direct, human exploration of Mars can be accomplished easily under the existing NASA budget -- which currently accounts for less than 1% of federal discretionary spending. A total mission cost of $30 billion, when spread out over the 20 years envisioned by Mars Direct (10 years to first flight, 10 years afterwards during which fivce missions are flown), represents approximately 10% of the $300 billion NASA budget for that time frame (based upon current annual funding levels of $15 billion).

One way mission solves the link

Makuch and Davies 10 (Dirk Schulze-Makuch – PhD @ Washington State, and Paul Davies, PhD, Arizona State, “[To Boldly Go: A One-Way Human Mission to Mars](http://www.amazon.com/Human-Mission-Mars-Colonizing-Planet/dp/0982955235/ref%3Dsr_1_3?s=books&ie=UTF8&qid=1287364920&sr=1-3)”, Journal of Cosmology, 2010, Vol 12, 3619-3626, Ovtober-November 2010, http://journalofcosmology.com/Mars108.html) JPG

A human mission to Mars is technologically feasible, but hugely expensive requiring enormous financial and political commitments. A creative solution to this dilemma would be a one-way human mission to Mars in place of the manned return mission that remains stuck on the drawing board. Our proposal would cut the costs several fold but ensure at the same time a continuous commitment to the exploration of Mars in particular and space in general. It would also obviate the need for years of rehabilitation for returning astronauts, which would not be an issue if the astronauts were to remain in the low-gravity environment of Mars. We envision that Mars exploration would begin and proceed for a long time on the basis of outbound journeys only. A mission to Mars could use some of the hardware that has been developed for the Moon program. One approach could be to send four astronauts initially, two on each of two space craft, each with a lander and sufficient supplies, to stake a single outpost on Mars. A one-way human mission to Mars would not be a fixed duration project as in the Apollo program, but the first step in establishing a permanent human presence on the planet. The astronauts would be re-supplied on a periodic basis from Earth with basic necessities, but otherwise would be expected to become increasingly proficient at harvesting and utilizing resources available on Mars. Eventually the outpost would reach self-sufficiency, and then it could serve as a hub for a greatly expanded colonization program. There are many reasons why a human colony on Mars is a desirable goal, scientifically and politically. The strategy of one-way missions brings this goal within technological and financial feasibility. Nevertheless, to attain it would require not only major international cooperation, but a return to the exploration spirit and risk-taking ethos of the great period of Earth exploration, from Columbus to Amundsen, but which has nowadays been replaced with a culture of safety and political correctness.

AT: Spending

A one way misson solves financial and political concerns

Schulze-Makuch 10, PHD Washington State University, Davies, Beyond Center Arizona State University (Dirk, Paul, Journal of Cosmology, “To Boldly Go: A One-Way Human Mission to Mars”,October – Novemeber 2010, http://journalofcosmology.com/Mars108.html

Accessed 6-3-11, AH)

A human mission to Mars is technologically feasible, but hugely expensive requiring enormous financial and political commitments. A creative solution to this dilemma would be a one-way human mission to Mars in place of the manned return mission that remains stuck on the drawing board. Our proposal would cut the costs several fold but ensure at the same time a continuous commitment to the exploration of Mars in particular and space in general. It would also obviate the need for years of rehabilitation for returning astronauts, which would not be an issue if the astronauts were to remain in the low-gravity environment of Mars. We envision that Mars exploration would begin and proceed for a long time on the basis of outbound journeys only. A mission to Mars could use some of the hardware that has been developed for the Moon program. One approach could be to send four astronauts initially, two on each of two space craft, each with a lander and sufficient supplies, to stake a single outpost on Mars. A one-way human mission to Mars would not be a fixed duration project as in the Apollo program, but the first step in establishing a permanent human presence on the planet. The astronauts would be re-supplied on a periodic basis from Earth with basic necessities, but otherwise would be expected to become increasingly proficient at harvesting and utilizing resources available on Mars. Eventually the outpost would reach self-sufficiency, and then it could serve as a hub for a greatly expanded colonization program. There are many reasons why a human colony on Mars is a desirable goal, scientifically and politically. The strategy of one-way missions brings this goal within technological and financial feasibility. Nevertheless, to attain it would require not only major international cooperation, but a return to the exploration spirit and risk-taking ethos of the great period of Earth exploration, from Columbus to Amundsen, but which has nowadays been replaced with a culture of safety and political correctness.

A one way Mission avoids spending issues – cuts costs by 80 percent. It also solves risky colonization issues and avoids politics disads

Schulze-Makuch 10, PHD Washington State University, Davies, Beyond Center Arizona State University, (Dirk, Paul, Journal of Cosmology, “To Boldly Go: A One-Way Human Mission to Mars”,October – Novemeber 2010, http://journalofcosmology.com/Mars108.html

Accessed 6-3-11, AH)

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

AT: Spending

Turn- Mars missions stimulate the economy.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Funds allocated to a Mars exploration program are not simply disappearing from the American economy, either -- indeed, the vast majority of those $30 billion goes to pay the salaries of engineers, support staff, even factory workers whose plants would assemble the hardware necessary for Mars missions. Meanwhile, the technological advances that are a natural by-product of space exploration programs -- which in the past have included MRIs, velcro, and the microwave oven, to name a few -- will help drive economic activity for years to come.

AT: Mission Tradeoff

Turn- The mission actually supports other project development.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Q: Won't sending humans to Mars distract NASA from other important work?

A: A properly managed humans to Mars program can be accomplished without unduly burdening NASA resources, budgetary or otherwise. This can be best illustrated in terms of the percentage of launches -- expressed in terms of current Shuttle launches -- necessary to support Mars Direct. Before the Columbia disaster, NASA averaged six Shuttle launches per year. Mars Direct requires two launches per Mars launch window-- roughly one launch per year. This means that a sustained human Mars exploration program can be accomplished using 16% of NASA launch capability, leaving plenty of room for other projects. Additionally, if the hardware necessary for Mars exploration is constructed in a modular fashion, subsets or recombinations thereof could be used to support other programs, such as the Lunar base envisioned in President Bush's recently announced initiative. Using one design in multiple missions drastically cuts costs and development times, and could thus actually accelerate other exploration programs.

AT: Mission Tradeoff

Only Mars can save future space missions.

Thompson, PhD, 2011 (Loren, the Lexington Institute, *The Mars Society,* “NASA's Human Spaceflight Program Is Dying And Only Mars Can Save It”, 4/25/2011, accessed 6/20/11, http://www.marssociety.org/home/press/news/nasashumanspaceflightprogramisdyingandonlymarscansaveit) KF

The greatest adventure in human history is ending in its infancy. NASA's human spaceflight program, a signature achievement of American civilization, is dying. The program was conceived during the bleak days following Russia's launch of Sputnik in 1957, and then was energized by President John F. Kennedy's proposal in 1961 to put astronauts on the Moon by decade's end. NASA succeeded, landing Neil Armstrong and Edwin (Buzz) Aldrin on the lunar surface only 98 months after Kennedy inspired the nation with his vision. If you grew up during that decade (as I did) and heard the bold rhetoric about new frontiers and carrying freedom's message into the cosmos, you couldn't help but be moved. America had a sense of mission back then that is largely missing from political discourse today, and the human spaceflight program epitomized the hopes of a new generation for the future. It is unsettling to see how our confidence has shriveled during the intervening years, both at NASA and in the broader political culture. At NASA, the Space Shuttle program is about to shut down and the Constellation program conceived to replace it with manned missions to the Moon and Mars has been canceled by the Obama Administration. What remains of the human spaceflight program looks unlikely to survive an era of budget cutting and cultural pessimism. There is only one way that the human spaceflight program can be rescued from the decaying orbit into which it was launched by the Challenger disaster in 1986: NASA must define a goal for the program that justifies the vast expenditures required and inspires the nation in the same way President Kennedy did in 1961. Going back to the Moon or visiting an asteroid won't do the trick. Only a series of manned missions to Mars will. Our astronauts will need to go to other places before they attempt a landing on the Martian surface, but if those missions aren't justified as initial steps in a long-term plan to visit the Red Planet, then they aren't going to happen. To put it bluntly, the public doesn't care about spending hundreds of billions of dollars to go someplace we already went a generation ago. It needs a new destination and a new rationale to convince it that NASA's human spaceflight program still makes sense. A series of missions to Mars answers the mail because the Red Planet is by far the most Earth-like place in the reachable universe beyond our own world. It has water. It has sunlight. It has atmosphere. It has seasons. In fact, it probably has everything required to support a self-sustaining human colony someday -- unlike the other planets, or the Moon, or an asteroid. And it also has a host of lessons to teach us about the fate of our own planet as the solar system evolves, because it is clear that the Martian environment has changed greatly over time. Mars was once a warmer, wetter place, perhaps a place hosting life. It may still host life today, although conditions seem to have grown more hostile. But we'll never know unless we put men and women on the Martian surface for an extended period to investigate.

Mars key to getting congressional support of other missions.

Thompson, PhD, 2011 (Loren, the Lexington Institute, *Human Spaceflight: Mars is the destination that matters,* April, accessed 6/20/11, http://www.lexingtoninstitute.org/library/resources/documents/Defense/HumanSpaceflight-Mars.pdf) KF

NASA’s human spaceflight program has been gradually losing ground since the Challenger disaster 25 years ago. Retirement of the Space Shuttle fleet and cancellation of the Bush Administration’s Constellation program signal an uncertain future for one of the most important scientific initiatives in human history. Although Congress and the Obama Administration have cobbled together a framework for proceeding with future missions, human spaceflight today lacks a core mission or rationale that can sustain political support during a period of severe fiscal stress. Mars is the sole destination for the human spaceflight program that can generate sufficient scientific benefits to justify the scale of expenditures required. It is also the only destination likely to sustain political support across multiple presidential administrations. Mars is the most Earth-like place in the known universe beyond our own planet, and it is the one location that could conceivably support a self-sustaining human colony. It has water, seasons, atmosphere and other features that may hold important lessons for the future of the Earth, but unlocking those lessons would require a sustained human presence on the Red Planet’s surface.

AT: Mission Tradeoff

Mars colonization is popular.

Thompson, PhD, 2011 (Loren, the Lexington Institute, Human Spaceflight: Mars is the destination that matters, April, accessed 6/20/11, http://www.lexingtoninstitute.org/library/resources/documents/Defense/HumanSpaceflight-Mars.pdf) KF

This all makes sense from a budgetary and scientific perspective. What’s missing is a grasp of the rationale required to sustain political support across multiple administrations. While exploration of the Moon’s far side or nearby asteroids may have major scientific benefits, those benefits are unlikely to be appreciated by politicians struggling to reconcile record deficits. NASA’s current research plans do not connect well with the policy agendas of either major political party, and the flexible path will not change that. To justify investments of hundreds of billions of dollars in human spaceflight over the next 20 years while entitlements are being pared and taxes are increasing, NASA must offer a justification for its efforts commensurate with the sacrifices required. Mars is the only objective of sufficient interest or importance that can fill that role. Thus, the framework of missions undertaken pursuant to the flexible-path approach must always be linked to the ultimate goal of putting human beings on the Martian surface, and the investments made must be justified mainly on that basis. The American public can be convinced to support a costly series of steps leading to a worthwhile objective, but trips to the Moon and near-Earth objects aren’t likely to generate sustained political support during a period of severe fiscal stress.

Mars colonization key to tech development.

Thompson, PhD, 2011 (Loren, the Lexington Institute, Human Spaceflight: Mars is the destination that matters, April, accessed 6/20/11, http://www.lexingtoninstitute.org/library/resources/documents/Defense/HumanSpaceflight-Mars.pdf) KF

By establishing Mars as the defining mission -- with SLS and MPCV as the foundational transport elements -- the stepping-stone approach can identify the intermediate missions and the incremental capabilities required to accomplish each new milestone. NASA and industry thus will understand technology gaps against which development roadmaps can be created, including “on-ramps” for technology breakthroughs and “off-ramps” for technology mis-steps. This will provide the space community with a stable and predictable future to ensure the necessary workforce is maintained, challenged and matured. Once the human spaceflight program moves beyond low-earth orbital missions, astronauts will also require new “extravehicular activity” (EVA) spacesuits and modules, and various robotic systems to assist them in space. The advanced cryogenic propulsion stage developed under the Ares upper-stage contract will be needed if NASA elects to return to the Moon, and a deep-space habitat will have to be developed if it elects to visit near-Earth asteroids. In the near term, though, NASA’s human spaceflight budget will be dominated by spending for the Space Launch System and Multi-Purpose Crew Vehicle. Those investments are essential requirements for continuation of the human spaceflight program, no matter what its planned objectives are. If Mars is to be the ultimate goal, then both systems must be developed with sufficient growth potential to evolve beyond their baseline configurations. For instance, the launcher may initially be able to loft a 130 metric-ton payload into orbit and 50 metric tons to fast-enough velocity to escape Earth’s gravity well, but eventually technology advances will be needed so that more challenging deep-space destinations can be reached. It will take some time for NASA to sort out its technology options and organize a development strategy that fits within projected budgets. The most important thing it must do in framing that strategy is to offer the public a vision of what human spaceflight can achieve if put on a stable course. The key to making that vision viable and sustainable is to provide a pathway to Mars -- the most Earth-like object in the reachable universe beyond our own planet, and the only planet that might one day host a self-sustaining human colony.

AT: Mission Tradeoff

Mars colonization key to future missions.

Bolden, NASA administrator, 2011 (Charles, *Federal News Serivce, “*REMARKS BY NASA ADMINISTRATOR CHARLES BOLDEN TO THE CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES (CSIS) (AS RELEASED BY NASA)”, 3/10/2011, Lexis) KF

Over the next decade, innovative technology investments are required to bring future missions, such as exploration of near-Earth objects, the Moon, and Mars within our reach. These transformative technologies will reduce the cost and risk of future missions. Similarly, technology needs abound in deep space exploration, astrophysics, aeronautics, and Earth science. In each case, NASA technology investment is critical - for without such an investment, these future missions will simply not occur.

Achieving great things also involves taking informed risk. The space program needs to return to our roots of informed and measured risk taking. Exploration and innovation have always come with risk. In fact, if we do not understand, accept and even embrace risk, we cannot move forward boldly. Landing on Mars will never be a low-risk venture, nor will the development of a telescope capable of detecting Earth- size planets around other stars, or the flight of a new generation of human-rated space systems. Our nation needs to dream big and these are precisely the right missions for NASA to pursue. An informed risk- taking strategy, commensurate with the agency's goals and expectations is not only acceptable, but also required.

AT: Brain Drain- Biotech

Colonizing Mars would lead to better biotech and other technological advancements

Schulze-Makuch, Associate Professor for the Department of Geology at Washington State University, and Davies, Astrobiologist working at Arizona State University, 10

(Dirk and Paul, *Journal of Cosmology*, “To Boldly Go: A One-Way Human Mission to Mars,” October-November, <http://journalofcosmology.com/Mars108.html>, 6-21-11, SRF)

In addition to offering humanity a "lifeboat" in the event of a mega-catastrophe, a Mars colony is attractive for other reasons. Astrobiologists agree that there is a fair probability that Mars hosts, or once hosted, microbial life, perhaps deep beneath the surface (Lederberg and Sagan 1962; Levin 2010; Levin and Straat 1977, 1981; McKay and Stoker 1989; McKay et al. 1996; Baker et al. 2005; Schulze-Makuch et al. 2005, 2008, Darling and Schulze-Makuch 2010; Wierzchos et al. 2010; Mahaney and Dohm 2010). A scientific facility on Mars might therefore be a unique opportunity to study an alien life form and a second evolutionary record, and to develop novel biotechnology therefrom. At the very least, an intensive study of ancient and modern Mars will cast important light on the origin of life on Earth. Mars also conceals a wealth of geological and astronomical data that is almost impossible to access from Earth using robotic probes. A permanent human presence on Mars would open the way to comparative planetology on a scale unimagined by any former generation. In the fullness of time, a Mars base would offer a springboard for human/robotic exploration of the outer solar system and the asteroid belt. Finally, establishing a permanent multicultural and multinational human presence on another world would have major beneficial political and social implications for Earth, and serve as a strong unifying and uplifting theme for all humanity.

the problem with this ^ card is it says biotechnology would be developed from studying alien life

The plan overcomes current limits on progress and causes massive advances in biotechnology and other areas

Dark, Assistant Professor in the Department of Political Science at California State University, 06

(Taylor E., “Reclaiming the Future: Space Advocacy and the Idea of Progress”, 9-(19-21)-06, pages 8-9, <http://taylordark.com/T.%20Dark%20--%20NASA%20conference%20paper.pdf>, 6-21-11, SRF)

The modern view of progress is resolutely opposed to the idea of limits, including limits in space and time on the growth of the human species. It is perfectly logical, therefore, that many authors see the rise in recent decades of the idea of “limits to growth” as signaling the decisive end of the idea (and reality) of progress in our time. “The belated discovery that the Earth’s ecology will no longer sustain an indefinite expansion of productive forces deals the final blow to the belief in progress,” Christopher Lasch confidently asserts. 7 Space advocates will have none of this. Responding to the first appearance of the “limits to growth” idea, pro-space intellectuals of the 1970s were eager to assert that space could be the source of limitless new reserves of energy and natural resources. In promoting his scheme of magnificent L-5 colonies, Gerard K. O’Neill wrote: The human race stands now on the threshold of a new frontier, whose richness surpasses a thousand fold that of the new western world of five hundred years ago. That frontier can be exploited for all of humanity, and its ultimate extent is a land area many thousands of times that of the entire Earth. As little as ten years ago we lacked the technical capability to exploit that frontier. Now we have that capability, and if we have the willpower to use it we9 cannot only benefit all humankind, but also spare our threatened planet and permit its recovery from the ravages of the industrial revolution. 8 Based on his calculations (which assumed a robust and cost-efficient space shuttle fleet), O’Neill thought it quite possible for a space colony to be “in place, with its productive capacity benefitting the Earth, before 1990.” 9 More recent space advocates have also been insistent that the development of space resources would overcome all resource constraints. Robert Zubrin, in his 1996 vision of Mars colonization, writes: “We can establish our first output on Mars within a decade, using welldemonstrated techniques of brass-tack engineering backed up by our pioneer forebears’ common sense.” Once settled on Mars, the colonists would find the opportunities for growth to be immense: “Virtually every element of significant interest to industry is known to exist on the Red Planet.” Eventually, the Mars colonists would venture off to the nearby asteroid belt, where they would find vast mineralogical resources just waiting to be tapped. The ultimate outcome would be a “triangle trade” similar to that which existed between Britain, the North American colonies, and the West Indies during the 18th century. In the twenty-first century version, Earth would supply “high technology manufactured goods to Mars,” Mars would supply “low-technology manufactured goods and food staples to the asteroid belt,” and the workers in the asteroid belt would send precious metals back to Earth. The new Martian civilization would also be a “hotbed of invention,” producing “wave after wave of invention in energy production, automation and robotics, biotechnology, and other areas.” As a result, Mars colonization “will dramatically advance the human condition in the twenty-first century.” 10

Space initiatives cause progress

Dark, Assistant Professor in the Department of Political Science at California State University, 06

(Taylor E., “Reclaiming the Future: Space Advocacy and the Idea of Progress”, 9-(19-21)-06, page 2, <http://taylordark.com/T.%20Dark%20--%20NASA%20conference%20paper.pdf>, 6-21-11, SRF)

Americans have been more deeply wedded to the idea of progress than perhaps any people on the face of the Earth. The key claim of the idea of progress – that human civilization has moved and will continue to move in a desirable direction – has been central to American culture and identity for virtually all of the nation’s history. Indeed, many would argue that a profound 2 faith in progress has been one of the key features distinguishing Americans from people elsewhere, and a recurring source of the country’s distinctive appeal across the globe. What happens, then, when the idea of progress starts to lose credibility? How do Americans react when they become fearful that the direction of society has become negative, rather than positive? The period of the late 1960s and early 1970s provides an example of a time when the American faith in progress started to unravel. While belief in progress has arguably recovered partially, most observers would still view the late sixties as a turning point after which the idea came under siege2 in ways that had not been experienced previously. The argument of this essay is that the rise of new forms and doctrines of space advocacy reflects exactly this crisis in the idea of progress. If the forward march of humanity (with America noticeably in the lead) had been halted, something had to be done. A movement into space was proposed as the solution. Thus was born the modern pro-space movement, and the contemporary fusion of the idea of progress with ideas about space travel, space development, and, most of all, space colonization. Over the last forty years, space advocates have constructed a set of doctrines that addresses all the key components found in the idea of progress since it first took modern form during the Enlightenment. This new pro-space ideology was a reaction to the problems that had become apparent by the time of the first Moon landing; namely, environmental crises, limits to economic growth, and fears of cultural decay. Space advocates proposed solutions to these problems, and others. They concluded that an expanded space program was the essential condition to revive both the idea and reality of progress. The irony was that they embraced this belief at the very moment that the Apollo program was coming to a close, and the future of NASA and space travel becoming increasingly uncertain. Thus, a strong edge of anxiety and urgency was introduced into the writings of space advocates. The means to ensure progress had been found, but would soon be lost forever if government policy was not properly adjusted. This combination of certainty about the path toward redemption alongside anxiety about the possibility of missing a singular opportunity energized the new pro-space literature, and encouraged the growth of an accompanying space advocacy movement.

AT: International Actor/Private Sector CP—Normal Means

International and commercial sector cooperation is normal means

Kaplan 10 (Jeremy, Oct 27, Fox News, “The Race to the Red Planet”, http://www.foxnews.com/scitech/2010/10/27/road-red-planet-mars-nasa-china/) CH

"If there is a race, the major and minor players are yet to be determined," he told FoxNews.com. "And unlike the Cold War space race, it may not be one to show off technological superiority -- but one that is focused on partnerships for resource needs (terrestrially, such as oil and [food](http://www.foxnews.com/scitech/2010/10/27/road-red-planet-mars-nasa-china/)), and/or political standing. Commercial interests on celestial bodies would be a possibility, but a longer term one." Hertzfeld noted the key issue standing before the U.S. and NASA when it comes to reaching Mars: money. And he asked: "Will either the U.S. or China (or someone else) commit the large amount of capital over a long period of time to these projects?" NASA is currently coordinating with a variety of commercial businesses to facilitate manned missions to Mars, including SpaceX, the United Launch Alliance (a partnership that includes Boeing Corp.), Orbital Sciences Corp., and others. Which one will successfully build our next-generation rocket for manned spaceflight remains a much debated question -- and representatives from NASA did not respond to multiple requests from FoxNews.com for comments for this story. NASA isn't resting on its laurels, however, or leaving the entire mission up to private [enterprise](http://www.foxnews.com/scitech/2010/10/27/road-red-planet-mars-nasa-china/). The space agency has given the green light for development of a 2013 Mars orbiter mission to investigate the mystery of how Mars lost much of its atmosphere, a program called the Mars Atmosphere and Volatile Evolution ([Maven](http://www.nasa.gov/maven)) mission.

AT: Private Sector CP—Cost

Only governments can pay for colonization at current projections—costs prohibit private groups

Zubrin 95 (Robert, aerospace engineer at Lockheed Martin and author of numerous books on Mars exploration, “The Economic Viability of Mars Colonization”, http://www.aleph.se/Trans/Tech/Space/mars.html, IWren)

Let us consider two models of how humans might emigrate to Mars; a government sponsored model and a privately sponsored model. If government sponsorship is available, the technological means required for immigration on a significant scale are essentially available today. In fig. 2 we see one version of such a concept that could be used to transport immigrants to Mars. An Shuttle derived heavy lift launch vehicle lifts 145 tonnes (A Saturn V had about this same capacity) to low Earth orbit, then a nuclear thermal rocket (NTR, such as was demonstrated in the USA in the 1960's) stage with an Isp of 900 s hurls a 70 tonne "habcraft" onto a 7 month trajectory to Mars. Arriving at Mars, the habcraft uses its biconic shell to aerobrake, and then parachutes and lands on its own sets of methane/oxygen engines. The habcraft is 8 meters in diameter and includes four complete habitation decks, for a total living area of 200 m2, allowing it to adequately house 24 people in space and on Mars. Expansion area is available in the fifth (uppermost) deck after the cargo it contains is unloaded upon arrival. Fig. 2. An NTR augmented heavy lift launch vehicle, capable of transporting 24 colonists 1-way to the Red Planet. Thus in a single booster launch, 24 people, complete with their housing and tools, can be transported one way from Earth to Mars. Now let us assume that starting in 2030 AD, an average of four such boosters are launched every year from Earth. If we then make various reasonable demographic assumptions, the population curve for Mars can be computed. The results are shown in fig. 3. Examining the graph, we see that with this level of effort (and the technology frozen at late 20th Century levels forever), the rate of human population growth of Mars in the 21st Century would be about 1/5th that experienced by colonial America in the 17th and 18th Centuries. Fig. 3. Colonization of Mars compared to North America. Analysis assumes 100 immigrants/year starting in 2030, increasing at 2% annual rate, 50/50 male/female. All immigrants are between ages 20 and 40. Average of 3.5 children to an ideal Martian family. Mortality rates are 0.1% per year between ages 0 and 59, 1% between ages 60 and 79, 10% per year for those over 80. This in itself is a very significant result. What it means is that the distance to Mars and the transportation challenge that it implies is not a major obstacle to the initiation of a human civilization on the Red Planet. Rather the key questions become those of resource utilization, growing food, building housing, and manufacturing all sorts of useful goods on the surface of Mars. Moreover the projected population growth rate, 1/5th that of Colonial America, while a bit slow, is significant on a historical scale, and assuming a cost of $1 billion per launch, the $4 billion per year program cost could be sustained for some time by any major power on Earth that cared to plant the seeds of its posterity on Mars. However, with a cost per launch of about $1 billion, the cost per immigrant would be $40 million. Such a price might be affordable to governments (for a time), but not to individuals or private groups. If Mars is ever to benefit from the dynamic energy of large numbers of immigrants motivated by personal choice to seek to make their mark in a new world, the transportation fee will have to drop a lot lower than this. Let us therefore examine an alternative model to see how low it is likely to drop.

AT: Privates

Private mechanisms fail—funding and missile regulations

Astrobiology Magazine 11 (February 15, “Mars, Brought to You by Cooperate Sponsers” Nexis) NS 5/26/11

It could be argued that NASA and other government space agencies should spearhead a human mission to Mars instead of corporations because of cost and safety. Man has never stepped foot on**Mars,** and like the Apollo mission that sent men to the Moon, the mission to **Mars** would need teams of engineers and other scientists working together over many years, with cost concerns more about staying under a projected budget than earning big profits. Governments also pioneered space travel due to the risky and untested aspects of venturing into such territory. Only after pushing boundaries to make voyages into space safer, more routine and less expensive, could business go where they once feared to tread. "I think it likely most people would find it difficult to conceive there wouldn't be any government involvement in such a mission," said space-law expert Timothy Nelson at New York-based law firm Skadden. "The possession of a rocket alone would probably trip you up on the military regulations that govern the ownership of missile technology in the United States. Not to sound too cynical, but space rockets were built as a byproduct of the arms race." There is no ban on putting ads on the sides of spacecraft or for licensing TV broadcast rights on such missions in the existing law regarding outer space, Nelson said. "The question becomes, economically, whether you can generate enough license fee revenue to pay for what you're trying to do," he said. In addition, "how much can one get exclusive rights to cover something as newsworthy as a human Mars mission?" Nelson asked. "I could imagine other media outlets arguing they had the right to report on it as news. Also, I can't help but think that if only one company in the world had the right to broadcast the mission, that would lead some people to view the mission as a hoax and a conspiracy. "There was a movie about that very idea, called 'Capricorn One.' To quell those kinds of doubts, you want to make such a mission as transparent as possible." As to land and other rights, "There's going to have to be an international organization deciding what you can or can't do on Mars," Levine said. "I don't think we can say we can divide up Mars and sell it." Indeed, there is no accepted international system for the licensing of mineral rights on the celestial bodies, including Mars. "There are web sites that tell you they can sell you a title deed to a celestial body, but unless there is an internationally recognized and sanctioned system for the utilization of resources in outer space, then you buy or sell those at your own risk," Nelson said.

Government involvement in a manned mission to Mars is necessary

Livingston 10 (March, Dr. David M., Former member of Board of Directors for the Space Frontier Foundation, founding member of the Mars Society and doctorate in Business Administration, “From Earth to Mars: A Cooperative Plan” Mars Society V. 10) NS 5/24/11

Government support for the manned mission to Mars is essential, even if the private sector is a significant participant in all aspects of the project. Whether NASA's and the government's influence on space matters is deserved or not, the fact is that everyone looks to these entities to approve new space projects. A space mission that is not endorsed by the government or its primary space agency, NASA, is extremely difficult to plan, finance, market, and initiate. At the present time, there is no support from the government or NASA for a manned flight to Mars.

AT: Privates

No private sector interest in Mars settlement

Livingston 10 (March, Dr. David M., Former member of Board of Directors for the Space Frontier Foundation, founding member of the Mars Society and doctorate in Business Administration, “From Earth to Mars: A Cooperative Plan” Mars Society V. 10) NS 5/24/11

A further reason that makes this Mars mission so daunting is that private-sector benefits are questionable. Simply put, sending humans to Mars is not a priority for businessmen and women unless they can clearly see a way to benefit from their investment. Nor is sending humans to Mars a priority for politicians in the United States or elsewhere. Missing Factors Important qualities are missing in both the public and private sectors that would allow for the development of a Mars mission. Some of the qualities overlap the two sectors. Certainly missing from the public sector is commitment and actual budget allocations for the mission. The citizenry, and officials in government, must be educated about the benefits of a manned mission to Mars. In similar fashion, missing from the private sector is commitment and, in particular, a willingness to play a significant role in the actual mission. Furthermore, those in the private sector need to understand the potential benefits of the mission and how these benefits might generate future value for shareholders. The opportunity to set a national priority or goal for placing humans on Mars rests with the public sector. Yet there is simply no national leadership or will to energize and mobilize toward such a purpose. Without the support of national leadership, such a mission would be virtually impossible to undertake. Inspiring leadership can make possible extraordinary results. In the case of the public sector, an entire economic powerhouse can be directed toward this mission if its leadership is effective and convinced of the project's value. Such leaders would clearly explain the purpose, the why's and how's of the mission and with the people by his side, see the mission through to its conclusion. President Kennedy inspiringly led the nation in seeing that there was value in going to the Moon. Later, toward the end of the Apollo program, other national issues took priority over continuing with Apollo and the national leadership of the time no longer connected Moon trips with value for the country and the people. Thus, the Apollo program disappeared as its previously strong support waned. In the years since the end of Apollo, our political leadership has not even attempted make a case that there is any value in returning to the Moon. Putting humans on Mars is even more abstract for most people than returning people to the Moon. In addition, there is currently no national or public effort to make an investment in such a venture, nor are there any budget allocations for even planning a manned mission to Mars. Certainly there are budget allocations for robotic and scientific missions to Mars. Investment also continues to be made in a public space program comprising low Earth orbit, asteroid, lunar, Mars, and other planetary and exploratory missions. Hopefully these space program investments will produce useful and important data that will someday contribute to our putting humans on Mars. Without specific national investments and budget allocations, however, it is doubtful that a manned mission to Mars can even begin its development stage.

AT: Privatization CP

Space industry isn’t key to US economy—it’s a strategic interest, not economic

Logsdon, Director of the Space Policy Institute at George Washington University, 3

(John M, Astropolitics, “Reflection on Space as a Vital National Interest”, <http://www2.gwu.edu/~spi/assets/docs/space_as_a_national_interest.pdf>, CH)

For example, Lt. Col. Peter Hays of the National Defense University has noted that the approximately $80 billion in annual revenues attributed to the commercial space sector is a rather small amount when compared to other areas of economic activity, and thus that “space-only revenues and valuations have never yet been that big a part of the US economy.” He concludes that space is “simply not a dominant sector or an economic COG [center of gravity] in terms of overall value, revenues, or market capitalization.” Rather, suggests Hays, in economic terms space is best seen as a strategic sector, important as part of the larger global information infrastructure for national security, public services and commercial discourse, and a sector that needs to be valued “in a variety of ways other than just in terms of economics.” 15

AT: Stop at The Moon CP

Stopping at the moon takes more energy and effort than a straight trip.

Mars Society, No Date (The Mars Society, “Society FAQ”, no date given [between ’05 and ‘07], <http://www.marssociety.org/home/about/faq>) SW

Q: Wouldn't launches from or refueling stops at a Moon base be easier than going straight from Earth to Mars?

A: As it turns out, the Delta-V (change in velocity; the energy needs of a mission go up as the Delta-V required goes up) required to get from Low Earth Orbit (LEO) to the surface of the Moon is actually greater than to get from LEO to the surface of Mars! This is because spaceships going to Mars can use a technique called aerobraking -- using the resistance from a planet's atmosphere to slow a moving body -- whereas Moon ships must expend more energy to slow themselves down. In order to get to the surface of the Moon, a Delta-V of 6 km/s is required -- 3.2 km/s to get from LEO to the Moon, 0.9 km/s to slow into Lunar orbit, and 1.9 km/s to slow from orbit into actual landing. To get to the surface of Mars (given a launch with Mars at conjunction), a Delta-V of 4.5 km/s is required -- 4.1 km/s to get to Mars, 0.1 km/s for post-aerocapture orbit adjustments, and 0.4 km/s to slow from post-atmospheric-entry speeds. Therefore, using the Moon as a refueling point is pointless, as simply getting there is more difficult than going straight to Mars. Since the raw materials and infrastructure necessary to construct spaceships do not exist on the Moon, everything that would be launched from the Moon would have to come from Earth to start with. Again, given the fact that stopping by the Moon is more difficult than going straight to Mars, it makes no sense to move the necessary materials to the Moon on their way to Mars.

NASA Best

NASA provides better direction on the Mars mission and working with other countries doesn’t solve our leadership advantage

Mclane, American Institute of Aeronautics and Astronautics, 10

(James, The Space Review, 6-1-10, “Mars as the key to NASA’s future”, http://www.thespacereview.com/article/1635/1, accessed 6-9-11, JG)

Such a program would receive enthusiastic, unwavering financial support when the entire world understands that humanity is finally embarked on a dramatic new course out into the universe. Just like the wildly successful (and profitable) Apollo moon landing effort, the human Mars landing should be an all-American project. Some experts claim that the return on investment (ROI) to the US from new and applied technology acquired during Apollo was as much as ten dollars in public benefit for each dollar our government spent. For a manned Mars program, do we really want to invite other countries to be partners and then have to share the tremendous ROI with them? The program will require new ways to work with the massively consolidated contractors who now dominate the American aerospace business. NASA can certainly provide better leadership, decision-making, and direction than it has demonstrated in recent years. While the new administrator has brought hope for a renaissance in attitude at NASA, a successful manned Mars program will require superior technical leaders at all levels.

Perm: Do both – Solves the counterplan without triggering our leadership impact

Stone, Space Policy Strategist, 11

(Josh, The Space Review, 5-16-11, “Collective assurance vs. independence in national space policies”, http://www.thespacereview.com/article/1843/1, accessed 6-11-11, JG)

As the US current space policy notes, every nation has the right to access and use space. Each nation has the right to develop its own nationally-focused “unilateral” space policies that serve to advance their vital interests in security, prestige, and wealth as the baseline for any international cooperation they choose to support. Failure to invest in bold, ambitious space efforts with a national tone (in all sectors) in space will not only hurt the US space industry, but will harm our nation’s ability to advance its global interests in space, impact our traditional vital interests of independence and achievement, and threaten the very preeminence that we have labored so hard to achieve over the past fifty years. If our goal is the advancement of a global exploration program in space, then fine, but the US needs to observe that other nations and partnerships such as the EU and Russia appear to be taking an alternate path toward increased domestic space capabilities and expanded infrastructure for national interests. They are pressing ahead with their goals to step into the vacuum of leadership that the US is allowing through the shutdown of US programs, abandoning capabilities, and allowing the loss of large numbers of skilled space workers. Our next space policy and strategy, while including international efforts of mutual benefit, should focus on advancing American capability and enable a long range strategy for exploration and enhanced military capabilities in space, just as our friends the Europeans are pursuing.

NASA Best

Perm: Do the plan and then jointly do it with (insert country) – American leadership is a pre-requisite to international solvency

Stone, Space Policy Strategist, 11

(Josh, The Space Review, 3-14-11, “American leadership in space: leadership through capability”, http://www.thespacereview.com/article/1797/1, accessed 6-11-11, JG)

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. 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”.

Perm only way to solve our leadership advantage – counterplan triggers it

Stone, Space Policy Strategist, 10

(Josh, The Space Review, 3-15-11, “Space export control reform: the different school of thought and a proposed way forward”, http://www.thespacereview.com/article/1587/1, accessed 6-12-11, JG)

The United States must remember that, despite a push for globalization and the trend of national strategy to embrace globalization and the global economic system in trade, its primary responsibility is to protect the sovereignty of the country and provide for the common defense as stated in the Constitution. In order to do this, America must maintain not just an edge over our peer and near-peer competitors on the world stage but also preeminence and preferably clear leadership in the areas of space. As one historian noted, John F. Kennedy understood that in order to maintain the top leadership position on Earth, a nation must maintain its leadership in space. This “High Ground” must be led by the United States and, with its cooperation and partnership of its allies, allow for freedom of access in space and to space capabilities. The United States must protect what it needs to and allow the industry to become the leading power economically with regards to space. Without a strong industrial base that is fully integrated into the planning and strategy-crafting processes of the national security space enterprise, our industry will eventually cease having the ability to effectively develop high-quality spacecraft and launch vehicles needed to maintain space leadership, much less that of a superpower.

NASA Best

Here’s more pre-requisite ev.

Smith, PhD International Relations, 11

(M.V., Politics and International Relations, The Space Review, “American leadership in space: leadership through capability”, http://www.thespacereview.com/article/1797/1, accessed 6-11-11, JG)

Mr. Stone makes a brilliant point in this article that I'd like to highlight and emphasize. "American leadership in space" does NOT imply dominance or hegemony, as many detractors assert. It simply means being the best at spacefaring activities. Unless America is recognized as the best at key spacefaring capabilities, no one will care to partner with us for any reason other than to constrain our freedom of action and to pick our pockets of classified data and intellectual property. Being the best means doing things routinely that others cannot, and promoting the operational and industrial bases that produce such performance. Ignoring the strategic importance of national spacepower across the civil and security sectors has resulted in failure to make timely decisions. As Mr. Stone points out, we now have no way to lift astronauts to the ISS, but we also have allowed our space industrial base to atrophy in several critical areas. Great care must be taken to ensure the implementation of the Obama administration's space policy does not result in US tax dollars being spent to create aerospace jobs in foreign countries. We must not forget that the geopolitical and economic environment on Earth is far more congested, contested, and competitive than space ever will be!

Cooperation Bad

Counterplan tanks U.S. leadership

Dinerman, Journalist, 09

(Taylor, The Space Review, 11-30-09, “Just how soft is NASA’s soft power going to be?”, http://www.thespacereview.com/article/1519/1, accessed 6-9-11, JG)

There is at least a possibility that the next NASA budget will simply reflect the status quo. If there is a large cut to the budget then the plans may change, but it will be difficult to durably change the overall direction of the program. At some point, a little more than a decade from now, America will send humans beyond low Earth orbit. Atmospherics, however, are also important. If the US is seen as meekly asking the rest of the world to please support the goals and ambitions of the exploration program, it will be treated with contempt. This will not only make it exceptionally difficult to come up with acceptable international agreements, but it will almost certainly ensure that the next Congress or the next administration will seek to overturn any unfair, unequal, or humiliating deals made by the current leadership. NASA’s experience with major international exploration agreements has been mixed NASA’s experience with major international exploration agreements has been mixed. The Apollo-Soyuz deal put together by Nixon and Brezhnev in 1972 and flown in 1975 was a bit of propaganda for the idea of “detente”. As Walter McDougall put it in his authoritative …the Heavens and the Earth: A Political History of the Space Age, “it gave Soviet technicians the chance to traipse through US space facilities and flight operations firsthand.” That’s something the Chinese can do today simply by going on the Internet. The Apollo-Soyuz flight was a dead end. Twenty years later, in February 1995, the Shuttle flew its first mission to Russia’s Mir space station. This was an early step in NASA’s second great international program, the International Space Station (ISS), and in spite of everything it has been a technological success. It has taught NASA and its partners invaluable lessons in building and maintaining large structures in space. The Clinton Administration, which created the program, and the George W. Bush administration, which largely built and paid for it, made sure that it was recognized as a US-led program. Neither of these projects represents a good or accurate model for the current situation. With Apollo-Soyuz the hardware already existed, so modifying it for the “Handshake in Space” that was intended to symbolize the end of the US-Soviet confrontation was not that difficult. The ISS project was based on previous work done by NASA on Space Station Freedom and above all on the need for Clinton to show some magnanimity towards the Russians. Today Washington’s political motivation for a US-Chinese joint space project is pretty murky. The Chinese have publicly laid out a path that does not require any international cooperation. They could change their plans, but this might upset delicate internal political or industrial arrangements that we know nothing about. There has been a lot of speculation about the exact motives that drive their human exploration program, but few hard facts have emerged. On the other hand, we know that the Obama Administration and Congress are chock-a-block full of motivations, many of them contradictory or confused, but all of them expressed with passion. There are political motivations: after all, Florida, Texas, and California are all big voter-rich states. There are questions of prestige and international power. There are industrial, scientific, and technological reasons why leaders in Washington think that this is important. There is a strong desire on the part of both parties to use NASA’s accomplishments as a way to inspire kids to study science and engineering. In all of NASA’s programs, ever since the Eisenhower days, there has been an element of “soft power”. Some administrations have used it more effectively than others, but it has always been there. Yet this kind of power is only a tool, not a goal in itself. If the US presents itself as too eager for partnership agreements or too weak to explore the solar system without assistance, then the world and the American people will only see softness.

Cooperation Bad

International cooperation kills Mars mission solvency

Independent Newspaper, Russian Daily Newspaper, 10

(Russian Newspaper, Pradvda.ru, 5-20-10, “International Cooperation in Space Is Impossible”, http://english.pravda.ru/science/tech/20-05-2010/113443-space\_cooperation-0/, accessed 6-9-11, JG)

The problems connected with international cooperation between the members of the ISS project and their dependence on Russia and the USA made NASA’s John Logsdon come to conclusion that the ISS program experience was negative for its members. As for the international cooperation in post-ISS projects, Barack Obama traditionally sees his major objective at this point in preserving America’s leadership in the organization of international efforts to explore the Moon, Mars, etc. Unlike Russia, the USA has no official document related to the space exploration program that would stipulate the nation’s future dependence on cooperation with other countries. The possible consequences of such dependence can be seen in the canceled program of another manned flight to the moon. If the USA had accepted Roskosmos’s request to include Russia in the project, the results would have led to lamentable consequences for Russia. Michael Griffin, a former head of NASA, said in 2006 that cooperation works best only if it is based on you-pay-for-yourself principle. Russia would have ended up with nothing if it had been accepted. A look back at the history of space exploration clearly shows that most significant and technological progress was achieved at the time when it was connected with the solution of strictly national, not international problems of space exploration. Superpowers used space technologies to demonstrate their scientific and technological strength. This competition gave a powerful incentive to the development of space industries in Russia and the United States. International cooperation in space nowadays is impossible.

Chinese Cooperation Bad

Turn – Chinese reliance tanks U.S. leadership position

Cheng, Chinese Military Affairs @ Heritage Foundation, 09

(Dean, Chinese Political Affairs, The Heritage Foundation, 10-30-09, “U.S.-China Space Cooperation: More Costs Than Benefits”, http://www.heritage.org/research/reports/2009/10/us-china-space-cooperation-more-costs-than-benefits, accessed 6-10-11, JG)

In light of this problem, the idea has been raised in some quarters, including in the report, that the United States should expand its cooperation with the People's Republic of China (PRC) and leverage Chinese space capabilities. Such cooperation has far more potential cost than benefit. Very Real Problems The idea of relying on Chinese cooperation glosses over very real problems. At a minimum, it is an open question whether the PRC is capable of providing substantial support to the International Space Station (ISS) in the timeframes discussed by the report. It is important to recall that the PRC has had only three manned missions and has never undertaken a manned docking maneuver. Would the U.S. and its partners be comfortable inviting a neophyte Chinese crew to dock with the ISS? Beyond the technical issues, however, there are more fundamental political concerns that must be addressed. The U.S. military depends on space as a strategic high ground. Space technology is also dual-use in nature: Almost any technology or information that is exchanged in a cooperative venture is likely to have military utility. Sharing such information with China, therefore, would undercut American tactical and technological military advantages. Moreover, Beijing is likely to extract a price in exchange for such cooperation. The Chinese leadership has placed a consistent emphasis on developing its space capabilities indigenously. Not only does this ensure that China's space capabilities are not held hostage to foreign pressure, but it also fosters domestic economic development -- thereby promoting innovation within China's scientific and technological communities -- and underscores the political legitimacy of the Chinese Communist Party. Consequently, the PRC will require that any cooperation with the U.S. provides it with substantial benefits that would balance opportunity costs in these areas.

Chinese Cooperation Bad

No solvency and Turn – Mars mission triggers our leadership impact and the Mars mission will fail due to the Chinese Space-Military Complex

Cheng, Chinese Military Affairs @ Heritage Foundation, 09

(Dean, Chinese Political Affairs, The Heritage Foundation, 10-30-09, “U.S.-China Space Cooperation: More Costs Than Benefits”, http://www.heritage.org/research/reports/2009/10/us-china-space-cooperation-more-costs-than-benefits, accessed 6-10-11, JG)

There is also the question of whether the other partners in the international station, such as Russia and Japan, are necessarily interested in including China, especially now that the most expensive work has already been completed. There is also the issue of transparency. While it seems logical that the principal partners for cooperation would be the Chinese and American civil space agencies, the reality is that the China National Space Agency is, in fact, nested within the Chinese military-industrial complex rather than being a stand-alone agency. Indeed, China's space program is overwhelmingly military in nature. And nowhere more so than in the manned space program, the "commanders" or "directors" of which include the head of the General Armaments Department, one of the four general departments responsible for day-to-day management of the entire People's Liberation Army (PLA). The challenges presented by the Chinese space program's strong ties to the PLA are exacerbated by the generally opaque nature of China's space program on issues ranging from who the top decision-makers are to the size of their budget. Any effort at cooperation is likely to be stymied so long as the PRC views transparency as a one-way affair. Reciprocity Lacking According to the discussions between Presidents Bush and Hu Jintao, NASA Administrator Michael Griffin's groundbreaking visit to China in 2006 (the first by a NASA administrator to the PRC) was supposed to be matched by a visit to the U.S. by the head of China's Second Artillery. Yet the PRC has never agreed to that visit, despite Hu's commitment and repeated invitations from the U.S. If reciprocity in terms of basic leadership visits cannot be obtained, it is even more problematic how either side would achieve reciprocity in other areas. There is a general disparity in technology between the U.S. and the PRC. Under such circumstances, reciprocity would likely benefit the Chinese side far more than the U.S. side. And if the U.S. holds back, it only undermines the case for cooperation. Yet well-founded reticence on the part of the U.S. to share information could also jeopardize the missions and safety of the crews. These are the high costs of cooperation with the Chinese on manned space flight. Covering funding shortfalls seems to be the only tangible motivation for the U.S., and even that prospect is not promising. If U.S. decision-makers conclude that a manned-space capacity is important to American interests, they should find a way to properly fund it -- and not rely on the one country in the world likely to emerge as a peer competitor for global influence.

Russian Cooperation Bad

Russia will use cooperation to tank U.S. leadership

Mathieu, European Space Policy Institute, 08

(Charlotte, ESPI, 6-08, “Assessing Russia’s Space Cooperation With China And India”, http://kms1.isn.ethz.ch/serviceengine/Files/ISN/124767/ipublicationdocument\_singledocument/cc9c3dfe-c97d-4c97-89eb-b396e61edfec/en/espi%2Bfinal%2Breport%2Bric.pdf, accessed 6-12-11, JG)

With the improvement of the overall situation of the country, the Russian leadership has gradually adopted a more confident posture on the international scene. Moscow is using economic and political means to increase Russia’s influence and is at the same time building up an image of a committed and responsible international power. This new attitude is coupled with an evolution of Russia’s foreign policy towards a multidirectional, more balanced and pragmatic strategy, with, in particular, an active promotion of cooperation with its Asian neighbours. Russia and Space These general trends are reflected in the space field. After a golden age, the space sector severely suffered from a lack of interest and funding during the nineties. Today, Russia has to re-build its space capabilities and to transform its space sector. The space sector has recently got a new impetus from the Russian leadership which has the will and means to further develop and diversify Russian space activities. Space is now back on Moscow’s strategic agenda for political and economic reasons, and is supported at the highest political level. The Russian leadership wants to fully use this key industrial asset and regain control over it. Ambitious programmes that cover the whole spectrum of space activities have been adopted, the funding has been increased and the industry is being reorganized to improve its competitiveness. However, there are many challenges to be addressed in this sector, including human resources, regulatory, financial, organizational and technological challenges. This new situation led to an evolution of Russia’s space cooperation. Russia remains open to cooperation, but wants its partnerships to better reflect its interests and to serve its technological needs. The recent shift towards a more balanced foreign policy also led to the diversification of its partnerships in the space domain. Russia’s attitude to its traditional partners has changed and it is now looking for new partners for strategic and commercial reasons. Another major development is the strengthening of its cooperation with the quickly-rising space-faring nations, in particular China and India.

Russian Cooperation is risky and the counterplan chances solvency

Freeman, EIR Science & Technology, 08

(Marsha, LaRouchePub.com, 9-26-08, “The Challenge of the Second 50 Years in Space”,

http://www.larouchepub.com/eiw/public/2008/2008\_30-39/2008\_30-39/2008-39/pdf/40-47\_3538.pdf, accessed 6-13-11, JG)

With no Soyuz at the station, in accordance with safety rules, there could not be a crew on board. Worse, cooperation with Russia in space is not immune to the political machinations and geopolitics that often characterize relations between the world’s two leading space and nuclear powers. More than once, U.S.-Russian cooperative space projects have had collateral damage inflicted on them, when political tensions have occurred. It was against this backdrop, of having already created a potentially untenable future for the space station and the Space Shuttle, that Bush promulgated his flawed “Vision for Space Exploration.”

ESA Cooperation Bad

The U.S. and ESA have different space structures making cooperation hard – recent events prove

Peter, Space Policy Institute at GWU, 07

(Nicolas, International Science and Technology Policy, NJIA, 10-13-09, “A New Paradigm in Trans-Atlantic Space Relations”, http://groups.northwestern.edu/njia/?p=229, accessed 6-13-11, JG)

For Europe and the ESA in particular, cooperation with the United States offered more opportunities to participate in missions which they could not achieve alone. Hence, there was a mutual interest in cooperation. However, fundamental differences in current motivations and ambitions, as well as recent cooperative results, have led to trans-Atlantic cooperation difficulties. With the re-election to a second term, U.S. President Bush has another three years to get his Vision for Space Exploration off to a solid start. But even with election results that put the Republican Party firmly in control of the Congress, the long term space exploration strategy laid out in January 2004 still faces considerable challenges. One is convincing the U.S. Congress to continually approve the funding that NASA is seeking to complete the effort. However, the short term challenge is to convince various international partners (especially Europe), to join this Vision for Space Exploration. A successful agreement on the future direction of the International Space Station is the prerequisite to any significant European participation in this program. If the U.S. wants to begin its journey it should seriously consider Europe as an important and equally capable partner. Cooperation between ESA and NASA in scientific projects represents the traditional mode of trans- Atlantic cooperation. However, the evolution of the space context in Europe, especially with the ESA’s evolving position on security issues, will be challenging for future trans- Atlantic relations. This has been clearly illustrated by the tension between the United States and Europe over Galileo. The emergence of new concerns regarding space and security within the EU and the ESA will thus involve a new axis of trans- Atlantic discussion involving a U.S. partner, the Department of Defense. The changes in policy, organizational structure, and funding at the European level and the development of a European level security space architecture will affect the nature of traditional European – U.S. space cooperation. The new European dipole consisting of the EU and the ESA could either be a capable partner or a serious competitor for the U.S., depending on the U.S. attitude. The second Bush administration needs to define a clear policy on the civilian and military agendas regarding Europe that will have to oscillate between cooperation and competition. The trans-Atlantic space relationship is at a crossroads. Europe and the U.S. have been close partners in space activities since the 1970s. Yet key trends on how each side approaches space may pose significant challenges to this partnership that may reinforce or exacerbate existing structural differences between the U.S. and the EU.

JAXA Cooperation Bad

No solvency – JAXA programs lack support and state backing

Berner, RAND Institute, 05

(Steven, RAND, “Japan’s Space Program A Fork in the Road?”, http://www.rand.org/pubs/technical\_reports/2005/RAND\_TR184.pdf, accessed 6-13-11, JG)

Of the top 100 topics, only two were space related. 26 Space does not seem to have captured the imagination of the public. More recently there has been much editorial and political criticism of the failures of the space program.27 The program lacks a champion at the highest levels of the government. The Japanese public is becoming increasingly skeptical of claims that the space program will produce major economic benefits. This skepticism particularly applies to the benefits of materials processing in space. JAXA officials also noted that the economic benefits of the space program are not always evident, and that JAXA needs to do a better job of developing and explaining those benefits to the public.

Japan’s new space structure stresses Japanese leadership – ensures lack of push from JAXA

PR Web, Online Journal, 10

(PR Web, Earth Times, 1-12-11, “US Space Competitiveness Erodes”, http://www.earthtimes.org/articles/press/space-competitiveness-index-trends,1391440.html, accessed 6-14-11, JG)

Japan Japan continues to realize competitiveness gains as it implements its comprehensive Basic Space Law, which provides a new military dimension to Japanese space activity and creates an executive-level space office, the Strategic Headquarters for Space Activity (SHSP). �Beginning with the reorganization the Japanese space agency in 2003 and ending with the Basic Space Law, this first decade of the 21st century has shown Japan's clear re-commitment to space at the national decision-making leve**l,**� says Futron Senior Analyst David Vaccaro. �Going forward, it will be important for Japan to reflect this renewed space engagement at home in its many space partnerships abroad.

Indian Cooperation Bad

ISRO is a failed space program – lack of public support, management, and funding will tank solvency

Singh, Business Writer, 11

(Seema, Business, 4-19-11, “ISRO’s Dead in Space”, http://business.in.com/printcontent/24132, accessed 6-13-11, JG)

The unqualified admiration it elicited from the public for its success with the moon mission in 2009 seems like a distant memory now. A year of glitches in satellites and rockets rounded off with allegations of a scam has put ISRO under immense pressure and its credibility is in question like never before.If nothing else, ISRO has been guilty in recent years of letting its public image deteriorate steadily and of doing nothing to arrest the slide by encouraging an open debate about its functioning. The situation spun out of control when a series of mishaps hit and the public turned sceptical about the space agency. The failure of the indigenously developed cryogenic engine in April 2010 and then the crash of the launch vehicle GSLV-F06 in December were bad enough, but the nation soon came in for another nasty surprise: The ISRO-Devas Multimedia deal for broadband spectrum that politicians and media described as a scam bigger than the 2G corruption scandal. The opinion in the scientific community is more nuanced but no less critical. They see a huge public organisation that is losing its research edge and slipping into a bureaucracy; a place where communication has broken down with the external world as well as within. They say ISRO is still full of honest people and that the Devas deal was not a scam at all; but they also say the organisation is straying from its core ideals. ISRO officials did not agree to be interviewed and failed to answer a detailed questionnaire from Forbes India on these issues. ISRO can hardly afford to get mired in organisational hiccups when the space race is heating up. China has made rapid strides in the last five years, putting a man in space. Advanced nations are moving in to colonise space and use it for their strategic advantage. For India to remain in this game, ISRO must buckle up and perform quickly.More specifically, a whole lot of important missions will suffer if ISRO delays launching a Geosynchronous Satellite Launch Vehicle (GSLV) with an indigenously developed cryogenic engine. At stake is not just the future of two big announced missions — Chandrayaan-2 in 2013 and the manned flight to the moon in 2015 — but significant commercial opportunities to sell its services to the rest of the world. The satellite launch market is seeing a boom with geostationary satellites getting bigger and more complex to meet the burgeoning communication needs of a connected world. Paris-based consulting firm Euroconsult expects this trend to continue till 2018. India must rush to exploit this opportunity before the window closes. India and China are the two forces that can challenge the market leader, Russia. But poor reliability of GSLV will not only dent ISRO’s commercial prospects but even its image, which is directly related to India’s prestige. Up, Up and OuchFailure is hardly a bad thing. Or uncommon in the world of space research. The fact that India’s space agency is seeing more failures now “shows that ISRO has reached a certain level of maturity which certainly calls for modern governance,” says Steve Bochinger, president of Euroconsult North America. Other space agencies have similarly struggled with launch failures, organisational bottlenecks or confusion about long-term vision that ISRO is experiencing right now.But then, a culture of openness, leadership and a high standard of accountability are the prescription for cure. And sadly ISRO ranks low in those departments.Take the case of the crash of GSLV-F06 (with an imported cryogenic engine) in December 2010. A Failure Analysis Committee was formed to look into it but experts associated with the exercise say they are not aware if it “is completed and a cohesive report prepared”. The Committee chairman, former ISRO boss G. Madhavan Nair, had given varying explanations as the work was in progress and a final report would have cleared the air.There is a larger review under way and its findings are disturbing. The GSLV Review Committee, led by another former ISRO chief K. Kasturirangan, says there is “no pattern to failures,” and points to a lack of rigour and attention to details.This had not been the case before. When earlier launch systems such as ASLV failed, scientists knew what they didn’t know. The case of the locally made cryogenic engine is more puzzling. To understand and pinpoint the error in the April 2010 experiment, ISRO must adopt a complete mathematical model to simulate the cryogenic

Indian Cooperation Bad

system through which it could test the engine under varied, even hypothetical, conditions. For instane, if the booster pump hadn’t worked properly because it was submerged in liquid hydrogen,

the test would have revealed it. But ISRO hasn’t done such a test. “Along with empirical understanding [from experiments], you need to have physical understanding [from simulation],” says B.N. Raghunandan, professor of aerospace engineering at Indian Institute of Science, Bangalore.The mishandling of situations didn’t stop with technical issues. When news broke in February suggesting that ISRO’s marketing arm, Antrix Corporation, had entered into a deal with Devas Multimedia in 2005 to favour the latter, the space agency dithered and failed to explain the true picture to the public. All that Antrix had done was to resort to “procedural” shortcuts in getting the deal approved by its board. It was done at a thinly attended meeting. Experts close to ISRO say if it had just continued with the traditional INSAT Coordination Committee meetings (it was last convened in 2005), which routinely involved all key science, technology and telecom departments, things wouldn’t have come to this flashpoint. But popular belief held that the deal that involved using Devas’ technology to provide satellite broadband services was the mother of all scams. The whole country was then in a mood to see a scandal in everything.No Space for a Chat Of all the problems at ISRO, insiders say, the lack of communication among its own arms is the most troubling. “They really have a management issue. There are so many good people working for them but they don’t seem to communicate with each other,” says Jayant Murthy, a professor at the Indian Institute of Astrophysics in Bangalore, who worked with ISRO for three years on an aborted project. Murthy was the principal investigator for Tauvex, a joint space observatory project between Israel and India. After a four-year delay, it was finally mounted on the satellite in November 2009, but got knocked off at the last minute when ISRO realised the weight of sundry payloads on the mission exceeded the limit. Despite repeated requests, ISRO never communicated the next launch date. Tauvex was finally sent back to Israel last year. “It’s a result of constantly changing set of priorities at ISRO, which now works in mission mode,” says Murthy, who along with his Israeli counterparts, is contemplating a Russian launch. The new thrust on commercial success may have come at a time when the focus on research is diminishing, say experts. “Instead of doing research, ISRO scientists are becoming large-scale managers,” says Raghunandan of IISc. Kasturirangan suggests a model of concentric rings: At the core is the application-driven vision that Vikram Sarabhai, the father of Indian space programme, laid down; around that ISRO needs to build programmes like Chandrayaan where bilateral and multilateral co-operation can add value; and the third ring should be even larger space programmes like a manned Moon mission. “There’s no end to the space programme for the next 100 years; we need to have a vision,” he says.This vision, to start with, was developing applications for the society’s benefit such as weather forecasting and enabling communication. But there are questions on ISRO’s committment to it. “I feel concerned about the relative shift in focus that ISRO has emphasised — from being application-driven to technology- and prestige-driven,” says Kiran Karnik, former president of software lobby Nasscom and who had worked at ISRO for two decades. Karnik, who recently resigned from the board of Devas, recalls how a large group of 150 social scientists constituted the ‘conscience’ of ISRO and helped it define national priorities. That mechanism exists no more. In the interplay between political leadership and scientific vision, the former is proving dominant. “Somebody should argue back and talk about the real issues that India’s space programme faces,” says Karnik.

Brazilian Cooperation Bad

Brazil’s military led space program partnered with China will fell to accomplish anything with the U.S. – ensures lack of solvency

Rohter, South American bureau chief @ NY Times, 04

(Larry, New York Times, “Brazil’s Soaring Space-Age Ambitions Are Shy of Cash and Sapped by Calamity”, http://www.nytimes.com/2004/01/23/world/brazil-s-soaring-space-age-ambitions-are-shy-of-cash-and-sapped-by-calamity.html?src=pm, accessed 6-14-11, JG)

Current and former employees say the military's hierarchical and secretive culture dampens the freewheeling inquiry needed for scientific research to flourish. ''The model adopted for the space program still depends on a heavy degree of military control, and that is a system that has not permitted the desired development,'' said Ennio Candotti, president of the Brazilian Society for the Progress of Science. He and others point to the comparative success of the satellite program as a way toward a more profitable and productive space program for Brazil in the future. In addition to putting communications satellites into space, Brazil has already launched two multiple-use satellites in partnership with China. In October they signed an agreement to launch two more. Both those satellites are expected to have polar orbits, which will allow Brazil and China to more closely monitor much of the Western Hemisphere. For Brazil, this means greater intelligence on the harvests of its main agricultural competitors, including the United States. Other satellites are used to monitor Amazon deforestation and off-shore fisheries activities. There may be military and intelligence-gathering applications as well, though Brazil says its effort is exclusively for peaceful purposes. China's position is ambiguous. 'Ours is a country of 3.3 million square miles, with one of the longest coastlines in the world and extensive land borders,'' Mr. Amaral, the minister of science and technology, said. ''We need to better know our own territory and borders and to be able to program our agricultural harvests.'' [Mr. Amaral resigned in mid-January, and his successor, Eduardo Campos, is scheduled to take office before the end of the month. The resignation was not directly related to problems with the space program.] Shifting control away from the military might also open Brazil's space program to greater international cooperation, experts say. Until now, the United States has repeatedly blocked Brazilian efforts to acquire certain technologies and, according to officials involved in the Brazilian program, has pressured allies to do the same. ''That's no secret,'' Luiz Bevilacqua, director of the Brazilian Space Agency, said in an interview in Brasília. ''They say that openly, and they have their reasons. They don't want a rocket falling into the hands of terrorists.'' The technological blockade has led to elaborate end-runs, like the Brazilian Air Force's quiet accommodation with Russian scientists after the collapse of the Soviet Union in 1989.

AT: Disposable Earth

The plan results in the overview effect which solves the environment-sending people into space transmits their insights through society and stimulates environmental awareness

White, he has written 6 books on space and coined the term overview effect, 98

(Frank, The Overview Effect: space exploration and human evolution 2nd edition, pg. 91, SRF)

If the overview hypothesis is correct, the process of sending people into space should not only affect the astronauts, but as their insights are transmitted throughout society, it should bring positive changes and a more responsible species. We would hope to see the species become more interested in preserving the environment, preventing war, and fostering other life-sustaining endeavors. The evidence already presented suggests that this has happened and that it is linked to changes in awareness associated with space exploration.

We are destroying the environment now due to the alternate causality of industrialization, not the disposable earth mindset

South Africa Sunday Tribune, 09

(“Climate Change is a Social Justice Issue,” 3-08-09, pg. 18, SRF p. l/n)

WE, as humanity, face a conundrum. Very few among us wilfully advocate the extinction of species or the suffering of our fellow humans. Yet we face rampant environmental destruction that is imposing hardship upon millions of those who cannot escape it. If so many of us care about nature, why is our impact on the Earth accelerating, rather than being reined in? If so many of us care about our fellow human beings, why is there such disparity in living standards? Why do so few have so much, while so many have so little? Morné du Plessis, the chief executive officer of WWF (World Wide Fund for Nature) in South Africa, has mused that a by-product of the industrial age is our disconnection from the natural world that sustains us. We have developed a temporal and physical disconnection from the resources that sustain us, and from our impact on them. Our forefathers had a direct, visceral connection to nature. Meat had to be caught, and killed, carried, then skinned - a taxing business. Fruit and vegetables had to be sought out growing in the wild or carefully tended. That effort caused our ancestors to waste very little. Modern life has removed that connection and the realisation of our impact on the earth. Supermarkets and packaged foods hide the processes involved in feeding us. In short, the consequences for our actions are delayed or hidden, so we assume they are waived. Yet the laws of physics are not mocked and the distance between us and our resources is being shrunk, like an elastic band returning to its original size. That process usually involves a stinging sensation and we're starting to feel the pain in many ways. Ending Ask fishermen about the size and numbers of the once-abundant stocks in their nets and you'll get a depressing picture of just how great the sting is. Fishing communities all over the world are ending a way of life that has changed little over centuries. That's an example of one sector. But it's a telling, urgent and tragic one. So how does humanity reduce the sting to come? We simply have to act individually and collectively to reduce our impact on the world. There is no shortage of information on how to do that. It just needs to be done by enough people. And acting on it must be impressed upon the government leaders who will meet in Copenhagen later this year to devise the next generation of guidelines on limiting carbon emissions and fighting climate change.

AT: Disposable Earth

We must do the plan to remove the burden humanity has on the Earth before it is destroyed-only way to solve

Combs, Texas instruments space website manager, 10

(Mike, *Texas Instruments,* “Space Settlement FAQ,” January 2010, http://space.mike-combs.com/spacsetl.htm#disposable\_Earth, 6-20-2011, SRF)

Will we emigrate to space after pollution has destroyed the ecology of the Earth? This has been called a "disposable Earth" policy, and certainly wouldn't be supported by any individual of good conscience. Ideally, we should try to remove much of the burden humanity has placed on our planet into space before catastrophic damage is done, not afterwards. Space habitats may make ideal refuges for endangered species. If we eventually reach the point where more people are living in space than on Earth, the Earth's primary industry may then become tourism. In such a situation, there would be an economic incentive to restore much of the planet to a natural state.

AT: Cosmic Preservationist Kritiks of Terraforming

Change represents the natural order of the universe; terraforming is good under their framework

Fogg, masters degree in astrophysics and widely acknowledged expert on terraforming, 2000

(Martyn J., “The ethical dimensions of space settlement”, *Space Policy,* volume: 16, p. 209-210, 6-16-2011, SRF)

The same applies to sentimentality, nicely defined recently as, “the elevation of feelings, image, spontaneity over reason, reality and restraint. 36 ” A prime example of this is the ecocentrist notion of ecological harmony: that there exists an ideal balance in nature that is perfect, unchanging, and which nurtures and sustains. Yet this is little more than a cosy illusion, based on out of date ecology. Nature is not static and unchanging and is better regarded as a continuous state of flux dominated by chaos and disharmony 21,37 . The history of our planet tells us in no uncertain terms that any harmony that may appear as an epiphenomenon of this state of affairs is transient. Innovation, evolution and extinction—all processes of irreversible change—represent the true natural order of life and, on differing timescales, they are a partial reality for inanimate existence too. And whilst it is reasonable to propose that animals with advanced nervous systems might have feelings, and therefore a point of view, surely it is gross sentimentality to propose such a thing for rocks. After all, a sentimental terraforming enthusiast might propose that, far from the rocks on Mars existing in a state of “blissful satori” (as a preservationist would have it) they might instead be “crying out for life.” Both arguments are unedifying. Rocks don’t think, don’t act and don’t care. They cannot have values of their own. Consider two scenarios where life is brought to a barren Mars and the differing reactions environmental philosophers might have to each... For the purposes of the first, let us propose that we discover that microbial life from Earth has already reached Mars, having arrived there at some time in the distant past by some sort of panspermia process. The possibility that bacteria could make such a journey across space was first proposed by Arrhenius 38 a century ago and has been revived in a different guise recently when it was realised that planets exchange pieces of themselves following impacts energetic enough to propel debris into space. Bacteria living in the middle of an ejecta fragment might be sufficiently shielded from heat shock and radiation to survive the many years in transit and the final trauma of touchdown onto the new world 39 . Would this discovery be morally criticised by preservationists? Might they consider that founding colony of microbes to have been violators of Mars? Might they regard its descendants, the extant population, to be a form of immoral pollution? Of course not. Bacteria cannot be praised or blamed for being in the right place or the wrong place at the right time. The discovery would be regarded as a particularly noteworthy event in the history of life, but one undeserving of moral censure. Even the most hard-line of preservationists would concede the contaminating event as a natural event. Arriving on a meteorite, those pioneer microbes no more polluted Mars than the first living cell polluted the Earth. In our second scenario however, it is humans who take life to Mars, who alter the climate of the planet so it can support a thriving ecosystem. We terraform Mars. Now there is an obvious ethical dimension: would it be right or wrong for us to do this? Perhaps in the light of scenario one though, the question can be rephrased. If the unconscious diversification of life is not a moral issue from the standpoint of Mars, why is it that intentional diversification be subject to moral scrutiny? The reason is that only humans are subject to moral praise or blame. It is our own values that are at issue, not fictional ones ascribed to unconscious or non-living entities. They are the only values we can know to be real and the only ones that can motivate both action and restraint. It is thus the conscious enactment of change that preservationists most object to, in the same manner that ecocentrists object to it on Earth. But is there anything fundamentally unnatural or wicked inherent in this ability? No. Whilst we are right to regard the Universe, with all its projects, from the vast to the microscopic, with wonder and a degree of humility, the Universe does seem to be a reasonable place. It seems to be showing us that it is comprehensible, if not all comprehended. It is subject to cause and effect, to free will. Reason therefore, as suggested by Plato and Kant, has a transcendent and autonomous nature. It can be projected as well as contained within the self. Its province is the Universe at large. Reason can enact intentional change. It can legitimately stand against what is, for ideals of what ought to be. Human consciousness, culture, creativity—and the technological artefacts produced thereby— are thus not unnatural. They have arisen from the same physics that gave birth to the cosmos and the same process of biological evolution that followed the genesis of the first living cell. They are as natural as sex, photosynthesis, aerobic respiration, and a host of other biological processes, all of which were invented some considerable time after life’s origin and all of which changed the Earth drastically and forever.