\*\*\*Solar CP – General\*\*\*

Solar CP – Solves Asteroid Deflection

Solar sails are comparatively more effective and efficient at defecting asteroids than existing methods

Gong, Lie, and BaoYin 09

(all profoseers of aeronatics at Tsinghua University, “Formation flying solar-sail gravity tractors in displaced

orbit for towing near-Earth asteroids”, June 2, 2009, Springer Science, http://www.spacesailing.net/paper/200508\_SanFrancisco\_DachwaldWie.pdf)

The methods of NEAs (Near Earth Asteroids) deflection can be classified as HEIMs (High Energy Impulse Methods) and LDLTMs (Long Duration Low Thrust Methods). There are usually two ways of implementing HEIMs: striking at the Asteroid at high relative velocity and a stand-off nuclear blast explosion. There are several kinds of LDLTMs being discussed in literature, such as “rendezvous and push” methods, surface ablation of the object using a laser or solar concentrator, exploitation of solar flux induced perturbations,mass driver, space tug and non-contact gravitational tractor. The typical representatives of HEIMs and LDLTMs are direct impact and “rendezvous and push” methods. Izzo et al. (2005) compares the direct impact method and “rendezvous and push” method. Since the resulting perturbation is due to the reaction principle stated by Newton’s third law, one might think of the impact case as being able to expel at once the entire final spacecraft mass with a relative high velocity and all spacecraft mass is used as reaction mass. The formula tells us that any mass expelled after a time from the deflection start contributes increasingly less to the miss-distance. Therefore, the direct impact method is superior to “rendezvous and push” method in theory (Vasile and Colombo 2008). However, the optimum direction impact is impractical with the consideration of transfer trajectory and the time to impact and the actual achievable miss-distance is different from the optimum value. Ahrens and Harris (1992) present several methods of deflection, including the deflections by nuclear explosion radiation and by surface nuclear explosion. Both methods utilize the energy released by the nuclear explosion to eject themass of the asteroid, which will disturb the velocity of the asteroid. For the radioactive stand-off explosion, velocity change of 1 cm/s for an asteroid of diameter 100 m, 1 km and 10km will require the energy about 0.01–0.1 kton, 0.01–0.1Mton and 0.01–0.1 Gton, respectively. It is mentioned that the method is more effective to deflect a small asteroid because the required escape velocity of the ejection is much larger for larger asteroid. McInnes (2004) considers impacting the asteroid with a solar sail, which can perform a head-to-head impact when solar sail evolves on a retrograde orbit. The relative velocity of impact can reach as high as 60 km/s, **the release energy of** **which is comparable with that of the nuclear explosion**. Melsoh (1993) proposes a creative strategy in which solar sail is used to focus sunlight onto the surface of the asteroid to generate thrust as the surface’s layers vaporize. According the formula given in the paper, a 0.5km solar sail collector operating for a year can deflect an asteroid up to 2.2 km in diameter, **which is much more effective compared with other strategies**. Joseph (2002) proposes another asteroid hazard mitigation method using Yarkovsky effect. The requirements 123 Formation flying solar-sail gravity tractors in displaced orbit for towing near-Earth asteroids 161 of long lead time and changing the diurnal thermal wave of the asteroid makes the method impractical.

Solar sails are the most realistic near-term option for and cost effective method of asteroid deflection

Wie 7

(Bong, Vance Coffman Endowed Chair Professor of Aerospace Engineering @Iowa State, pHD in Aeronautics and Astronautics from Stanford University, Hovering Control of a Solar Sail Gravity Tractor Spacecraft for Asteroid Deflection, Presented at Planetary Defense Conference, Washington, D.C., March 5-8, 2007, http://www.aero.org/conferences/planetarydefense/2007papers/S3-5--Wie-Paper.pdf)

Propellantless solar sail propulsion, therefore, emerges as a **realistic near-term option** to such a technically challenging problem of mitigating the threat of NEAs. Solar sails are large, lightweight reflectors in space that are pushed by sunlight.4,5 A previously proposed concept of using solar sails to tow or tug an asteroid requires an unrealistically large solar sail, which is not technically feasible to assemble in space. Furthermore, attaching such an extremely large solar sail to a tumbling asteroid will not be a simple task. However, **solar sails have the potential to provide cost effective, propellantless propulsion that enables longer mission lifetimes, increased payload mass fraction, and access to previously inaccessible orbits** (e.g., high solar latitude, retrograde heliocentric, and non-Keplerian). In the past, various solar sailing rendezvousmissions with a comet or an asteroid, as illustrated in Fig. 1, have been studied. As illustrated in Fig. 1, asolar sailing concept was studied by JPL in 1977 for a rendezvous mission with Halley’s comet for the 1986 passage.4 Although it soon became an ill-fated mission concept of 1970s, that required a very large, 800-m solar sail to be deployed in space, it introduced the propellantless solar sailing concept to achieve a large, 145-deg orbital inclination change at 0.25 AU in order to rendezvous with Halley’s comet in a retrograde orbit. The recent advances in lightweight deployable booms, ultra-lightweight sail films, and small satellite technologies are spurring a renewed interest in solar sailing and the missions it enables. A solar sailing mission described in Refs. 6-10 utilizes the solar sailing technology to deliver a kinetic energy impactor (KEI) into a heliocentric retrograde orbit, which will result in a head-on collision with a target asteroid at its perihelion, thus increasing its impact velocity to at least 70 km/s. A solar sailing KEI mission architecture, which employs 160-m, 300-kg solar sail spacecraft with a characteristic acceleration of 0.5 mm/s2, was examined as a realistic near-term option for mitigating the threat posed by NEAs in Refs. 7-10, as illustrated in Fig. 2. For example, a head-on impact (at a relative velocity of 70 km/sec) of a 150 kg impactor on a 200-m, S-class asteroid (with a density of 2,720 kg/m3) results in a pure kineticimpact Δ*V* of approximately 0.1 cm/s. If the asteroid is composed of hard rock, then the modeling of crater ejecta impulse from previous studies would predict an additional Δ*V* of 0.2 cm/s, which is double the pure kinetic-impact Δ*V* . However, if the asteroid were composed of soft rock, the previous studies would instead predict an additional Δ*V* of 0.55 cm/s, which is more than five times the pure kinetic-impact Δ*V* . Thus, an accurate modeling and prediction of ejecta impulse for various asteroid compositions is a critical part of the most kinetic-impact approaches. For a solar sail KEI mission, its solar sail will be deployed at the beginning of an interplanetary solar sailing phase toward a target asteroid and the KEI spacecraft will be separated from the solar sail prior to impacting a target asteroid. The critical, enabling technologies required for the proposed solar sailing KEI mission include: deployment and control of a 160-m solar sail, development of microspacecraft bus able to withstand the space environment only 0.25 AU from the sun, precision solar sailing navigation, terminal guidance and targeting (accuracy better than 50 m at an impactor speed of 70 km/s), and impact-crater ejecta modeling and accurate Δ*V* prediction. A 160-m solar sail is not currently available, and the deployment and control of such a large solar sail in space will not be a trivial task.

Substantial technologies investments can produce solar sails effective at asteroid deflection in the relative near term

Dachwald and Wie 5

(Bernd--Scientist, Institute of Space Simulation and Bong--Professor, Dept. of Mechanical & Aerospace Engineering @ Arizona State University, “Solar Sail Trajectory Optimization for Intercepting,

Impacting, and Deflecting Near-Earth Asteroids” American Institute of Aeronatics and Astronatics, August 15-18, 2005, http://www.spacesailing.net/paper/200508\_SanFrancisco\_DachwaldWie.pdf)

A head-on collision yields an impact velocity of more than 80km/s, which is much higher than the typical impact velocity of about 10km/s of conventional missions such as NASA’s Deep Impact mission7, 8 or ESA’s Don Quijote mission.9 The impactor is to be separated from the solar sail prior to impacting the target asteroid, because of the extremely demanding terminal guidance and targeting requirements (the accuracy of the impactor trajectory must be much better than 100m at a relative velocity of more than 80km/s). For the present scenario, several KEI sailcraft will be required to increase the Earth-miss distance to a safe value. For larger asteroids, the impactor may not have to be separated from the solar sail, but the complete solar sail spacecraft could be designed to impact, thereby increasing the impacting mass and thus the resulting 2 of 18 American Institute of Aeronautics and Astronautics v. The critical technologies required for the proposed mission include: (1) deployment and control of a 160m×160m solar sail, (2) development of a solar sail and a micro-spacecraft bus that is able to withstand the extreme space environment at less than only 0.25AU from the sun, (3) autonomous precision navigation, terminal guidance and targeting, and (4) accurate impact-crater ejecta modeling and v prediction. A 160m × 160m solar sail is currently not available. However, a 20m × 20m solar sail structure was already deployed on ground in a simulated gravity-free environment at DLR in December 1999, a 40m × 40m solar sail is being developed by NASA and industries for a possible flight validation experiment within 10 years, and thus a 160m × 160m solar sail **is expected to be available within about 20 years of a sharply pursued technology development program.**

Solar CP – Solves Space Exploration/Colonization

Solar sails make deep-space exploration and colonization viable by 2040

Vulpetti, et. al, 7 – Ph.D, member of he International Academy of Astronautics, Associate Fellow of AIAA, and Member of the Planetary Society(2007, Giovanni Vulpetti, Les Johnson, and Gregory Matloff, Solar sails : a novel approach to interplanetary travel,p. 91-110)

As time elapses, humanity's technological progress is certain to continue. After 2040, a substantial in-space infrastructure may well exist. There may be facilities in near-Earth space where space resources or Earth-launched material can be processed to produce solar sails with near-theoretical- maximum performance. Larger sails will be possible in this time frame—with dimensions measured in kilometers. And these large, space-manufactured sails will perform better than their Earth-launched predecessors. Human-Exploration Sailships Current-technology, micron-thick, Earth-launched sails are not yet up to the support of human exploration of the solar system. These sails are too small to carry the tens of thousands of kilograms necessary to support humans between the planets and exploration gear. Also, sail-implemented missions to Mars (for example) using today's sail technology would be of longer duration than rocket-propelled interplanetary ventures. But when sail linear dimensions are measured in kilometers and sail thicknesses are in the sub-micron range, all this will change. **The sail may then become the most economical means of transport throughout the inner solar system**. New constellations of 21st century space clipper ships might be visible in Earth's night skies as they spiral outward toward Mars or the asteroids. The first of these might be rather modest, a mere 800 meters on a side, carrying 5000 to 10,000-kilogram payloads between Earth and Mars on a recurring basis. While too massive to launch from Earth, such a large- diameter sail could be readily made in space to perform this mission without overly stressing the other sail figure of merit—areal density. Initially, these craft will support exploration missions. But since sailships should be capable of many interplanetary roundtrips without fuel expenditure, human settlements will also benefit from the technology as they begin to grow on celestial bodies beyond the Moon.

Even if all other human colonization attempts fail, the quick transit times of solar sails makes launching of panspermia possible—only chance to populate planets outside of our solar system

Mautner 10 (Michael N. Mautner, Ph.D., Research Professor of Chemistry, Virginia Commonwealth University, “Seeding the Universe with Life: Securing Our Cosmological Future”, Journal of Cosmology, 2010)

Directed panspermia aims to preserve and expand our family of gene/protein life. Fortunately, the main features of organic gene/protein life are present in every cell, from microorganisms to humans. Therefore, microorganisms can carry the seed our family of gene/protein life, which can develop into many diverse new life-forms. Zuckerman, 1981, Directed panspermia was suggested as a possible origin of life on Earth started by an earlier civilisation, and sending directed panspermia missions from Earth was also discussed briefly (Shklovskii and Sagan, 1966; Crick and Orgel, 1973). The technical requirements and ethics of such missions were developed in more detail (Mautner and Matloff, 1979; Zuckerman, 1981, Mautner, 1995, 1997a) Zuckerman, 1981, Panspermia missions may be aimed at extrasolar planets, at accretion disks about new stars, or at star-forming interstellar clouds. Once these environments are seeded with microorganisms, life may expand there through natural panspermia ( Mautner et al., 2004, Napier 2004; Wikramsinghe et al., 2003). The biological payload may be divided into large numbers of small capsules to increase the chances of capture. For example, each capsule of about 20 micron radius may contain 100,000 microorganisms weighing altogether 0.1 micrograms. The panspermia capsules may be bundled in shielded containers and dispersed at the target. They may be sent also directly as large swarms of small capsules that are easier and cheaper to launch. The panspermia missions need to be: - Launched at sufficient velocities to assure survivable transit times. **This can be achieved with present technology using solar sails**. - Aimed or navigated to reach the capture zones, whose positions need to be predicted with sufficient accuracy. The probability to arrive at the targets increases with the resolution of proper star motion and with the area of the target (see Appendix). - Decelerated at the target zones, **by solar sails approaching the target stars or by drag in the gas and dust at the targets**. - Captured into orbit about target stars, or into gas and dust and accreting comets in accreting solar nebulae and interstellar clouds. - Delivered to planets along with meteoritic dust or by cometary impact. The probability of delivery depends on the mixing ratio of the panspermia capsules and the dust, and on the fraction of this dust that is delivered to planets. - Survive and evolve on the target planets. Each of these steps have been considered in detail, and the probability of success has been evaluated (Mautner, 1997a). If the probability of capture of the panspermia capsules is small, large numbers of capsules may be sent to achieve success.

Solar CP – Solves Space Leadership

**Mick 10 -** senior news editor at independent tech news site DailyTech (Jason, “Japan's Revolutionary Solar Sail Accelerates Towards the Stars,” DailyTech, 7/19/10, http://www.dailytech.com/Japans+Revolutionary+Solar+Sail+Accelerates+Towards+the+Stars/article19078.htm)

IKAROS is currently happily accelerating through space via its solar sail, an incredible success for Japan's space program.  (Source: JAXA)

NASA is yet again left behind in the space race  
**Once the U.S. led in the space race, exploring the moon and sending probes to distant stars**.  **Now that's far from the case**, as funding to the U.S. space program has been cut and goals scaled back.  Fortunately, there are plenty of other innovative nations willing to step in and pick up the slack.  
Japan last month launched the first full solar sail craft into space, transforming a science fiction dream into reality.  The craft, IKAROS, successfully deployed its solar sail.  
Now the Japan Aerospace Exploration Agency has updated the world on its progress.  The sail is performing extremely well, constantly accelerating, with every passing day.  
Japanese researchers calculated that each photon striking the sail exerts 0.00025 pounds of force on the sail.  That force adds up slowly, speeding up the the 3,000 square foot sail and its attached 700-pound payload.  
**With the new Japanese success, solar sail look to become the new gold standard for deep space propulsion**, until better technologies (plasma engines, nuclear engines) are more fully developed.  And **the success is a sign of Japan's growing presence as a space pioneer.**  
Japan plans to land a robotic army on the moon, starting a few years from now.  In the private sector, the Planetary Society, a space research group, and Cosmos Studios of Ithaca, N.Y., headed by Ann Druyan, a film producer and widow of the late astronomer and author Carl Sagan, will launch the LightSail-1, another solar sail design, into space late this year.

Solar CP – A2: Violates Laws of Physics

Doesn’t Violate Law of Physics – top experts disagree with their specific claims

Majaraj, ‘4 (Jai, PhD and space expert, 8/7, http://www.natscience.com/Uwe/Forum.aspx/physics/5943/SOLAR-SAILING-BREAKS-LAWS-OF-PHYSICS

But Thomas Gold from Cornell University in New York says the proponents of solar sailing have forgotten about thermodynamics, the branch of physics governing heat transfer. Solar sails are designed to be perfect mirrors, meaning that they reflect all the photons that strike them. Gold argues that when photons are reflected by a perfect mirror, they do not suffer a drop in temperature. That brings in a thermodynamic law called the Carnot rule, which basically states that you never get something for nothing: if there is no temperature change when the photons are reflected, it is impossible to extract any free energy from them to push the sail along. "Carnot's rule says there must be a degradation of energy in any machine that turns out free energy," Gold says in the New Scientist report. "A mirror does not have any degradation." This does not mean sunlight cannot exert a force- comet tails point away from the sun, and are often cited as evidence in favour of solar sails. But Gold says this is because a comet tail is not a perfect mirror: it absorbs some of the light. In this scenario Carnot's rule says some energy can be extracted, so long as the object absorbing the light remains cooler than the radiation itself. A solar sail that absorbed photons would heat up within seconds, Gold argues. The claim has been greeted with scepticism. "There may be limits on how much solar radiation can be turned into work, but I do not think these are thermodynamic limits," says Jeffrey Lewins, a thermodynamics expert at the University of Cambridge.

Prefer our evidence – empirics are on our side - their card is from 2003 – NASA demonstrations and use of solar sails occurred after that – disproving the claim

A2: CP Links to Politics

Avoids the link – our ev proves nuclear is uniquely controversial

Prefer our 1nc grossman ev –

1. its comparative – says solar sails avoid the controversy and the spending link – its 10 times cheaper
2. their ev isn’t specific to SOLAR sails - says the reason for cost opposition is because of the expense of developing *direct beaming energy lasers* – SOLAR sails don’t need that because they directly use the sun – and even if they are required for *deep* space exploration – that would come way down the line – in the short term the solar sails wouldn’t use beaming

*(if they read general link turns on politics)*

Their link turns on politics take out the link to the CP but not the plan – concedes that NASA spending link is wrong but doesn’t answer our specific nuclear link

*(if they didn’t read generic link turns on politics)*

Their general NASA spending links are wrong – but our nuclear specific links still apply

**Rash ’10** (Wayne, 6/30/10, eWeek, “NASA Space Flight Funding Plan Stymies Congress, Obama Administration” http://www.eweek.com/c/a/IT-Infrastructure/NASA-Space-Flight-Funding-Plan-Embroils-Congress-Obama-Administration-503112/)

The White House's plans for NASA's manned space program have been encountering strong objections from both Democrats and Republicans. Members of Congress have repeatedly said the White House and Congress need to find a way to pay for continued space exploration by NASA. The current plans would effectively gut NASA's manned space program, eliminate planned manned-rated heavy-lift boosters and only direct long-term funding for manned space flight to private industry. In addition, the administration has delayed any decision on government-funded heavy-lift booster development programs for at least five years. In the meantime, NASA's current space shuttle fleet would be retired and any travel to the International Space Station would be either outsourced to startup space launch companies or to the Russian space program, or would simply be eliminated. The opposition in Congress has been partly driven by high-profile testimony from experts and astronauts, including Neil Armstrong and Buzz Aldrin, the first two humans to land on the moon. In addition, members of Congress, especially in the economically hard-hit Gulf states, fear that the elimination of an effective manned space program by NASA would be a serious blow to their economies, already reeling from the BP oil leak that is throwing thousands of people out of work and shutting down a wide range of businesses along the coast.

\*\*\*Solar CP – Solves Fusion Good Add Ons\*\*\*

A2: ALL Fusion Good Add Ons – Solar CP Solves\*

Their Fusion add ons aren’t net benefits – they misunderstand their own internal link - Fusion *propulsion* is IRRELEVANT to broader fusion power – their Schmidt evidence says *moon mining and helium 3* are key – if we win solar sails solve moon access – it solves every one of their fusion good add ons –even if we don’t use fusion propulsion

And – there’s no time frame solvency deficit – – plans solvency is long term too and theres zero argument why EPPP itself spurs global fusion – the only internal link is Helium 3 – which we access just as quickly – and the impact to their advantages is long term anyway

CP Solves HE-3/Fusion Power/nuclear waste (if they don’t read lunar mining advantage)

*(NOTE – THESE CARDS ARE ALREADY IN THEIR MOON MINING ADVANTAGE – I INCLUDED THEM HERE AS PROOF THE CP SOLVES THEIR FUSION ADD ONS, YOU SHOULD ONLY READ THESE IF THEY DON’T READ THE MOON MINING ADVANTAGE)*

Lunar mining will spur the development of fusion reactors that do not produce radioactive waste

Schmitt 4 (October 2004, Harrison H., Popular Mechanics, Apollo 17 astronaut, “Mining the Moon,” vol. 181, no. 10, Academic Search Premier)

Initially, scientists believed they could achieve fusion using deuterium, an isotope of hydrogen found in seawater. They soon discovered that sustaining the temperatures and pressures needed to maintain the so-called deuterium-deuterium fusion reaction for days on end exceeded the limits of the magnetic containment technology. Substituting helium-3 for tritium allows the use of electrostatic confinement, rather than needing magnets, and greatly reduces the complexity of fusion reactors as well as eliminates the production of high-level radioactive waste. These differences will make fusion a practical energy option for the first time.

It is not a lack of engineering skill that prevents us from using helium-3 to meet our energy needs, but a lack of the isotope itself.Vast quantities of helium originate in the sun, a small part of which is helium-3, rather than the more common helium-4. Both types of helium are transformed as they travel toward Earth as part of the solar wind. The precious isotope never arrives because Earth's magnetic field pushes it away. Fortunately, the conditions that make helium-3 rare on Earth are absent on the moon, where it has accumulated on the surface and been mixed with the debris layer of dust and rock, or regolith, by constant meteor strikes. And there it waits for the taking.

An aggressive program to mine helium-3 from the surface of the moon would not only represent an economically practical justification for permanent human settlements; it could yield enormous benefits back on Earth.

LUNAR MINING

Samples collected in 1969 by Neil Armstrong during the first lunar landing showed that helium-3 concentrations in lunar soil are at least 13 parts per billion (ppb) by weight. Levels may range from 20 to 30 ppb in undisturbed soils. Quantities as small as 20 ppb may seem too trivial to consider. But at a projected value of $40,000 per ounce, 220 pounds of helium-3 would be worth about $141 million.

Because the concentration of helium-3 is extremely low, it would be necessary to process large amounts of rock and soil to isolate the material. Digging a patch of lunar surface roughly three-quarters of a square mile to a depth of about 9 ft. should yield about 220 pounds of helium-3 — enough to power a city the size of Dallas or Detroit for a year.

Although considerable lunar soil would have to be processed, the mining costs would not be high by terrestrial standards. Automated machines, perhaps like those shown in the illustrations on pages 56 and 57, might perform the work. Extracting the isotope would not be particularly difficult. Heating and agitation release gases trapped in the soil. As the vapors are cooled to absolute zero, the various gases present sequentially separate out of the mix. In the final step, special membranes would separate helium-3 from ordinary helium.

The total estimated cost for fusion development, rocket development and starting lunar operations would be about $15 billion. The International Thermonuclear Reactor Project, with a current estimated cost of $10 billion for a proof-of-concept reactor, is just a small part of the necessary development of tritium-based fusion and does not include the problems of commercialization and waste disposal.

The second-generation approach to controlled fusion power involves combining deuterium and helium-3. This reaction produces a high-energy proton (positively charged hydrogen ion) and a helium-4 ion (alpha particle). The most important potential advantage of this fusion reaction for power production as well as other applications lies in its compatibility with the use of electrostatic fields to control fuel ions and the fusion protons. Protons, as positively charged particles, can be converted directly into electricity, through use of solid-state conversion materials as well as other techniques. Potential conversion efficiencies of 70 percent may be possible, as there is no need to convert proton energy to heat in order to drive turbine-powered generators. Fusion power plants operating on deuterium and helium-3 would offer lower capital and operating costs than their competitors due to less technical complexity, higher conversion efficiency, smaller size, the absence of radioactive fuel, no air or water pollution, and only low-level radioactive waste disposal requirements. Recent estimates suggest that about $6 billion in investment capital will be required to develop and construct the first helium-3 fusion power plant. Financial breakeven at today's wholesale electricity prices (5 cents per kilowatt-hour) would occur after five 1000-megawatt plants were on line, replacing old conventional plants or meeting new demand.

**This spurs a transition to a nuclear fusion economy --- solves safety and proliferation risks, public fears and prevents economic and environmental collapse**

**Kulcinski & Schmitt 2000** (July 2000, G.L. Kulcinski and H.H. Schmitt, with the Fusion Technology Institute in the Department of Engineering Physics at the University of Wisconsin-Madison, Fusion Technology Institute, “Nuclear Power Without Radioactive Waste – The Promise of Lunar Helium-3,” Presented at the Second Annual Lunar Development Conference, “Return to the Moon II”, 20–21 July 2000, Las Vegas NV, <http://fti.neep.wisc.edu/FTI/pdf/fdm1131.pdf>)

Observations on the Development of Fusion Energy in the 21st Century

If one accepts the need to develop nuclear energy to satisfy the needs of Earth’s inhabitants in the 21st century and beyond, then it is reasonable to ask “How can one transition from the current fission nuclear economy to a future fusion economy and what would be the benefits of such a transition?” A detailed discussion of this important question is beyond the scope of this paper but the general outline of an answer is summarized in Figure 6. For example, the level of concern over proliferation, nuclear waste, safety, and radiation damage to reactor components is very high in the case of fission reactors. This is not to say that the fission industry has not or cannot solve those problems, but it is clear that the public has concerns in those areas. If one moves to the first-generation fusion fuels, the issues of proliferation, nuclear waste, and safety are somewhat alleviated. However, the radiation damage issue is as difficult (or some would say even more difficult) to solve. One additional area of concern that is faced by first-generation fuels is the safe handling of large amounts of radioactive tritium.

Basically, the use of second-generation fuels (D3He) eliminates the proliferation issue and the safety issues are greatly reduced. However, these advantages are purchased at the price of more difficult physics requirements. Finally, the move to the third-generation fuel (3He3He) completely removes the concerns over proliferation, radiation damage, nuclear waste, safety, and tritium. However, these benefits have to be balanced against the much more difficult physics requirements of this fuel cycle.

Conclusions

It is appropriate, as society enters a new millennium, to question how future generations will be able to sustain life on Earth while expanding into the solar system. One of the essential questions to answer is how will future generations find enough energy to avoid the economic and environmental collapse that could occur if fossil fuels become prohibitively expensive in the next 50-100 years. Presently, nuclear energy appears to be the only solution capable of sustaining society as we know it. There is a growing resistance, whether justified or not, to expansion of fission energy. Fusion energy represents an improvement over fission, if it can be shown to be economic, but the first-generation fuels (DT, DD) are very capital intensive because they generate large amounts of radioactive waste and must contain large amount of radioactive materials in a hostile environment. The second-generation fuels (D3He) represent a tremendous improvement over the DT and DD cycles but face somewhat more difficult plasma physics requirements. Ultimately, the thirdgeneration fusion fuels (3He3He) could remove the concern of the public over radioactive waste and releases of radioactivity during reactor malfunctions. This optimism must be balanced against much more challenging physics regimes compared to those for the first- and second-generation fusion fuels.

If one takes the long-range viewpoint, it is clear that some effort should be expended early in the 21st century to developing the third-generation fusion fuels. The ultimate payoff from such research could be the “pot of gold at the end of the rainbow”, the production of clean, safe, economical, and long lasting nuclear energy without nuclear waste in the 21st century.

A2: Warming Add On – Solar Sails Solve

Solar Sails would send the effects of warming to pre-industrial levels—also spurs massively new innovation in science and tech.

Angel and Worden 5

(Roger and S. Pete, both prof. of Astronomy @ Univ. Of Arizona, A Moon-Made Screen in Space to Reverse Global Warming: Is it Now Feasible and Affordable?, International Lunar Base Workshop “Jamestown on the Moon”Washington DC October 12, 2005, http://forum.nasaspaceflight.com/index.php?topic=1849.0)

A screen in space could be used to mitigate warming caused by increased greenhouse effect. Recent estimates are that a screen yielding a 1.8% reduction in solar flux could reverse fully reverse the effect of a doubling of CO2 relative to pre-industrial level (1). In a controlled orbit near L1, the Lagrange point a million miles toward the sun, a screen would remain permanently lined up to block a small fraction of the solar radiation. To be effective it would have to be 1000 miles across, and even at gossamer thickness it would weigh millions of tons. In 1989 Early (2) proposed a blocker made either opaque or of thin ribbed glass to deflect away the sunlight. He recognized that the costs of launching so much mass could be prohibitive, and that a practical solution might be found by making the shield from lunar material. Solar power could be used to both process the material into glass and structural elements, and to drive a magnetic rail for launch into the L1 orbit. This idea is now worth revisiting. Global warming is better modeled and defined. The value of maintaining a viable climate can be determined in different ways and is likely to be in the range five to ten trillion dollars, a few percent of world GNP over the next 50 years. The best mitigation strategy will likely be some combination of reducing future CO2 production and shading from space. In order to find this balance, research is needed now to better understand if a shade could be implemented within the above cost ceiling. Such studies would provide an important focus to NASA’s exploration initiative. There are two major elements for any system: the making and launching the shade components on the moon, and the assembly, deployment and maintenance of the very large system.at L1. The basic manufacturing and launch parameters can be derived on the assumption that the shade is to be completed within a few decades. To steer the full spectrum of sunlight away from the Earth the glass needs an average thickness of about 2 microns, and a million square miles will thus weigh 12 million tons. The production rate would need to be some 1000 tons a day, along with several hundred tons a day of titanium or aluminum for structural components. The electric power needed to mine the ore and to process and accelerate 1500 tons/day to 3 km/sec launch speed would be ~ 250 MW. This would require a solar plant with a square kilometer or so of solar cells weighing ~ 1000 tons. At L1, it will be likely be preferable to assemble the shade not as a single structure but as a constellation of many identically sized, free-flying elements. For example, if each self-contained unit were as small as a 14 m square and weighing ~ 1 kg, about ten billion would be needed to make up the shield. The residual force of gravity that pulls each unit toward the center line would be balanced by suitably orientating the redirected light. In manufacture, the moon-derived structural metal would be fashioned into ultralightweight support struts at free-orbiting factories about L1. The screen itself, cut in squares from a 14 m wide roll of thin lunar glass, would be attached to a structural cross with four 10-m long struts connected at a center hub. Each unit wouldinclude tiltable reflecting panels to be used as solar sails for initial placement in the constellation and station keeping, particularly to stabilize any drift in the unstable longitudinal direction. We envisage the constellation as like a large shoal of fish or flock of birds, with control by autonomous computers in each unit to prevent collisions or self-shadowing. The constellation would be three-dimensional. On the smallest scale, the units in any plane would be separated from each other by 14 m in both dimensions. Full blocking would be accomplished by arranging the units in complementary positions in four planes separated longitudinally by ~ 20 m. The structure would be fractal, with the 4-plane blocking pattern repeated on ever larger scales until the constellation would extend longitudinally as much as 1000 miles. The average density would then be only ten units per cubic mile. For each unit the electronics with its own small solar cell might weigh ~1 gram To make ten billion units in 30 years (10,000 days) will require manufacture and placement of a million units a day at L1. If there are 1000 factories working in parallel, each factory would have to complete a unit in little more than a minute. The factories would need to use sophisticated robots made on Earth, and might weigh in the range 1 – 10 tons each. The above rough sketch is given simply to establish feasibility and to focus attention to the broad range of studies that need to be undertaken. Clearly such a massive undertaking is beyond the current state of the art in its use of lunar material and in robotic manufacture. However, the new paradigm based on extensive use of in-situ lunar resources and large scale robotic manufacturing capability on the moon and at L1 appears both feasible. The developments needed for this application with potentially immense benefits to human life on Earth could form a key part of NASA’s New Vision for Space Exploration. Some of the key areas for study and experiment are: 1) Launch costs and the balance of Earth based and lunar based manufacture. There are three major high tech, lightweight elements that would likely be launched from the Earth. The first would be for the moon, the robots, electronics, solar cells, wire, bearings, motors and high temperature ceramics for the lunar manufacturing and rail gun. It would also include the pilot facilities on the moon to bootstrap the local manufacture of structural elements used in full scale lunar operations. The total mass to be delivered to the moon we estimate at around ten thousand tons. At L1, the ten billion control units at 1 g each will weigh also ten thousand tons, and so will the thousand robotic assembly factories if we allow ten tons each. The total mass to be launched from Earth of 30,000 tons is less than 0.2 percent of the screen’s mass, and even at today’s high launch costs of $20,000/kg would cost less than $1 trillion. Reductions in launch cost, however, would give cushion and flexibility to the project. 2) Space experiments – Clearly it would be desirable and practical to place prototype blocker units at L1 within a few years, to test positioning and station keeping by solar sails. The materials would be consistent with expected lunar products, and the units should have the correct mass, e.g 1 kg for the example we have chosen. 3) Development of optimum glass and structural metal composition and manufacturing strategy from lunar ore. A key requirement for the glass is that it remain crystal clear for a century. Solarization would affect solar radiation pressure and the orbital balance of the blocker elements. Prospecting for the optimum ores will be required. Techniques to mass produce the ribbed sheets need to be developed and tested. We envisage that ultimately the glass would be manufactured 14 m wide and rolled up for launch. 4) Computer optimization of the “collective intelligence” of the blocker swarm for robustness and stability. 5) Definition and development of robotic requirements for both the moon and L1 factories. Century long lifetime for the free flyer control units is desired. Also since there will be millions of failures, an almost biological system to identify failed units and sweep them out for refurbishment or replacement before the swarm is damaged. In conclusion, the project is very challenging but is not clearly impossible within the financial target. It seems certain it would attract the best and brightest from across the world to solve the myriad of challenges, in a way that has not happened since Apollo and the Manhattan projects. Now is the time to open channels to bring this talent to bear.

And it can control weather services and decrease warming

Roy 1

(Kenneth-- American Institute of Physics, engineer working in Oak Ridge “Solar Sails - An Answer to Global Warming” The Ultimax Group White Paper #2001-3, The Ultimax Group Inc http://www.ultimax.com/whitepapers/2001\_3a.html)

Solar sails can be used to adjust the earth's solar constant (in effect making it a variable that can be controlled). These sails will need to actively track their environment and be intelligent enough to act accordingly. They could be part of the solution, or even **the entire solution, to the problem of global warming and climate change**. Having solar sails reduce the sunlight hitting the earth could lead to some degree of weather control. The implementation of the solar sail solution requires the development of a large space infrastructure that does not exist today. As a minimum it will require a large-scale, cheap, and dependable low earth orbit access capability. It will probably require lunar mining and materials processing facilities as well as automated manufacturing and lunar launch capabilities. We must come to a far better understanding of the sun, the earth's climate, and how these interact. If the problem of global warming is real, and if the solution involves the use of solar sails, then the infrastructure necessary to build, launch, and control these solar sails will give the people of the earth, not only a better climate, but also access to the solar system.

Shielding the sun would be capable of rolling back Warming

Angel and Worden 6

(Roger-- a Regents Professor at the University of Arizona and is on the faculty of the UA astronomy department and the Optical Sciences College, and Research Professor of Astronomy at the University of Arizona and Director of NASA Ames Research Center, “Making moon sun-shades from moondust”, Summer 2006, Ad Astra, http://www.nss.org/adastra/volume18/angel.html)

The Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise 1 to 4.5°F (0.6 to 2.5°C) in the next 50 years, and 2.2 to 10°F (1.4 to 5.8°C) in the next century, with significant regional variation. Global warming will have generally negative impacts on human life and the biosphere, so, to varying degrees, industry, scientists and policymakers are making significant efforts to mitigate the problem. Most proposals for reversing global warming are aimed at lowering greenhouse gases, most notably the Kyoto Treaty, which aims to halt the rise—and eventually to lower—greenhouse gas emissions. Technical solutions to enable current levels of economic activity to proceed with lowered emissions are under investigation and development in private industry and at universities. These solutions focus on finding non-fossil fuels, and, more to the point, non-carbon-emitting energy sources. To this end, nuclear, solar and other energy sources are promising. Dave Criswell, a physics professor at the University of Houston, is exploring the possibility that solar energy captured on the Moon could be relayed to Earth to satisfy much of its future energy needs. But even if fossil-fuel burning were stopped tomorrow, the current exceptionally high level of carbon dioxide in the atmosphere would take more than a century to dissipate. Other solutions under study therefore include the capture and underground sequestration of atmospheric carbon. Here we explore another approach for mitigating global warming, or indeed global climate change of any origin, by placing a shield at the Earth-Sun L1 point to redirect sunlight away from the Earth (or toward it to mitigate cooling). Shields Many experts have discussed a screen in space to mitigate global warming. A 2000 study by Bala Govindasamy and Ken Caldeira showed that a screen yielding a 1.8 percent reduction in solar flux **could fully reverse the current effect** of the doubling of CO2. In a controlled orbit near L1, a screen would remain permanently lined up to block a small fraction of the solar radiation. To be effective, these huge "sunglasses" would have to be 1,000 miles across, and even at gossamer thickness would weigh millions of tons. In 1989, engineer James Early, whose work fostered the creation of Telstar-1, the first American communications satellite, proposed a blocker made of thin ribbed glass to deflect the sunlight. He recognized that the costs of launching so much mass from Earth could be prohibitive, and that a practical solution might be found by making the shield from lunar material. Solar power could be used to process the material into glass and structural elements, and to drive a magnetic rail for launch into the L1 orbit. Early's idea is now worth revisiting. The value of maintaining a viable climate can be determined in different ways, and is likely to be in the range of $5 to $10 trillion—again, just a few percent of world GNP over the next 50 years. In order to find this balance, research is needed now to better understand if a shade could be implemented within the above cost ceiling, and within a few decades. To steer the full spectrum of sunlight away from the Earth, the glass needs an average thickness of about 2 micron—a fiftieth that of a human hair. Even at such light weight, a thousand- mile diameter sheet will weigh 10 million tons. To build the shield in 30 years, glass production would need to be about 1,000 tons a day, along with several hundred tons a day of titanium or aluminum for structural components. The electric power needed to mine the ore and to process it, and to accelerate 1,500 tons a day to escape the Moon and reach the L-1 point, at a 3 km/sec launch speed would be about 500 megawatts. This would require a solar plant with a couple of square kilometers of solar cells weighing about 2,000 tons. The shade would be built not as a single structure but as a constellation of many identically sized, free-flying parasol elements. For example, if each self-contained unit were as small as a 14-meter square and weighed about 1 kilogram, ten billion units would be needed to make up the shield. In manufacture, the Moon-derived structural metal would be fashioned into ultra-lightweight support struts at free-orbiting factories near L1. The screen itself, cut in squares from a 14meter-wide roll of thin glass also delivered from the Moon, would be attached to a structural cross with four 10-meter-long struts connected at a center hub. Each unit would include tilting reflecting panels, to be used as solar sails for initial placement within the constellation and for station-keeping, particularly to stabilize any drift in the unstable longitudinal direction. We envision the constellation as being like a large shoal of fish or flock of birds, with station-keeping control largely by autonomous computers in each unit to prevent collisions or self- shadowing. A local positioning system like GPS would also be used. To make ten billion units of 14-meter squares in 30 years (10,000 days) would require manufacture and placement of a million units a day at L1. If there were 1,000 factories working in parallel, each factory would have to complete a unit in little more than a minute. The factories would need to use sophisticated robots made on Earth, and might weigh in the range of 1 to 10 tons each. Economics We can make some estimate of the value of global warming from the current "carbon credit" market. Following the 1997 Kyoto Treaty, individuals or nations can purchase excess "credits" for atmospheric emission of carbon dioxide from nations that produce less than their allocated treaty quota. This amount varies between a few dollars to more than $60 per metric ton. The doubling of carbon dioxide in the Earth's atmosphere that the shield described above **would alleviate corresponds** to about 400 billion tons. Mitigating this using the carbon credit analogy would be worth trillions of dollars. The cost might be financed by selling shield credits to both nations and industries. If a group were to purchase a set amount of shield structure, this would translate directly into carbon credits. In this way, the entire project might be financed "off budget" from government funds. How to Proceed The shield would require three major high-tech elements that would likely be manufactured and launched from the Earth. The first would be the package to enable material production and launch on the Moon. This would include the robots, electronics, solar cells, wire, bearings, motors and high-temperature ceramics for the lunar manufacturing and for the rail gun to launch the manufactured items back off the Moon. It would also include the pilot facilities on the Moon to bootstrap the local manufacture of structural elements used in full-scale lunar operations. We estimate the total mass to be delivered to the Moon at around 10,000 tons. At L1, the 10 billion control units at 1 gram will also each weigh 10,000 tons, and so will the 1,000 robotic assembly factories if we allow 10 tons each. The total mass to be launched from Earth for the entire screen project of 30,000 tons is less than 0.2 percent of the screen's final mass, and even at today's high launch costs of $20,000/kg would cost less than $1 trillion to launch. Reductions in launch cost, however, would be desirable to give cushion and flexibility to the project. The cost of manufacturing the elements to be launched, including the development of the manufacturing and robotic techniques, might bring their costs to $10,000/kg or $3 trillion. Another $20 billion per year might be allocated for project management. The estimated total of less than $5 trillion is not out of line with the value of the shield—$5 to $10 trillion over several decades. The developments needed for this application with potentially immense benefits to human life on Earth are consistent with the New Vision for Space Exploration, which aims at more affordable access to space beyond near-Earth orbit. We identify several specific near-term activities that should be undertaken. It would be desirable and practical to develop and place a few prototype blocker units at L1 within a few years, to test positioning and station keeping by solar sails. The materials would be consistent with expected lunar products, and the units should have the correct mass, about 1 kg for the example we have chosen. A key requirement for the glass is that it remain crystal-clear for a century. The Sun produces darkening or "solarization" in some glass materials over long periods of time. We need to find glass that is resistant to this effect. Prospecting for the optimum lunar ores will be required. Techniques to produce the glass ingots on the Moon and to mass-produce the ribbed sheets need to be developed and tested. We envision that ultimately the glass would be rolled up for launch. Another valuable near-term step is, thus, to computer-simulate and optimize the "collective intelligence" of the blocker swarm for robustness and stability. The free-flyer control units will have to last for a century or more. Since there will likely be millions of failures, there must also be a system to identify failed units and sweep them out for refurbishment or replacement before the swarm is damaged. In Conclusion A global-warming Sun shield is a very challenging project, to say the least, but is not clearly impossible within the financial target. It seems certain that it would attract the best and brightest from across the world to solve the myriad of challenges involved, in a way that has not happened since Apollo or the Manhattan Project. It might also represent the first truly large-scale commercial and private-sector use of space, and would **certainly be of benefit to the entire population of Earth**. Now is the time to begin in earnest the development and testing of these critical technical steps.

New computer simulations show shading the sun sufficient to solving

BBC News 6

(Molly Bentley, “Guns and sunshades to rescue climate”, March 2, 2006, http://news.bbc.co.uk/2/hi/science/nature/4762720.stm)

Consider the notion of shading the planet with mirrors. The US National Academy of Sciences found that 55,000 orbiting mirrors would reflect enough sunlight to counter about half the doubling of carbon dioxide. But each mirror must be 100 sq km; any larger and you would need a manufacturing plant on the Moon, says Dr MacCracken. The price tag of space-based fixes makes them prohibitive - for now. By contrast, the "human-volcano" approach is on terra firma and less costly. Inspired by studies of the Mt Pinatubo eruption of 1991 and the cooling effect of its sulphur plume, one proposal suggests that naval guns shoot sulphur pellets into the air to increase Earth's albedo, or reflectivity. We know that blocking sunlight can counter global warming, but can we get the balance right? Ships could fire sulphur aerosols to mimic the effect of volcanoes "I don't think we can get it right," says Ken Caldeira from the Carnegie Institution Department of Global Ecology at Stanford University in California. "One of the problems of putting sulphate particles in the stratosphere is that it would destroy the ozone layer; so you might solve the global warming problem, but then we'd all die of that." And this from a man whose work supports the idea of dimming the Sun. A few years ago, Dr Caldeira set out to disprove an idea put forward by Livermore physicists Lowell Wood and Edward Teller to cool the Earth with a sheet of superfine reflective mesh - similar in concept to orbiting mirrors. In a computer model, Dr Caldeira and colleague Bala Govindasamy simulated the effects of diminished solar radiation. "We were originally trying to show that this is a bad idea, that there would be residual regional and global climate effects," explains Dr Caldeira. "Much to our chagrin, it worked really well." Acts of hostility The simulation showed that blocking even a small percent of sunlight balanced out the doubling of atmospheric CO2. But in their published paper, the scientists caution against the environmental risks of geoengineering.

A2: Econ/Enviro/Ag/Warming Add Ons – Solar CP Solves

If we solve colonization we solve their add on – spurs SPS that solves all energy needs and environmental concerns

Davis, 9 **[**senior aerospace scientist at Boeing Spring 2009, Dean E., Ad Astra, “Why Go to the Moon?” Ad Astra 21 no1,

Based upon this analysis, the best economic reason to establish a permanent human presence on the Moon is to provide the prospecting, mining, manufacturing, agriculture, and transportation logistics infrastructure necessary for an affordable Space Solar Power (SSP) constellation. SSP can provide America and the rest of the Earth with most of its power needs from the sun-day or night, in all weather conditions, and without dependence on foreign energy interests, while minimizing the effects of global warming. Other economic reasons for establishing a permanent human presence on the Moon include helium-3 mining (assuming a nuclear fusion technology breakthrough occurs), significant reductions in space transportation costs, the prospect of space tourism (lunar hotels and resorts.)

A2: Space Debris Add On – Solar CP Solves

CP Solves – this is just another impact to a moon colony – which we access

**Solar sails are critical to satellite burnups solving space debris**

**Mann 2/3** – staff writer for Nature News (2011, Adam, “Solar sails pick up speed”, http://www.nature.com/news/2011/110203/full/news.2011.68.html, accessed June 25, 2011, ZR)

In contrast to IKAROS, NanoSail-D was designed to travel closer to home. Launched into low-Earth orbit, it will experience drag on the sail as it skims the planet's upper atmosphere. Within a few months, the spacecraft should slow sufficiently to re-enter and burn up. The technology could one day be attached to decommissioned satellites to slow them down and assist in de-orbiting, says Dean Alhorn, an engineer at NASA's Marshal Spaceflight Center in Huntsville, Alabama, and principal investigator of the NanoSail-D mission.

\*\*\*A2: Add Ons\*\*\*

A2: EPPP Good - Disarm Add On

Zero International Solvency – other countries won’t disarm – even if you demonstrate nuclear weapons can have peaceful uses countries will still want them for SECURITY reasons – their ev is a fantasy from a hack blogger whos only qualifications as a “political researcher” are that he writes about it on his own blog

Disarm causes great power wars, crushes heg, causes bioweapon use and makes all their impacts more likely by incentivizing nuclear breakouts

Barnett 09

(Thomas, **B.A. in International Relations and Russian Literature, University of Wisconsin, 1984, A.M. in Soviet Union Program, Harvard University, 1986**, **Ph.D. in Political Science, Harvard University, 1990,** “Seven Reasons Why Obama's Nuke-Free Utopia Won't Work” 5/14/09 Esquire Magazine, <http://www.esquire.com/the-side/war-room/obama-nuclear-proliferation-051409>//chris)

**Last month in Prague,** President Obama [declared](http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/) his country's "moral responsibility to act" in transforming our planet into one free of nuclear weapons. He called for a global summit and a treaty to end nuke development, then signaled his seriousness back home by [axing](http://blogs.tnr.com/tnr/blogs/the_plank/archive/2009/05/12/obama-breaks-with-gates-cancels-nuke-program.aspx) the Pentagon's much-needed Reliable Replacement Warhead program. Speaking before tens of thousands of Czechs on the day North Korea tested a long-range missile, Obama may have sounded like Martin Luther King ("This goal will not be reached quickly — perhaps not in my lifetime"), but his concept of a nuclear-proof world is patently unattainable, potentially dangerous, and inherently wrong. "I'm not naïve," the president said. "But we go forward with no illusions." But he is, and he has. George W. Bush had his "axis of evil," while Obama seems to find nuclear weapons to represent a kind of natural evil unto themselves — no matter who possesses them. Now the twentysomethings in Prague may have cheered his invocations of "hope" and "change," and others may be [jumping on board](http://www.esquire.com/the-side/war-room/%20http:/www.huffingtonpost.com/joe-cirincione/the-new-realism-of-arms-c_b_202996.html), but I've discovered something in my years of global-strategy analysis, and it's not the deadly fatalism Obama describes — it's the modern realism he ignores: Nuclear weapons are the single best thing that has ever happened in mankind's long history of war. Globalization existed prior to World War One, but then nukes arrived with their own "crystal-ball effect," previewing the suicidal destruction of modern war between great powers. And if globalization's economic interdependence [was a "great illusion" back then](http://books.google.com/books?id=HiKuvZ8NYDgC&dq=norman+angell+great+illusion&printsec=frontcover&source=bl&ots=tt4fyVFpCB&sig=35xrTZAVl2IOlaGmh06X845hSVQ&hl=en&ei=LTkMSurnI9bgtgfdneGRCA&sa=X&oi=book_result&ct=result&resnum=3), it's become a rock-solid strategic reality in recent decades — and our recent global financial contagion has only made that more indisputably clear. Meanwhile, the world's great powers have come to understand that nuclear weapons are for having, not using. And that is why no nuclear power has ever directly gone to war against another. If Obama simply wants to reengage Russia on further warhead reductions, fine. But it seems to me that his nuclear utopianism is not so much an extension of his youthful optimism as a vestige of the generational guilt promoted by Cold Warriors like Henry Kissinger — "wise men" who seek to end America's hypocrisy in preaching non-proliferation while relying on nuclear weapons as strategic back-stop. This vision isn't just a backwards one; it's a dangerously destabilizing policy agenda that makes conventional great-power war conceivable once again. Here's why Obama's nuclear ideals put World War III back on the table: 1. The "increasing speed" of proliferation is a myth. As far as a world filled with nuclear powers is concerned, we're just reaching double digits (as in, ten!) with North Korea and Iran. Meanwhile, roughly three-dozen additional states have achieved nuclear power while eschewing weaponization. Ah, but we are told that when "irrational" regimes reach for the Bomb, like Tehran's mullahs or Pyongyang's whacked-out Kims, we enter into a new, far more threatening era. And yet history remains clear on this subject: When nuclear monopolies are ended and existing rivalries are nuclearized, stabilitytends to break out — time and again. So, yeah, let's manage Iran's ascension to the great-power club (and Israel's temptation to wipe it off the map preemptively) and encourage Beijing to rid the world of Kim's war-crime-worthy regime (lest South Korea and Japan go nuclear, too), but let's not pretend that a nuclear-free world facilitates either evolution. 2. One nuke in a nuke-free world is more usable. If nuclear weapons are suddenly in short supply by the destabilized great powers, any regime that rapidly fields them would become, overnight, the strategic equivalent of the one-eyed man in the land of the blind. As much as some experts hype the dangers associated with Iran and North Korea, the fact that Israel possesses hundreds of nuclear warheads, while Pyongyang's potential opponents own them in the thousands, keeps these threats reasonably deterred (Ahmadinejad being no more rhetorically aggressive than Mao was in his nuclear debut). 3. An America with fewer nukes breeds a new class of military powers. By reducing "barriers to entry" to the marketplace called great-power war, I believe we would actually *encourage* the proliferation of nuclear weaponry. If Obama and his successors were to withdraw America's virtually global nuclear umbrella, numerous middle powers would become highly incentivized to fill that security gap. Of course, the dream would be to include all such states in a global rejection of nuclear weaponry, but that's not likely if the system's clear Leviathan (the United States) demotes itself to the status of a de-nuclearized great power. That scenario (Obama's scenario) instantly elevates a slew of suddenly "near-peer" military powers in a manner that smaller states will likely find strategically unpalatable. As in, they could be blown into oblivion — strategic or literal — at any moment. 4. A new class of military powers breeds a new round of local wars. The fallout from the collapse of our nuclear umbrella would be as frightening as it would be immediate: the resumption of great-power rivalries and proxy wars in regions once again subject to profound spheres of influence. That would further complicate the strategic landscape and undo so much of the Obama administration's diplomatic success between now and then. 5. An America without nuclear retaliation doesn't keep enemies scared. It's not that fear-mongering accomplishes much, really. But a superpower needs an outwardly fearless image beyond this one that Obama offered in Prague: "As long as these weapons exist, the United States will maintain a safe, secure and effective arsenal to deter any adversary, and guarantee that defense to our allies." Even if the capability remains, Obama's words eliminate the existential threat of massive American retaliation to disabling strikes, be they directly mounted by nation-states or indirectly by their proxies. And without the threat of our "unhinged" or "angry" response, the U.S. arguably encourages further asymmetrical responses from likely opponents, cyberwarfare being preeminent among them. 6. Getting rid of old-

school nukes won't stop the rise of new-school biological weapons. This century's scientific advances in warfare will certainly be centered in biology — not in physics, which defined that great twentieth-century advance known as the atom bomb. These new advances will lead to weapons likely destined to the same fate as chemical weaponry: unusable in any deterrent sense because of their uncontrollability (once unleashed, who knows where they spread?). So if the only players crazy enough to use warfare's new scientific weaponry are nihilistic terror groups — groups that don't care where the blowback hits because their aim is widespread instability and fear — undoing nuclear capabilities won't diminish that danger whatsoever. 7. The threat of "loose nukes" is for Jack Bauer to worry about, not Barack Obama. In his speech, Obama described a scenario in which a nuclear weapon falls into the hands of terrorists "the most immediate and extreme threat to global security." But the historical record here is equally clear: Recognized nuclear powers do not share technology indiscriminately, while unrecognized ones (e.g., North Korea, Pakistan) are tempted to cash in. Recognized nuclear states don't just pass bombs to terrorists, because that would negate the primary reason for having them: keeping the state safe from any attacks by fellow nuclear powers (in Iran's case, from the U.S. and Israel). **The Obama administration wants to separate itself** from the Bush-Cheney legacy of rejecting nuclear arms control while, at the same time, obsessing over the dangers of nuclear terrorism. I understand this. But there are better ways to bridge those two dangers than seeking to turn back the clock on nuclear weapons, which — counter-intuitive as it may seem — have actually kept us free of great-power war for well over six decades and counting. Don't underestimate the power of America's large nuclear arsenal; it constitutes a very big stick that allows our leadership to speak softly as the world's sole military superpower. For a president of Obama's temperament and ambition, this is a match made in heaven. Now all he has to do is appreciate it, because with enough on his plate to consume five or six terms, Obama needs to husband his political capital at home and his diplomatic capital abroad to focus more on pressing matters and immediate threats. I mean, this man is attempting to unwind America's two military quagmires while finessing Iran and North Korea. As Obama makes Afghanistan-Pakistan *his* war, he disappoints the Left. As he's forced to engage Iran more equally, he angers the Right. And promising a "nuclear-free world" preemptively apologizes in both directions. Instead, America should remain committed to the strategic concepts of nuclear deterrence and continue our decades-long policy of being openly ambiguous about the conditions that will trigger our use of such weapons. Because if the threat is out there, America — and Obama — has to remain in control of it.

other countries will cheat – even attempting disarm causes nuclear war

Schneider, 2k9

(Mark B. Schneider, National Institute for Public Policy, "Prevention through Strength? Is Nuclear Superiority Enough?" COMPARATIVE STRATEGY v. 27 n. 2, April 2009, pp. 116-139, ASP.)

Multilateral inspection regimes are even worse than those of national regimes because of the politics of the inspecting agencies and the presence of agents of the rogue dictatorships in their bureaucracies. How can one possibly assume that hostile authoritarian states, driven by extreme religious ideologies, extreme nationalism, and legacy Cold War attitudes, will not build and hide nuclear warheads (and probably, in some cases, a very large number) and use them at a time of their choosing? It is simply impossible to eliminate nuclear weapons and the factor of nuclear deterrence if the West wishes to survive in a world in which these capabilities exist. In the words of French then Chief of Staff General Henri Bentegeat, “I do not believe that the elimination of all the nuclear weapons in the world is technically possible, or necessarily a factor of stability for the world as a whole.”50 In the context of a supposed “global zero” nuclear arms control treaty, the discovery of a covert arsenal might precipitate an immediate nuclear attack by the cheater to prevent any response. In light of what we now know about nuclear EMP effects,51 that could mean the end of Western civilization. Absent the bedrock of an effective nuclear deterrent, the risks associated with arms control solutions to the proliferation problem involving regimes likePutin'sRussia**,** CommunistChina, North Korea, Syria, and Iran are potentially suicidal.

**No nuclear accidents – only risk of our turns**

**PERROW 1999** (Charles, Professor of Sociology at Yale, Normal Accidents: Living with High-Risk Technology, p 257-258)

No such encouraging lessons come from the section on nuclear weapons and early warning systems. We will not dwell on “the fate of the earth,” that is, the destructive power of nuclear weapons, but on the limits of human capabilities and the even narrower limits of organizational capabilities. There is much to fear from accidents with nuclear weapons such as dropping them or an accidental launch, but with regard to firing them after a false warning we reach a surprising conclusion, one I was not prepared for: because of the safety systems involved in a launch-on-warning scenario, it is virtually impossible for well-intended actions to bring about an accidental attack (malevolence or derangement is something else). In one sense this is not all that comforting, since if there were a true warning that the Russian missiles were coming, it looks as if it would also be nearly impossible for there to be an intended launch, so complex and prone to failure is this system. It is an interesting case to reflect upon: at some point does the complexity of a system and its coupling become so enormous that a system no longer exists? Since our ballistic weapons system has never been called upon to perform (it cannot even be tested), we cannot be sure that it really constitutes a viable system. It just may collapse in confusion!

Moves towards disarm enhance incentives for allied and rogue proliferation – internal link turns all offense

Payne, 98

(Keith B. Payne, President, National Institute for Public Policy, “The Case Against Nuclear Aboition and for Nuclear Deterrence,” COMPARATIVE STRATEGY v. 17 n. 1, January-March 1998, ASP.)

The existence of U.S. nuclear weapons itself almost certainly has little to do with creating incentives for proliferation by "legitimizing" nuclear weapons. Indeed, as noted previously, to some extent the contrary is true: confidence in the American security guarantee, with its nuclear backstop, is a critical element in persuading U.S. allies that they do not need to go nuclear themselves. And for other potentially hostile states, going to very low or zero weapons on the part of the United States--or other nuclear powers, for that matter--may actually increase proliferation incentives, because it lowers the resource threshold to the point where even small states could create a strategically significant nuclear arsenal. Exclusive U.S. reliance on conventional forces for deterrence also would make more inviting an important potential role for a rogue's nuclear weapons--threatening to trump U.S. conventional forces for the purposes of deterring or coercing Washington.

Small arsenals during the transition will cause crisis escalation and nuclear wars – Turns accidents

ARQUILLA '96

[John, Professor, Defense Analysis, U.S. Naval Postgraduate School Christian Science Monitor, 18 December]

The second dilemma revolves around the increasing vulnerability of smaller arsenals. At today's levels, either of the leading nuclear powers could suffer a "first-strike" while still retaining deadly retaliatory capacity. At lower levels, though, the ability to respond after absorbing an attack grows problematic, particularly if the first blow comes as a surprise. This problem will encourage nuclear powers involved in crises with each other to alert their •forces early and to consider launching their weapons of mass destruction "on warning," to sidestep a potentially disabling first strike. Actions of these sorts would greatly raise the likelihood of the outbreak of an inadvertent nuclear war.

Moves towards nuclear free world will fail – other countries won’t do it – but attempting to get their crushes deterrence causing extinction

Schneider, 2k8

(Mark Schneider, National Institute for Public Policy, "The Future of the U.S. Deterrent," COMPARATIVE STRATEGY v. 27 n. 4, July 2008, pp. 345-360, ASP.)

Today, the United States, the world's only superpower with global responsibilities, is the only nuclear weapons state that is seriously debating (admittedly largely inside the beltway) about whether the United States should retain a nuclear deterrent. By contrast, the British Labour Government has decided to retain and modernize its nuclear deterrent. In every other nuclear weapons state—Russia, China, France, India, Pakistan, and allegedly Israel—there is general acceptance of the need for a nuclear deterrent and its modernization. Amazingly, the United States is the only nuclear-armed nation that is not modernizing its nuclear deterrent. Distinguished former leaders such a George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, despite the manifest failure of arms control to constrain the weapons of mass destruction (WMD) threat, call for “A world free of Nuclear Weapons” because “… the United States can address almost all of its military objectives by non-nuclear means.”1 This view ignores the monumental verification problems involved and the military implication of different types of WMD—chemical and biological (CBW) attack, including the advanced agents now available to potential enemies of the United States and our allies. A U.S. nuclear deterrent is necessary to address existing threats to the very survival of the U.S., its allies, and its armed forces if they are subject to an attack using WMD. As former Secretary of Defense Harold Brown and former Deputy Secretary of Defense John Deutch wrote in The Wall Street Journal, “However, the goal, even the aspirational goal, of eliminating all nuclear weapons is counterproductive. It will not advance substantive progress on nonproliferation; and it risks compromising the value that nuclear weapons continue to contribute, through deterrence, to U.S. security and international stability.”2

Breakout inevitable during crises—increases risk of miscalculation and instability

LYON, 2K

[Rod, Dept. of Gov't, Univ. of Queensland Australian Journal of International Affairs, v. 54 n.3, p. 301-302]

Breakout is important because the most dangerous point on the path of nuclear proliferation lies with assembly of the first few warheads. This is because small arsenals are inherently more vulnerable than large arsenals. In very small numbers, nuclear weapons are more easily targeted by an opponent - indeed, they might well be successfully targeted using only conventional weapons. So pressures build upon national leaders to drive nations to war, but in most credible breakout scenarios, national leaders would usually be under other pressures, else why approve a return to a nuclear weapons program in the first place? Across important global and regional balances. fleeting advantages would appear and disappear, and during international crises the temptations to seize those advantages would be strong-stronger, in fact, than they were on President Harry Truman in 1945, who at least was reasonably assured that neither Germany nor Japan had built the bomb. Crossing and re-crossing those unstable bridges between the nuclear free world and nuclear weapons reconstitution would be a recipe for constant miscalculation and strategic disorder**.**

Disarm creates spirals of re-armament, increasing risk of nuclear war

Glaser, 98

(Charles L. Glaser, Associate Professor, Public Policy, University of Chicago, "The Flawed Case for Nuclear Disarmament," SURVIVAL v. 40 n. 1, Spring 1998, p. 113.)

Analyses that conclude thai nuclear disarmament will reduce the probability of deliberate nuclear war tend to confuse a political problem with a military one. A prerequisite for nuclear disarmament Is that the nuclear powers have achieved excellent, robust political relations. If political relations remain sufficiently good, the probability of rearmament and then nuclear war would be very low. However, If relations are this good, the probability of nuclear war could be just as low In a nuclear-armed world. If relations sour following disarmament, then states are far more likely to rearm and nuclear war Is more likely during this rearmament phase than In a well-designed nuclear world. Consequently, disarmament would Increase the probability of deliberate nuclear war. Most Important, perhaps, disarmament would neither produce nor preserve the outstanding relations required to make it feasible. In fact, political relations would be more fragile in a disarmed wrorld: If relations become strained, a downward spiral is more likely to continue In the disarmed world, thereby further Increasing the probability of deliberate nuclear war.

Re-arm/breakout is, on balance, much more likely to cause a nuclear war and the status quo

BROWN, '96

[Michael, Assoc. Dir, International Security Program, Harvard Univ Phase Nuclear Disarmament and US Defense Policy, October, www.stimson.org/publs/zeronuke/Brown.pdf]

Realists would contend that nuclear disarmament would not eliminate the nuclear threat from world politics, it would only transform the threat—probably for the worse. If states were still capable of arming themselves with conventional weapons and going to war, many would be tempted to build and use nuclear weapons if things were to go badly on the battlefield. Two (or more) combatants could engage in a nuclear arms race, a race that would unfold under the worst possible circumstances—when tensions and emotions are high and restraints are few. Once they acquired nuclear capabilities, warring states would have strong incentives to use them, either in preventive attacks against the nuclear facilities of others or on the battlefield. If powerful states—say, Russia and China—were the combatants in question, outsiders, even if banded together under the umbrella of the United Nations, would probably be unable to stop this renuclearization process from unfolding. Ironically, the probability of nuclear weapons being used in a denuclearized world could be quite high—higher perhaps than in a world in which a few powers possessed small nuclear forces. It would not be enough, therefore, to eliminate nuclear arsenals from the face of the Earth. It would not be enough to eliminate nuclear infrastructures and civilian nuclear facilities. It would not be enough to eliminate conventional armaments. As long as people organize themselves into states and as long as these states have the capacity to wage war, conventional rearmament can lead to nuclear rearmament. For the foreseeable future, the world will have to live with nuclear risks of one kind or another. The risks associated with a denuclearized world could be particularly grave.

A2: EPPP Good - Nuclear Waste Add On

1ac ev proves the counterplan solves nuclear waste – we access Helium 3 by solving moon exploration – their own schmidt says that spurs fusion power which solves nuclear waste

*(Optional if extending accidents turn)*

This supercharges our accidents turn impact – the REASON waste causes extinction is because of accidental release of radiation – which IS our accidents extinction argument

### Defer to our impact, studies prove your impact is improbable

Alvarez Et Al 3(\*Robert, a Senior Scholar at IPS, where he is currently focused on nuclear disarmament, environmental, and energy policies, served as a Senior Policy Advisor to the Secretary and Deputy Assistant Secretary for National Security and the Environment. \*Jan Beyea, PhD, earth science and environmental studies \*Klaus Janberg, \*Jungmin Kang, \*Ed Lyman, \*Allison Macfarlane, \*Gordon Thompson, \*Frank N. von Hippel, PhD Princeton University. “Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States” Science and Global Security, 11:1–51, 2003 www.irss-usa.org/pages/documents/11\_1Alvarez.pdf) MFR

The U.S. Nuclear Regulatory Commission (NRC) has estimated the probability of a loss of coolant from a spent-fuel storage pool to be so small (about 10−6 per pool-year) that design requirements to mitigate the consequences have not been required.1 As a result, the NRC continues to permit pools to move from open-rack conﬁgurations, for which natural-convection air cooling would have been effective, to “dense-pack” conﬁgurations that eventually ﬁll pools almost wall to wall. A 1979 study done for the NRC by the Sandia National Laboratory showed that, in case of a sudden loss of all the water in a pool, dense-packed spent fuel, even a year after discharge, would likely heat up to the point where its zircaloy cladding would burst and then catch ﬁre.2 This would result in the airborne release of massive quantities of ﬁssion products.

### All scenarios that would cause an accident are highly unlikely

Alvarez Et Al 3(\*Robert, a Senior Scholar at IPS, where he is currently focused on nuclear disarmament, environmental, and energy policies, served as a Senior Policy Advisor to the Secretary and Deputy Assistant Secretary for National Security and the Environment. \*Jan Beyea, PhD, earth science and environmental studies \*Klaus Janberg, \*Jungmin Kang, \*Ed Lyman, \*Allison Macfarlane, \*Gordon Thompson, \*Frank N. von Hippel, PhD Princeton University. “Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States” Science and Global Security, 11:1–51, 2003 www.irss-usa.org/pages/documents/11\_1Alvarez.pdf) MFR

The cooling water in a spent-fuel pool could be lost in a number of ways, through accidents or malicious acts. Detailed discussions of sensitive information are not necessary for our purposes. Below,we providesomeperspective for the followinggeneric cases: boil-off; drainageinto other volumes through the opening of some combination of the valves, gates and pipes that hold the water in the pool;a ﬁre resulting from the crash of a large aircraft; and puncture by an aircraft turbineshaft or a shaped charge**.** Boil Off Keeping spent fuel cool is less demanding than keeping the core in an operating reactor cool. Five minutes after shutdown, nuclear fuel is still releasing 800 kilowatts of radioactive heat per metric ton of uranium (kWt/tU)30 . However, after several days, the decay heat is down to 100 kWt/tU and after 5 years the level is down to 2–3 kWt/tU (see Figure 5). In case of a loss of cooling, the time it would take for a spent-fuel pool to boil down to near the top of the spent fuel would be more than 10 days if the most recent spent-fuel discharge had been a year before. If the entire core of a reactor had been unloaded into the spent fuel pool only a few days after shutdown, the time could be as short as a day.31 Early transfer of spent fuel into storage pools has become common as reactor operators have reduced shutdown periods. Operators often transfer the entire core to the pool in order to expedite refueling or to facilitate inspection of the internals of the reactor pressure vessel and identiﬁcation and replacement of fuel rods leaking ﬁssion products.32 Even a day would allow considerable time to provide emergency cooling if operators were not prevented from doing so by a major accident or terrorist act such as an attack on the associated reactor that released a large quantity of radioactivity. In this article, we do not discuss scenarios in which spent-fuel ﬁres compound the consequences of radioactive releases from reactors. We therefore focus on the possibility of an accident or terrorist act that could rapidly drain a pool to a level below the top of the fuel. Drainage All spent-fuel pools are connected via fuel-transfer canals or tubes to the cavity holding the reactor pressure vessel. All can be partially drained through failure of interconnected piping systems, moveable gates, or seals designed to close the space between the pressure vessel and its surrounding reactor cavity.33 A 1997 NRC report described two incidents of accidental partial drainage as follows:34 Two loss of SFP [spent fuel pool] coolant inventory events occurred in which SFP level decrease exceeded 5 feet [1.5 m]. These events were terminated by operator action when approximately 20 feet [6 m] of coolant remained above the stored fuel. Without operator actions, the inventory loss could have continued until the SFP level had dropped to near the top of the stored fuel resulting in radiation ﬁelds that would have prevented access to the SFP area. Once the pool water level is below the top of the fuel, the gamma radiation level would climb to 10,000 rems/hr at the edge of the pool and 100’s of rems/hr in regions of the spent-fuel building out of direct sight of the fuel because of scattering of the gamma rays by air and the building structure (see Figure 6).35 At the lower radiation level, lethal doses would be incurred within about an hour.36 Given such dose rates, the NRC staff assumed that further ad hoc interventions would not be possible.37 Fire A crash into the spent fuel pool by a large aircraft raises concerns of both puncture (see below) and ﬁre. With regard to ﬁre, researchers at the Sandia National Laboratory, using water to simulate kerosene, crashed loaded airplane wings into runways. They concluded that at speeds above 60 m/s (135 mph), approximately 50% of the liquid is so ﬁnely atomized that it evaporates before reaching the ground. If this were fuel, a ﬁreball would certainly have been the result, and in the high-temperature environment of the ﬁreball a substantially larger fraction of the mass would have evaporated.39 The blast that would result from such a fuel-air explosion might not destroy the pool but could easily collapse the building above, making access difﬁcult and dropping debris into the pool. A potentially destructive fuel-air deﬂagration could also occur in spaces below some pools. Any remaining kerosene would be expected to pool and burn at a rate of about 0.6 cm/minute if there is a good air supply.40 The burning of 30 cubic meters of kerosene—about one third as much as can be carried by the type of aircraft which struck the World Trade Center on September 11, 200141 —would release about 1012 joules of heat—enough to evaporate 500 tons of water. However, under most circumstances, only a relatively small fraction of the heat would go into the pool. Puncture by an Airplane Engine Turbine Shaft, Dropped Cask or Shaped Charge As Figure 2 suggests, many spent-fuel pools are located above ground level or above empty cavities. Such pools could drain completely if their bottoms were punctured or partially if their sides were punctured. Concerns that the turbine shaft of a crashing high-speed ﬁghter jet or an act of war might penetrate the wall of a spent-fuel storage pool and cause a loss of coolant led Germany in the 1970s to require that such pools be sited with their associated reactors inside thick-walled containment buildings. When Germany decided to establish large away-from-reactor spent-fuel storage facilities, it rejected large spent-fuel storage pools and decided instead on dry storage in thick-walled cast-iron casks cooled on the outside by convectively circulating air. The casks are stored inside reinforced-concrete buildings that provide some protection from missiles.42 Today, the turbine shafts of larger, slower-moving passenger and freight aircraft are also of concern. After the September 11, 2001 attacks against the World Trade Center, the Swiss nuclear regulatory authority stated that From the construction engineering aspect, nuclear power plants (worldwide) are not protected against the effects of warlike acts or terrorist attacks from the air. . . . one cannot rule out the possibility that fuel elements in the fuel pool or the primary cooling system would be damaged and this would result in a release of radioactive substances [emphasis in original]43 The NRC staff has decided that it is prudent to assume that a turbine shaft of a large aircraft engine could penetrate and drain a spent-fuel-storage pool.44 Based on calculations using phenomenological formulae derived from experiments with projectiles incident on reinforced concrete, penetration cannot be ruled out for a high-speed crash but seems unlikely for a low-speed crash.45 This is consistent with the results of a highly-constrained analysis recently publicized by the Nuclear Energy Institute (NEI).46 The analysis itself has not been made available for independent peer review “because of security considerations.” According to the NEI press release, however, it concluded that the engine of an aircraft traveling at the low speed of the aircraft that struck the Pentagon on Sept. 11, 2001 (approximately 350 miles/hr or 156 m/s) would not penetrate the wall of a spent-fuel-storage pool. Crashes at higher speed such as that against the World Trade Center South Tower (590 miles/hr or 260 m/s), which had about three times greater kinetic energy, were ruled out because the “probability of the aircraft striking a speciﬁc point on a structure—particularly one of the small size of a nuclear plant—is signiﬁcantly less as speed increases.”

A2: He3 Add Ons - all

Fusion propulsion fails and has long time frame - He3 not feasible and has dangerous radioactive side effects - aff authors live in biased fantasy world

**Williams 7** (Mark, Contributing Editor at Techonolgyreview.com, “Mining the Moon” August 23, 2007, http://www.technologyreview.com/energy/19296/)

**Could He3 from the moon truly be a feasible solution to our power needs on Earth? Practical nuclear fusion is nowadays projected to be** five decades off--the same prediction that was made at the 1958 Atoms for Peace conference in Brussels. If fusion power's arrival date has remained constantly 50 years away since 1958, why would helium-3 suddenly make fusion power more feasible? Advocates of He3-based fusion point to the fact that **current efforts to develop fusion-based power generation**, like the ITER megaproject, **use the deuterium-tritium fuel cycle, which is problematical.** (See "International Fusion Research.") Deuterium and tritium are both hydrogen isotopes, and when they're fused in a superheated plasma, two nuclei come together to create a helium nucleus--consisting of two protons and two neutrons--and a high-energy neutron. A deuterium-tritium fusion reaction releases 80 percent of its energy in a stream of high-energy neutrons, which are highly destructive for anything they hit, including a reactor's containment vessel**.** Since **tritium is highly radioactive, that makes containment a big problem as structures weaken and need to be replaced. Thus, whatever materials are used in a deuterium-tritium fusion power plant will have to endure serious punishment. And if that's achievable, when that fusion reactor is eventually decommissioned, there will still be a lot of radioactive waste. Helium-3 advocates claim that it,** conversely, **would be nonradioactive**, obviating all those problems. **But** a serious critic has charged that **in reality, He3-based fusion isn't even a feasible option.** In the August issue of Physics World, theoretical **physicist Frank Close**, at Oxford in the UK, has published an article called "Fears Over Factoids" in which, among other things, he **summarizes some claims of the "helium aficionados," then dismisses those claims as essentially fantasy.**

Multiple Barriers Preclude Helium 3

Seife, 04 (Charles Seife, American science author, journalist, and professor at NYU University, “Moon’s ‘Abundant Resources’ Largely an Unknown Quantity” March 12, 2004, http://www.planetary.brown.edu/planetary/geo016/moon\_resources.pdf)

It’s 2014. Forty-five years after the Apollo 11 landing, humans return to the moon to set up the lunar base that President George W. Bush proposed a decade earlier. Which will they be: homesteaders or campers? Apollo astronauts, who roved the lunar surface for tens of hours, could easily bring with them enough food, water, and air for a short visit. Under NASA’s ambitious new plans for lunar exploration, however, astronauts will live on the moon for weeks or months at a time—and the longer they stay, the more difficult and expensive it becomes to supply them from Earth. Some space boosters, the president included, suggest that part of the solution lies in living off the land. “The moon is home to abundant resources,” Bush stated in his 14 January speech announcing NASA’s new vision. Scientists agree that potentially useful chemicals, such as water ice and various gases, are indeed locked up in lunar soil. But when it comes to estimating how abundant they are and how practical it would be to extract them, one resource still in short supply is information. Water. More valuable than gold to a lunar base, water can be used for drinking or it can be split to create oxygen to breathe—or oxygen and hydrogen for rocket fuel. A few tons of hydrogen-oxygen fuel could send a rocket off the surface of the moon and into space. That’s why moon buffs such as Paul Spudis, a planetary scientist at Johns Hopkins University’s Applied Physics Laboratory in Laurel, Maryland, think the most important lunar resource is likely to be water from ice. In theory, ice from crashed comets may linger in cold, dark niches at the lunar poles, from which it could relatively easily be extracted and distilled. But scientists disagree about how much of it is trapped there. In 1996, a Department of Defense satellite called Clementine bounced radar waves off the moon’s surface and back to radar telescopes on Earth. Spudis and colleagues noticed that reflections from shadowy nooks near the lunar south pole could be interpreted as signatures of multiple scattering within crystals of water—an indication that about 1.5% of the lunar soil in those regions is water ice. Similar results came when the Lunar Prospector satellite, launched in 1998, used a spectrometer to count neutrons bouncing off the moon in energy ranges known to interact with hydrogen—presumably in water ice. The answer: Patches of polar lunar soil were about 0.5% to 1% ice by weight— less water than Clementine found, but still enough to make a polar base attractive. On the other hand, Donald Campbell, a physicist at Cornell University, and colleagues twice bounced radio waves off the moon from the Arecibo telescope in Puerto Rico but saw no signs of water ice. “We don’t believe that the radar data supports” the large amounts of ice that the Clementine analysis would imply, Campbell says. And when the Lunar Prospector crashed into the moon’s south pole at the end of its mission, scientists didn’t see water in the resulting plume of debris. Spudis thinks a more energetic crash would have splashed up water vapor, but for now, lunar water remains an open question. Trapped gases. Even if there’s little water on the moon, astronauts might be able to make it and other useful chemicals from more-abundant raw materials: light elements such as nitrogen, oxygen, and carbon, manufactured by nuclear fusion inside the sun and blown to the lunar surface on the solar wind. These trace elements are present in the lunar soil, or regolith, at levels of parts per million, so it would take a huge amount of mining to get usable quantities. The good news is that they are extremely easy to extract: Just heat soil up (using the base’s solar or nuclear power source) and the gases escape, yielding nitrogen, carbon monoxide, carbon dioxide, methane, and hydrogen that can be converted into air or water. Water, in turn, can be used to strip oxygen from a common iron-titanium lunar mineral known as ilmenite. Helium. Even more valuable in the long run may be a much rarer legacy of the solar wind, **helium-3**. Only Earth-bound humans would benefit, however, and even its **enthusiasts acknowledge that it’s a long shot.** Helium-3 is attractive because it can fuel an advanced fusion reactor. A helium-3 atom combined with a hydrogen-2 (deuterium) atom or with another helium-3 releases a great deal of energy with relatively little radioactive waste. “If we replaced all the electrical power plants in the United States with [helium-3/ deuterium] reactors, you’d need only 40 metric tons to produce all the electricity needed in 2004,” says Gerald Kulcinski, a physicist at the University of Wisconsin, Madison. Only a few hundred kilograms of helium-3 are accessible on Earth, he says, but the lunar regolith harbors millions of tons of it. **Several factors make mining helium-3 a dicey proposition**. For one, **most** of the **solar wind strikes the lunar farside, which faces the sun** when the moon’s orbit takes it upwind of Earth’s magnetic shadow. **But ilmenite, the only lunar mineral that traps helium-3 effectively, is more common on the moon’s nearside.** Wherever it crops up, **even helium-3–rich lunar soil won’t contain much of the gas. “It’ll be** a little better than **10 parts per billion by weight,” says Timothy Swindle, a geochemist at the University of Arizona** in Tucson. **“To make a dent in the world’s energy needs, you’re going to have to mine a large fraction of the surface of the moon.” Physicists will also have to create a working helium-3 reactor**—no easy task, considering that **decades of research have yet to produce a fusion power plant of any sort. And, of course, someone will have to ship all the helium back to Earth.**

Even if mined, using Helium-3 for energy through fusion is dangerous

Williams, 07 (Andrew Williams, Contributing Editor at Techonolgyreview.com, “Mining the Moon” August 23, 2007, http://www.technologyreview.com/energy/19296/)

At the 21st century's start, few would have predicted that by 2007, a second race for the moon would be under way. Yet the signs are that this is now the case. Furthermore, in today's moon race, unlike the one that took place between the United States and the U.S.S.R. in the 1960s, a full roster of 21st-century global powers, including China and India, are competing. Even more surprising is that one reason for much of the interest appears to be plans to mine helium-3--purportedly an ideal fuel for fusion reactors but almost unavailable on Earth--from the moon's surface. NASA's Vision for Space Exploration has U.S. astronauts scheduled to be back on the moon in 2020 and permanently staffing a base there by 2024. While the U.S. space agency has neither announced nor denied any desire to mine helium-3, it has nevertheless placed advocates of mining He3 in influential positions. For its part, Russia claims that the aim of any lunar program of its own--for what it's worth, the rocket corporation [Energia](http://www.energia.ru/english/) recently started blustering, Soviet-style, that it will build a [permanent moon base](http://www.space.com/news/ap_060126_russia_moon.html) by 2015-2020--will be extracting He3. The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011. Nor does India intend to be left out. (See "[India's Space Ambitions Soar](http://www.technologyreview.com/Infotech/19115/).") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, [Chandrayaan-1](http://www.isro.org/chandrayaan/htmls/home.htm), will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending [Chandrayaan-2](http://www.hindu.com/2007/01/04/stories/2007010401342200.htm), a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He3 and bringing it back to fuel fusion-based nuclear reactors on Earth.  Could He3 from the moon truly be a feasible solution to our power needs on Earth? Practical nuclear fusion is nowadays projected to be five decades off--the same prediction that was made at the 1958 Atoms for Peace conference in Brussels. **If fusion power's arrival date has remained constantly 50 years away since 1958, why would helium-3** suddenly **make fusion power more feasible?** Advocates of He3-based fusion point to the fact that **current efforts to develop fusion-based power generation**, like the [ITER](http://www.iter.org/index.htm) megaproject, **use the deuterium-tritium fuel cycle, which is problematical.** (See "[International Fusion Research](http://www.technologyreview.com/Energy/14618/).") Deuterium and tritium are both hydrogen isotopes, and when they're fused in a superheated plasma, two nuclei come together to create a helium nucleus--consisting of two protons and two neutrons--and a high-energy neutron. **A deuterium-tritium fusion reaction releases** 80 percent of **its energy in** a stream of **high-energy neutrons, which are highly destructive for** anything they hit, including **a reactor's containment vessel.** Since tritium is highly radioactive, that makes containment a big problem as structures weaken and need to be replaced. Thus, whatever **materials** are **used in a deuterium-tritium** fusion power **plant will have to endure serious punishment**. And **if that's achievable, when that** fusion **reactor is** eventually **decommissioned, there will still be a lot of radioactive waste.**

A2: He 3 Good – Ag

Food scarcity doesn’t cause conflict

Falcon and Naylor in ‘5 (Walter, Helen Farnsworth Prof. Int’l. Agricultural Policy and Co-Director of Center for Environmental Science and Policy @ Institute for Int’l. Studies @ Stanford, and Rosamond, Julie Wrigley Senior Fellow @ Center for Environmental Science and Policy @ Institute for International Studies and Director of Program on Food Security and the Environment @ Stanford, American Journal of Agricultural Economics, “Rethinking Food Security for the Twenty-First Century” 87:5, December, OneFile)

Three separate, but interrelated, questions seem relevant: (5) 1. Do poverty and food insecurity cause international terrorism? 2. Do poverty and food insecurity cause civil conflict? 3. Does reducing poverty and food insecurity lead to increased democratization and improved national security? Evidence on this daunting array of issues is mostly preliminary and frequently inconclusive. For example, the argument that hunger and poverty directly breed terrorism finds little support in the literature. Data on terrorist organizations generally show that their members are more likely to come from educated middleclass families than from poverty-stricken households (Krueger and Maleckova). Not considered in that proposition, however, is the notion that poverty sustains the kinds of states that are havens for terrorist activity. Unconsidered also is the motivational role that the existence of poverty and global inequality has on terrorists who themselves are not poor. Recent econometric work indicates that the presence of poverty is a key determinant of whether or not a civil war will develop in a country. Other standard explanations, like ethnic or religious tension, do not stand up well under systematic cross-sectional scrutiny. The lack of income opportunities in agriculture or in the formal labor market has been shown to be an important underlying variable, affecting greatly the cost of rebel recruitment (Collier and Hoeffler; Miguel, Satyanath, and Sergenti). Several authors alternatively suggest poverty and hunger may simply be a proxy for bad government, and that governance is the causal variable (Fearon and Laitin). Most of the new literature rejects the hypothesis that poor people take up arms "because" they are poor relative to their neighbors. In particular, there seem to be no systematic correlations between measures of income inequality and the timing of civil wars (Collier and Hoeffler). There is some evidence, however, that both low and unequal per capita incomes cause civil wars to last longer than "normal." This prolongation occurs primarily because poor people are cheaper to recruit and retain, and because they have relatively more to gain if they are victorious (Collier, Hoeffler, and Soderbom). The evidence that civil conflict increases the likelihood of terrorism is mostly anecdotal. Civil conflict sometimes creates weak states and safe havens for terrorists (Bannon and Collier), but we can find no systematic scholarly evidence on this point. Civil wars also create political and ethnic grievances, and these disputes may spill over into broader terrorist activities. Although Sudan, Afghanistan, and Lebanon would seem to be cases in point, many terrorists have also come from countries without civil wars (Collier and Hoeffler). For example, an overwhelming percentage of Middle-East suicide bombers have come from Saudi Arabia and Morocco (Pape).

Conflict-resource ties are weak at best ---- agricultural commodities have minimal relationship to violence

Ross in ‘4 (Michael, Associate Prof. Pol. Sci. @ UCLA, Journal of Peace Research, “What Do We Know About Natural Resources and Civil War?” 41:3, Sage, DOI 10.1177/0022343304043773 ISSN 0022-3433)

What can these studies tell us about the relationship between natural resources – including oil, gas, non-fuel minerals, gemstones, narcotics, timber, and agricultural products – and violent conflict? At first glance, the answer appears to be: not much. Table I summarizes the findings of 14 crossnational econometric studies of resources and conflict. There appears to be little agreement on the validity of the resource–civil war correlation. These and other, more qualitative studies reach varying conclusions on at least five aspects of the resource–conflict relationship: • whether or not natural resources influence the onset of conflict; • whether or not resources influence the duration of conflict; • whether resources influence all types of civil wars or only a subtype, e.g. ethnic or separatist conflicts; • whether all types of resources, or only a subset (e.g. oil, diamonds) are linked to conflict; and • what causal mechanisms link resources to conflict. Quantitative studies of natural resources and civil war have also been shadowed by concerns about misspecification and spuriousness. Most scholars measure a country’s ‘resource wealth’ by using the ratio of its resource exports to its GDP. This opens the door to two problems. First, there is a danger that the causal arrow between natural resource exports as a fraction of GDP and the onset of civil war might run the other way: civil wars might cause resource dependence by forcing a country’s manufacturing sector to flee while leaving its resource sector – which is location-specific and cannot easily move – the major force in the economy by default.2 Using lagged independent variables does not eliminate the danger of reverse causality: civil wars can be preceded by years of low-level violence that drives off manufacturing firms, producing a higher level of resource dependence before the conflict officially commences. Second, the natural resource–-civil war correlation could be spurious: both civil war and resource dependence might be independently caused by some unmeasured third variable, such as the weak rule of law. A state where the rule of law is weak might be unable to attract investment in its manufacturing sector, and hence would depend more heavily on resource exports; it might also face a heightened risk of civil war through a different process. The result could be a statistically significant correlation between resource dependence and civil war, even though neither factor would cause the other. Because the rule of law – and other potentially significant missing variables, like the security of property rights – are so difficult to measure across countries and over time, it is hard to test this possibility statistically. Despite these problems, a close look at both the quantitative and qualitative studies suggests four regularities – which could be characterized as two patterns and two conspicuous ‘non-patterns’. The first pattern is that oil exports are linked to the onset of conflict;

Famine inevitable – economic recession

Independent Media Institution 6/6/08 (http://www.alternet.org/environment/87071/)

Much of our current recessionary intrigue has been aided and abetted by market speculation, from the oil and food sector all the way to the White House itself. For the last seven years, the Bush administration has placed climate crisis on the back burner in existential pursuit of resource wars and an "American way of life" that has turned from a dream of Hummers, housing and bling into a nightmare of price hikes, foreclosures and layoffs. Mission accomplished. But someone will have to pick up the pieces, which are going viral fast. In that chaos, food has stopped being our other energy problem and become a chief terror of the future. And considering increasing prices, decreasing dollars and a world that will soon house many more people but feed even less of them, we're probably in for a famine or two before all is said and done.

Alt cause – GM crops cause mass crop failure and famine

Ho 1/21/07 (Mae-Wan Ho, PhD, director of the London-based Institute for Science in Society (ISIS), “Making the World GM-Free and Sustainable,” http://www.westonaprice.org/farming/gm-free-sustainable.html)

Genetically modified (GM) crops epitomize industrial monoculture, with its worst features exaggerated. They are part and parcel of the "environmental bubble economy," built on the over-exploitation of natural resources, which has destroyed the environment, depleted water and fossil fuels and accelerated global warming. As a result, world grain yields have been falling for six of the seven past years. Expanding the cultivation of GM crops at this time is a recipe for global bio-devastation, massive crop failures and global famine. GM crops are a dangerous diversion from the urgent task of getting our food system sustainable in order to really feed the world.

A2: He 3 Good – Econ

### No causality – economic decline doesn’t cause war

Ferguson in ‘6

Niall Ferguson, MA, D.Phil., is the Laurence A. Tisch Professor of History at Harvard University and William Ziegler Professor at Harvard Business School, “The Next War of the World”, Foreign Affairs 85.5, Proquest

There are many unsatisfactory explanations for why the twentieth century was so destructive. One is the assertion that the availability of more powerful weapons caused bloodier conflicts. But there is no correlation between the sophistication of military technology and the lethality of conflict. Some of the worst violence of the century -- the genocides in Cambodia in the 1970s and central Africa in the 1990s, for instance -- was perpetrated with the crudest of weapons: rifles, axes, machetes, and knives. Nor can economic crises explain the bloodshed. What may be the most familiar causal chain in modern historiography links the Great Depression to the rise of fascism and the outbreak of World War II. But that simple story leaves too much out. Nazi Germany started the war in Europe only after its economy had recovered. Not all the countries affected by the Great Depression were taken over by fascist regimes, nor did all such regimes start wars of aggression. In fact, no general relationship between economics and conflict is discernible for the century as a whole. Some wars came after periods of growth, others were the causes rather than the consequences of economic catastrophe, and some severe economic crises were not followed by wars.

Energy shortage won’t cause economic decline or conflict - empirics

Victor ’07 (David G,- Adjunct Senior Fellow for Science and Technology, Council on Foreign Relations; Director, Program on Energy and Sustainable Development @ Stanford “What Resource Wars?” 11/12 http://www.nationalinterest.org/Article.aspx?id=16020)

RISING ENERGY prices and mounting concerns about environmental depletion have animated fears that the world may be headed for a spate of “resource wars”—hot conflicts triggered by a struggle to grab valuable resources. Such fears come in many stripes, but the threat industry has sounded the alarm bells especially loudly in three areas. First is the rise of China, which is poorly endowed with many of the resources it needs—such as oil, gas, timber and most minerals—and has already “gone out” to the world with the goal of securing what it wants. Violent conflicts may follow as the country shunts others aside. A second potential path down the road to resource wars starts with all the money now flowing into poorly governed but resource-rich countries. Money can fund civil wars and other hostilities, even leaking into the hands of terrorists. And third is global climate change, which could multiply stresses on natural resources and trigger water wars, catalyze the spread of disease or bring about mass migrations. Most of this is bunk, and nearly all of it has focused on the wrong lessons for policy. Classic resource wars are good material for Hollywood screenwriters. They rarely occur in the real world. To be sure, resource money can magnify and prolong some conflicts, but the root causes of those hostilities usually lie elsewhere. Fixing them requires focusing on the underlying institutions that govern how resources are used and largely determine whether stress explodes into violence. When conflicts do arise, the weak link isn’t a dearth in resources but a dearth in governance.

### Economy resilient – we’ve survived worse

Le Masurier ‘10

September, Scoop du Jour: Americans will adapt to economic woes, Peninsula Gateway, Lexis

The global economy is shrinking for the first time since WWII, causing subsequent financial disasters for countries like Greece, which then undermines whatever weak recovery was underway. It’s clear this recession has run deeper than most people expected. And, yet, as bad as it is today, Americans have survived worse. During the Great Depression, unemployment hit 24.9 percent, and it never dropped below 16 percent between 1932 and 1936, staying in the teens until WWII. Add in a dust bowl that was created by the severe drought at the time, soup kitchens and long bread lines, and it starts to give us some perspective on current affairs. Things have been worse in the world as well as America. The Dark Ages aren’t likely to make a return. We no longer force children to work full-time jobs in factories, at least in this country. The chances of a new Civil War breaking out seem slim. We’re making progress on civil rights. New challenges have arisen, of course, because, as people, we collectively continue to fall short of perfection. But the quality of life in America has generally gotten better over time. To most of the world, 92 percent of us still live a luxurious life, worrying about whether to cut some cable channels rather than where to find a scrap of food. That doesn’t ease the pain of those among us who are struggling to keep their homes, or who have visited the food bank for the first time in their lives. That suffering is real, right now. But it will eventually pass. The economy will get better. New jobs will emerge that never existed before. Home values will stabilize. Slowly, over time, America will get healthy again. The quality of life will continue to improve at home and abroad, as it has done throughout the history of man. Looking back at historical patterns tells us that it will. But there’s an even more convincing reason to take an optimistic view of the future: the resilient human capacity for change. Mankind has continually adapted to many dynamic changes in the environment since before the time we had fire and lived in caves. We are a resourceful and inventive species, and we will use our creativity and ingenuity to lift ourselves out of this current problem. We can do it because we have always done it.

### Empirical studies show no causal relationship between economic decline and war – democratic regimes don’t collapse and authoritarian governments increase repression as a response.

Miller in ‘1

Morris Miller, adjunct economics professor at the University of Ottawa. “Poverty: A Cause of War?”. Peace Magazine Jan-Mar 2001, page 8 http://archive.peacemagazine.org/v17n1p08.htm

Library shelves are heavy with studies focused on the correlates and causes of war. Some of the leading scholars in that field suggest that we drop the concept of causality, since it can rarely be demonstrated. Nevertheless, it may be helpful to look at the motives of war-prone political leaders and the ways they have gained and maintained power, even to the point of leading their nations to war. Poverty: The Prime Causal Factor? Poverty is most often named as the prime causal factor. Therefore we approach the question by asking whether poverty is characteristic of the nations or groups that have engaged in wars. As we shall see, poverty has never been as significant a factor as one would imagine. Largely this is because of the traits of the poor as a group - particularly their tendency to tolerate their suffering in silence and/or be deterred by the force of repressive regimes. Their voicelessness and powerlessness translate into passivity. Also, because of their illiteracy and ignorance of worldly affairs, the poor become susceptible to the messages of war-bent demagogues and often willing to become cannon fodder. The situations conductive to war involve political repression of dissidents, tight control over media that stir up chauvinism and ethnic prejudices, religious fervor, and sentiments of revenge. The poor succumb to leaders who have the power to create such conditions for their own self-serving purposes. Desperately poor people in poor nations cannot organize wars, which are exceptionally costly. The statistics speak eloquently on this point. In the last 40 years the global arms trade has been about $1500 billion, of which two-thirds were the purchases of developing countries. That is an amount roughly equal to the foreign capital they obtained through official development aid (ODA). Since ODA does not finance arms purchases (except insofar as money that is not spent by a government on aid-financed roads is available for other purposes such as military procurement) financing is also required to control the media and communicate with the populace to convince them to support the war. Large-scale armed conflict is so expensive that governments must resort to exceptional sources, such as drug dealing, diamond smuggling, brigandry, or deal-making with other countries. The reliance on illicit operations is well documented in a recent World Bank report that studied 47 civil wars that took place between 1960 and 1999, the main conclusion of which is that the key factor is the availability of commodities to plunder. For greed to yield war, there must be financial opportunities. Only affluent political leaders and elites can amass such weaponry, diverting funds to the military even when this runs contrary to the interests of the population. In most inter-state wars the antagonists were wealthy enough to build up their armaments and propagandize or repress to gain acceptance for their policies. Economic Crises? Some scholars have argued that it is not poverty, as such, that contributes to the support for armed conflict, but rather some catalyst, such as an economic crisis. However, a study by Minxin Pei and Ariel Adesnik shows that this hypothesis lacks merit. After studying 93 episodes of economic crisis in 22 countries in Latin American and Asia since World War II, they concluded that much of the conventional thinking about the political impact of economic crisis is wrong: "The severity of economic crisis - as measured in terms of inflation and negative growth - bore no relationship to the collapse of regimes ... or (in democratic states, rarely) to an outbreak of violence... In the cases of dictatorships and semi-democracies, the ruling elites responded to crises by increasing repression (thereby using one form of violence to abort another)."

A2: He 3 Good - Prolif

Helium 3 doesn’t solve radioactive waste – which is their warrant why they solve prolif

Williams, 07 (Andrew Williams, Contributing Editor at Techonolgyreview.com, “Mining the Moon” August 23, 2007, http://www.technologyreview.com/energy/19296/)

At the 21st century's start, few would have predicted that by 2007, a second race for the moon would be under way. Yet the signs are that this is now the case. Furthermore, in today's moon race, unlike the one that took place between the United States and the U.S.S.R. in the 1960s, a full roster of 21st-century global powers, including China and India, are competing. Even more surprising is that one reason for much of the interest appears to be plans to mine helium-3--purportedly an ideal fuel for fusion reactors but almost unavailable on Earth--from the moon's surface. NASA's Vision for Space Exploration has U.S. astronauts scheduled to be back on the moon in 2020 and permanently staffing a base there by 2024. While the U.S. space agency has neither announced nor denied any desire to mine helium-3, it has nevertheless placed advocates of mining He3 in influential positions. For its part, Russia claims that the aim of any lunar program of its own--for what it's worth, the rocket corporation [Energia](http://www.energia.ru/english/) recently started blustering, Soviet-style, that it will build a [permanent moon base](http://www.space.com/news/ap_060126_russia_moon.html) by 2015-2020--will be extracting He3. The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011. Nor does India intend to be left out. (See "[India's Space Ambitions Soar](http://www.technologyreview.com/Infotech/19115/).") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, [Chandrayaan-1](http://www.isro.org/chandrayaan/htmls/home.htm), will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending [Chandrayaan-2](http://www.hindu.com/2007/01/04/stories/2007010401342200.htm), a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He3 and bringing it back to fuel fusion-based nuclear reactors on Earth. Could He3 from the moon truly be a feasible solution to our power needs on Earth? Practical nuclear fusion is nowadays projected to be five decades off--the same prediction that was made at the 1958 Atoms for Peace conference in Brussels. **If fusion power's arrival date has remained constantly 50 years away since 1958, why would helium-3** suddenly **make fusion power more feasible?** Advocates of He3-based fusion point to the fact that **current efforts to develop fusion-based power generation**, like the [ITER](http://www.iter.org/index.htm) megaproject, **use the deuterium-tritium fuel cycle, which is problematical.** (See "[International Fusion Research](http://www.technologyreview.com/Energy/14618/).") Deuterium and tritium are both hydrogen isotopes, and when they're fused in a superheated plasma, two nuclei come together to create a helium nucleus--consisting of two protons and two neutrons--and a high-energy neutron. **A deuterium-tritium fusion reaction releases** 80 percent of **its energy in** a stream of **high-energy neutrons, which are highly destructive for** anything they hit, including **a reactor's containment vessel.** Since tritium is highly radioactive, that makes containment a big problem as structures weaken and need to be replaced. Thus, whatever **materials** are **used in a deuterium-tritium** fusion power **plant will have to endure serious punishment**. And **if that's achievable, when that** fusion **reactor is** eventually **decommissioned, there will still be a lot of radioactive waste.**

### No proliferation— NPT empirically successful at stopping proliferation— It is so successful that it can stop non-members

World Nuclear Organization 2011 [International organization studying nuclear power and weapons, “Safeguards to Prevent Nuclear Proliferation”, June 2011, <http://www.world-nuclear.org/info/inf12.html>, TT]

In the 1960s it was widely assumed at there would be 30-35 nuclear weapons states by the turn of the century. In fact there were eight - a tremendous testimony to the effectiveness of the Nuclear Non-Proliferation Treaty (NPT) and its incentives both against weapons and for civil nuclear power, despite the baleful influence of the Cold War (1950s to 80s) which saw a massive build-up of nuclear weapons particularly by the USA and the Soviet Union. The nuclear non-proliferation regime is much more than the NPT, although this is the pre-eminent international treaty on the subject. The regime includes treaties, conventions and common (multilateral and bilateral) arrangements covering security and physical protection, export controls, nuclear test-bans and, potentially, fissile material production cut-offs. The international community can apply pressure to states outside the NPT to make every possible effort to conform to the full range of international norms on nuclear non-proliferation that make up this regime. This was seen over 2007-08 with India.

### No internal link— NPT stops production of nuclear weapons from used fuel

World Nuclear Organization 2011 [International organization studying nuclear power and weapons, “Safeguards to Prevent Nuclear Proliferation”, June 2011, <http://www.world-nuclear.org/info/inf12.html>, TT]

Over the past 35 years the International Atomic Energy Agency's (IAEA) safeguards system under the Nuclear Non-proliferation Treaty (NPT) has been a conspicuous international success in curbing the diversion of civil uranium into military uses. It has involved cooperation in developing nuclear energy while ensuring that civil uranium, plutonium and associated plants are used only for peaceful purposes and do not contribute in any way to proliferation or nuclear weapons programs. In 1995 the NPT was extended indefinitely. Its scope is also being widened to include undeclared nuclear activities. Most countries have renounced nuclear weapons, recognising that possession of them would threaten rather than enhance national security. They have therefore embraced the NPT as a public commitment to use nuclear materials and technology only for peaceful purposes. The successful conclusion, in 1968, of negotiations on the NPT was a landmark in the history of non-proliferation. After coming into force in 1970, its indefinite extension in May 1995 was another. The NPT was essentially an agreement among the five nuclear weapons states and the other countries interested in nuclear technology. The deal was that assistance and cooperation would be traded for pledges, backed by international scrutiny, that no plant or material would be diverted to weapons' use. Those who refused to be part of the deal would be excluded from international cooperation or trade involving nuclear technology. At present, 187 states are party to the NPT. These include all five declared Nuclear Weapons States (NWS) which had manufactured and exploded a nuclear weapon before 1967: China, France, the Russian Federation, the UK and the USA. The main countries remaining outside the NPT are Israel, India and Pakistan, though North Korea has moved to join them. These all have weapons programs which have come to maturity since 1970, so they cannot join without renouncing and dismantling those. In 2008 special arrangements were agreed internationally for India, bringing it part way in.\

### Availability of resources don’t matter— Political pressure and deterrence checks

World Nuclear Organization 2011 [International organization studying nuclear power and weapons, “Safeguards to Prevent Nuclear Proliferation”, June 2011, <http://www.world-nuclear.org/info/inf12.html>, TT]

The most important factor underpinning the safeguards regime is international political pressure and how particular nations perceive their long-term security interests in relation to their immediate neighbours. The solution to nuclear weapons proliferation is thus political more than technical, and it certainly goes beyond the question of uranium availability. International pressure not to acquire weapons is enough to deter most states from developing a weapons program. The major risk of nuclear weapons' proliferation will always lie with countries which have not joined the NPT and which have significant unsafeguarded nuclear activities, and those which have joined but disregard their treaty commitments.

### IAEA checks and sanctions solve

World Nuclear Organization 2011 [International organization studying nuclear power and weapons, “Safeguards to Prevent Nuclear Proliferation”, June 2011, <http://www.world-nuclear.org/info/inf12.html>, TT]

The IAEA was set up by unanimous resolution of the United Nations in 1957 to help nations develop nuclear energy for peaceful purposes. Allied to this role is the administration of safeguards arrangements. This provides assurance to the international community that individual countries are honouring their treaty commitments to use nuclear materials and facilities exclusively for peaceful purposes. The IAEA therefore undertakes regular inspections of civil nuclear facilities to verify the accuracy of documentation supplied to it. The agency checks inventories and undertakes sampling and analysis of materials. Safeguards are designed to deter diversion of nuclear material by increasing the risk of early detection. They are complemented by controls on the export of sensitive technology from countries such as UK and USA through voluntary bodies such as the Nuclear Suppliers' Group. Safeguards are backed up by the threat of international sanctions.

### Nuclear power and reprocessing have nothing to do with proliferation— Nations were going to proliferate regardless

World Nuclear Organization 2011 [International organization studying nuclear power and weapons, “Safeguards to Prevent Nuclear Proliferation”, June 2011, <http://www.world-nuclear.org/info/inf12.html>, TT]

Civil nuclear power has not been the cause of or route to nuclear weapons in any country that has nuclear weapons, and no uranium traded for electricity production has ever been diverted for military use. All nuclear weapons programmes have either preceded or risen independently of civil nuclear power\*, as shown most recently by North Korea. No country is without plenty of uranium in the small quantities needed for a few weapons. Former US Vice-President Al Gore said (18/9/06) that "During my eight years in the White House, every nuclear weapons proliferation issue we dealt with was connected to a nuclear reactor program. Today, the dangerous weapons programs in both Iran and North Korea are linked to their civilian reactor programs." He is not correct. Iran has failed to convince anyone that its formerly clandestine enrichment program has anything to do with its nuclear power reactor under construction (which is fuelled by Russia), and North Korea has no civil reactor program. In respect to India and Pakistan, which he may have had in mind, there is evidently a link between military and civil, but that is part of the reason they are outside the NPT. Perspective is relevant: As little as five tonnes of natural uranium is required to produce a nuclear weapon. Uranium is ubiquitous, and if cost is no object it could be recovered in such quantities from most granites, or from sea water - sources which would be quite uneconomic for commercial use. In contrast, world trade for electricity production is almost 70,000 tonnes of uranium per year, all of which can be accounted for. There is no chance that the resurgent problem of nuclear weapons proliferation will be solved by turning away from nuclear power or ceasing trade in the tens of thousands of tonnes each year needed for it.

A2: He 3 Good – Warming

### No warming—we’ve entered a 30 year period of cooling—proved by PDOs

Easterbrook ‘10

Don, g[eology](http://en.wikipedia.org/wiki/Geology) professor emeritus at [Western Washington University](http://en.wikipedia.org/wiki/Western_Washington_University). EVIDENCE OF THE CAUSE OF GLOBAL WARMING AND COOLING: RECURRING GLOBAL, DECADAL, CLIMATE CYCLES RECORDED BY GLACIAL FLUCTUATIONS, ICE CORES, OCEAN TEMPERATURES, HISTORIC MEASUREMENTS AND SOLAR VARIATIONS. http://myweb.wwu.edu/dbunny/research/global/easterbrook\_climate-cycle-evidence.pdf

‘Global warming’ (the term used for warming from 1977 to 1998) is over. No warming above the level temperatures in 1998 has occurred and global cooling has deepened since 2005 (Fig. 24). Switching of the PDO back and forth from warm to cool modes has been documented by NASA’s satellite imagery (Figs. 25, 26). The satellite image from 1989 is typical of the warm mode (1945-1977) with most of the eastern Pacific adjacent to North America showing shades of yellow to red, indicating warm water. The satellite image from 1999 (Fig. 27) shows a strong contrast to the 1997 image, with deep cooling of the eastern Pacific and a shift from the PDO warm to the PDO cool mode. This effectively marked the end of ‘global warming’ (i.e., the 1977 to 1998 warm cycle). Figures 27–30 show that the switch of the PDO from its warm cycle to the present cool cycle has become firmly established. Each time this has occurred in the past century, global temperatures have remained cool for about 30 years (Fig. 31). Thus, the current sea surface temperatures not only explain why we have had global cooling for the past 10 years, but also assure that cool temperatures will continue for several more decades.

### Warming isn’t human induced—empirical evidence that Co2 doesn’t correlate with global temperatures.

Easterbrook ‘10

Don, g[eology](http://en.wikipedia.org/wiki/Geology) professor emeritus at [Western Washington University](http://en.wikipedia.org/wiki/Western_Washington_University). EVIDENCE OF THE CAUSE OF GLOBAL WARMING AND COOLING: RECURRING GLOBAL, DECADAL, CLIMATE CYCLES RECORDED BY GLACIAL FLUCTUATIONS, ICE CORES, OCEAN TEMPERATURES, HISTORIC MEASUREMENTS AND SOLAR VARIATIONS. http://myweb.wwu.edu/dbunny/research/global/easterbrook\_climate-cycle-evidence.pdf

1945 to 1977 cool period with soaring CO2 emissions. Global temperatures began to cool in the mid–1940’s at the point when CO2 emissions began to soar (Fig. 4). Global temperatures in the Northern Hemisphere dropped about 0.5° C (0.9° F) from the mid-1940s until 1977 and temperatures globally cooled about 0.2° C (0.4° F) (Fig. 1). Many of the world’s glaciers advanced during this time and recovered a good deal of the ice lost during the 1915–1945 warm period. However, cooling during this period was not as deep as in the preceding cool period (1880 to 1915). Many examples of glacial recession during the past century cited in the news media show contrasting terminal positions beginning with the maximum extent at the end of a ~30 year cool period (1915 or 1977) and ending with the minimum extent of the recent 20 year warm period (1998). A much better gauge of the effect of climate on glaciers would be to compare glacier terminal positions between the ends of successive cool periods or the ends of successive warm periods. Figure 4 shows CO2 that even though emissions from 1945 to 1977 soared, global temperature dropped during that 30–year period. If CO2 causes global warming, temperature should have risen, rather than declined, strongly suggesting that rising CO2.did not cause significant global warming.

### Warming won’t cause massive deaths—humans adapt.

Michaels and Balling ‘9

Patrick, professor of environmental sciences @ The University of Virginia and a senior fellow in the environmental studies at the CATO institute; Robert, professor in the climatology program in the School of Geographical Sciences at @ASU. “Climate of Extremes: Global Warming Science They Don’t Want You to Know” pgs 178-180

There is no question that the heat wave of 2003 was a natural disaster in Europe with a substantial loss of human life. Europe was not prepared for an event that, from a purely statistical view point, was inevitable, with or without global warming. In 2006, another article appeared in the International Journal of Biometeorology that put the 2003 disaster in perspective. Mohamed Laaidi and two coauthors, from the Medical University at Dijon, France, examined daily temperature and mortality data from 1991-95 for six "departments" (a.k.a., states or counties) located in urban, oceanic, interior, mountain, and two different Mediterranean settings (Figure 6.2). They broke the data into three age groups including less than 1 year old, 1 to 64 years old, and greater than 64 years old. They also divided the data by sex and by major causes of death including respiratory disease, cardiovascular disease or stroke, heart disease, and other diseases of the circulatory system. Murders and accidents were excluded. The Laaidi et al, team found that for the whole population As expected, temperature and daily deaths exhibited a marked temporal pattern. For all the departments investi- gated, mean daily counts of deaths showed an asymmetrical V-like or If-like pattern with higher mortality rates at the time of the lowest temperatures experienced in the area than at the tune of the highest temperatures. The data also clearly showed that people adjust to their environments. Individuals living in cold regions experience more mortality in warm temperatures, and those from warm areas are more susceptible to cold Ones. There is also a range in temperature, called the thermal optimum, in which mortality is low; the authors noted: The level of the thermal optimum rises in line with the warmer climatic conditions of each department. The thermal optimum is greater in Paris, probably due to the urban heat island, than in the Herault, which is situated in the extreme south of France in a Mediterranean climate. In other words, here's the shocking news: People adjust to the climate in which they reside. In Meltdown, one of us (Michaels) cited work he had done with Robert Davis at the University of Virginia in which they found that heat-related mortality declined as cities get warmer, which cities do with or without global warming. The same phenomenon was seen by Laaidi et al., except they added in the adjustment for cold climates, showing less mortality there from cold waves than occurs when temperatures fall dramatically in warm climates. Concerning any temperature rise for any reason, Laaidi et al. found: "For both men and women mortality was higher at low temperatures, suggesting a lesser ability to adapt to the cold." On the basis of another related study, they state, "In England and Wales, the higher temperatures predicted for 2050 might result in nearly 9,000 fewer winter deaths each year." Laaidi et al. conclude: "Our findings give grounds for confidence in the near future: the relatively moderate (2'C) [3.6'F] warming predicted to occur in the next half century would not increase annual mortality rates." Computer models for carbon dioxide-induced global warming consistently predict more warming in winter in midlatitude locations such as France and less warming in the summer. The Laaidi et al, study shows that the greater threat of human mortality lies in the cold end of the thermal spectrum rather than the warm end. Higher temperatures in the winter would certainly decrease mortality, and we could conclude from this and other studies that in terms of temperature-related mortality, global warming would save lives- a message not well conveyed in the hundreds of thousands of websites on the subject.

### Most recent evidence disproves the warming theory

Chapman ‘8

Phil, geophysicist and astronautical engineer, Sorry to ruin the fun, but an ice age cometh, http://www.sciencealert.com.au/opinions/20082105-17356.html

The scariest photo I have seen on the Internet is [www.spaceweather.com](http://www.spaceweather.com/), where you will find a real-time image of the sun from the Solar and Heliospheric Observatory, located in deep space at the equilibrium point between solar and terrestrial gravity. What is scary about the picture is that there is only one tiny sunspot. Disconcerting as it may be to true believers in global warming, the average temperature on Earth has remained steady or slowly declined during the past decade, despite the continued increase in the atmospheric concentration of carbon dioxide, and now the global temperature is falling precipitously. All four agencies that track Earth's temperature (the Hadley Climate Research Unit in Britain, the NASA Goddard Institute for Space Studies in New York, the Christy group at the University of Alabama, and Remote Sensing Systems Inc in California) [report](http://wattsupwiththat.wordpress.com/2008/02/19/january-2008-4-sources-say-globally-cooler-in-the-past-12-months/) that it cooled by about 0.7C in 2007. This is the fastest temperature change in the instrumental record and it puts us back where we were in 1930. If the temperature does not soon recover, we will have to conclude that global warming is over.

A2: Moon Good – China War

Only plan spurs a space race with china

Smith 03[Wayne Smith, Staff writer for nuclearspace.com, *Space Daily*, January 28, 2003, “Will There Be A Nuclear Space Race Between America And China”, http://www.spacedaily.com/news/nuclearspace-03d.html]

With Russia suffering economic problems and the [ESA unsure of its future](http://www.spacedaily.com/news/esa-general-03b.html), China seems to be on an inside straight to success. However, Prometheus changes everything. NASA is "[moving from windpower to steam](http://www.space.com/businesstechnology/technology/okeefe_nasa_030124.html)" as Sean O'Keefe puts it and that may leave China suddenly out in the cold.

Unless of course, they respond with their own nuclear space program. China and Russia have been increasing ties for a number of years now. [Space](http://www.space.com/news/russia_china_010910.html) and [Arms](http://www.newsmax.com/articles/?a=2000/6/8/200001) technology trade in particular have increased due to new treaties.

The Russians, who launched more nuclear reactors than the US, are no strangers to nuclear space technology having had their own shadowy nuclear propulsion program -- which no doubt compared very favourably to past US efforts.

If pushed to develop their own nuclear space initiative, the Chinese will likely enquire of Russia for help. The Russians, in turn, will demand a high cost for such secret technology, just as they have done for all previously purchased space systems technologies. China will either pay or attempt to develop their own.

China, also no stranger to nuclear power, has stated owned national nuclear facilities and a state owned space programme. Efforts at combining nuclear and space branches of Government will face very little red tape within a communist regime. A chinese INSPI or Los Alamos seems very possible.

**China lacks the capability to use ASATs**

**Angela & Yuan *et al*. 02** (Deters, Jing-dong, “China's Space Capabilities and the Strategic Logic of Anti-Satellite Weapons” . Monterey, CA: Center for Nonproliferation Studies, July 22, 2002)

Despite numerous indications that China is interested in developing ASAT weapons and significant overall improvements in China's space program over the last two decades, China still lacks a number of capabilities that would be required for a viable ASAT program. These limitations include: 1. Limited tracking capabilities. China continues to rely heavily on shared and leased space tracking facilities, which might not be available in the event of a conflict. Despite a domestic network, two foreign sites, and four tracking ships, the Chinese tracking system does not have a global reach. 2. Limited launch capabilities. Although its launch capabilities have been improving, China still lacks the launch on-demand capability required for space warfare and for an effective ASAT system. 3. Vulnerable infrastructure. China's immobile launch facilities, tracking facilities, space infrastructure, and possible ground-based laser sites would all be vulnerable to attack.

**A US – China space race is unlikely for several reasons**

**Katz-Hyman, and Krepon 07.** (Michael, Michael "*An Arms Race in Space Isn't the Problem*." Space News. February 12, 2007.)

If the Cold War space competition did not rise to the level of an arms race in some respects, there are strong reasons why the Chinese-U.S. competition can be even less intense. The Chinese leadership is smarter than the Soviet leadership. Beijing will not bankrupt itself in a military competition. Instead, the Chinese military will compete asymmetrically and cost-effectively. The People's Liberation Army (PLA) could employ temporary and reversible effects against U.S. satellites – the Pentagon's preference – or it could fight dirty, with kinetic energy weapons. Presumably one message of its crude A-Sat test was to clarify that, if push comes to shove, China will contest the Pentagon's objective of space control using weapons of its choosing. Beijing's ambitions in space go well beyond this objective. China's space program is also intimately connected to its economic goals and status consciousness. Beijing's status has been damaged by creating an enduring hazard to space operations in low Earth orbit. Its economic ambitions also will be jeopardized if the Cold War taboo against destroying another nation's satellites is broken. The interconnectedness of the economic and military aspects of space power – another key difference from the Cold War – constitutes another reason why an arms race in space is unlikely. The Pentagon also has learned important lessons from the Cold War. Back then, the United States had insufficient appreciation of the dangers of space debris. Now all stakeholders in space are keenly aware that debris constitutes an indiscriminate, lethal hazard. This is why the Chinese test was so irresponsible – and why Congress would further damage America's standing and security by emulating Chinese misbehavior. Perhaps the most important reason why an arms race in space between the United States and China is unlikely is because a race is not required to mess up essential satellites. A single nuclear detonation can do extraordinary harm, as can a modest arsenal of old-fashioned kinetic energy weapons. Neither China nor the United States needs to race to mess up space.

### Economic interdependence and political costs checks space wars

Macdonald 08

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That is, the United States could threaten to attack not just Chinese space assets, but also ground-based, including ASAT command-and-control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and thus might climb the escalatory ladder to a more damaging war both sides would probably want to avoid.

War between China and the United States seems unlikely, given their increasing economic interdependence and ongoing efforts in both countries to improve relations.

### No war- Chinese policy institutions ensure no risk of nuclear escalation even if war happened

Moore, CNS (Center for Nonproliferation Studies) East Asia research assistant, 10-18-2006

[Scott, Monterey Institute for International Studies; James Martin Center for Nonproliferation Studies, "Nuclear Conflict in the 21st Century: Reviewing the Chinese Nuclear Threat," NTI, http://www.nti.org/e\_research/e3\_80.html]

Even with projected improvements and the introduction of a new long-range Intercontinental Ballistic Missile, the DF-31A China's nuclear posture is likely to remain one of "minimum deterrence."[6] Similarly, despite concern to the contrary, there is every indication that China is extremely unlikely to abandon its No First Use (NFU) pledge.[7] The Chinese government has continued to deny any change to the NFU policy, a claim substantiated by many Chinese academic observers.[8] In sum, then, fears over China's current nuclear posture seem somewhat exaggerated. This document, therefore, does not attempt to discuss whether China's nuclear posture poses a probable, general threat to the United States; most signs indicate that even in the longer term, it does not. Rather, it seeks to analyze the most likely scenarios for nuclear conflict. Two such possible scenarios are identified in particular: a declaration of independence by Taiwan that is supported by the United States, and the acquisition by Japan of a nuclear weapons capability. Use of nuclear weapons by China would require a dramatic policy reversal within the policymaking apparatus, and it is with an analysis of this potential that this brief begins. Such a reversal would also likely require crises as catalysts, and it is to such scenarios, involving Taiwan and Japan, that this brief progresses. It closes with a discussion of the future of Sino-American nuclear relations. The Chinese Policymaking Apparatus and the Nuclear Option China's leadership has today achieved broad consensus that the nation's interests are best served by a stable and peaceful international environment.[9] This has given rise to the strategy of "peaceful development" (heping fazhan) often emphasized by Chinese officials. Given the consensus towards moderation in foreign and security policy, and its embodiment in overarching national policy, there is much to suggest that the use of nuclear weapons against the United States, in whatever situation, would be anathema to China's decision makers. The new generation of Chinese leaders, which has risen to power in the aftermath of the 1989 Tiananmen Square incident (liu si), has tended to consist of moderate technocrats,[10] who are unlikely to support radical policy reversals, such as the use of nuclear weapons. Chinese politics in general have also evolved into a "more pragmatic, risk-adverse" form.[11] This process was initiated by the rise of "interest group politics" during the tenure of President Jiang Zemin.[12] This new structure of decision-making involves the specialization of bureaucratic institutions, which have become more assertive, and occasionally resisted high-level decisions they believed to be ill conceived.[13] It is probable that certain institutions, such as the Ministry of Foreign Affairs, would strongly resist the actual or threatened use of nuclear weapons against the United States in almost any situation. In a risk-adverse policy environment that seeks consensus, this kind of strong opposition may well prevail.

**Even in worst-case-scenario, no impact to US-Sino Space war**

**Forden 08** (Geoffrey Forden, PhD, MIT research associate, former UN weapons inspector, weapons analyst for Congressional Budget Office, “How China Loses the Coming Space War,” article, *Wired* Magazine, Page 1, <http://www.wired.com/dangerroom/2008/01/inside-the-chin/>, January 10, 2008)

The answers to these questions should influence how the US responds to the threats China’s ASAT represents.  There is at least one way to answer these questions: “war-gaming” a massive Chinese attack on US satellites, where China is only limited by the laws of physics and the known properties of their ASAT, and see how much damage could be done.  Such an exercise also reveals what the US could do, and what it could not do, to minimize the consequences.  **The results of my calculations are reported here.  They assume that China launches a massive attack and that everything works exactly as planned:** every ASAT launches, the US does not respond until after the attacks are launched even though it will have overwhelming evidence ahead of time, and every ASAT hits its target.  **Thus, this is a worst case scenario for the U**nited **S**tates.  In the end, we’ll show, **the US would still has sufficient space assets to fight a major conventional war with China**, even after such an attack.  **America’s military capabilities would be reduced, for a few hours at a time.  But they would not be crippled.** Back in 2001, a commission lead by Donald **Rumsfeld warned of a "**[**space Pearl Harbor**](http://www.spacedaily.com/news/bmdo-01b.html)**,"** a single strike that could cripple America’s satellite network.  **It turns out, there is no such thing.**

A2: Moon Good – Disease

Their ev is entirely theoretical – it says the moon COULD be used to conduct dangerous genetic experiments – not that it WOULD

Past pandemics prove that disease doesn’t lead to extinction

Peters and Chrystal ‘03 (Dr. Clarence, Director of Biodefense and Emerging Infectious Diseases @ UT, and Dr. Ronald, Chairman of Genetics Medicine @ Cornell, FDCH Political Transcripts, “U.S. REPRESENTATIVE CHRISTOPHER COX (R-CA) HOLDS HEARING ON COUNTERING THE BIOTERRORISM THREAT”, 3-15, L/N)

PETERS: I think we have one example from the movement of the Conquistadors to the New World. They brought measles, smallpox and a variety of other diseases with them. They didn't wipe out the Indians, but they destroyed their civilization and were instrumental in the Spaniards being able to conquer the New World with relatively few people. I think we have something going on right now with SARS that we don't know exactly what the end of it's going to be, but we already know that Asian economies are suffering tremendously. My prediction is that they will not be able to control it in China. If that's true, then we will be dealing with repeated introductions in this country for the indefinite future so that we may see a change in our way of life where we are taking temperatures in airports, in addition to taking your shoes off and putting them through the X-ray machine. And we may see emergency rooms rebuilt so that if you have a cough you go in one entrance and go into a negative pressure cubicle until your SARS test comes back. So I think that while wiping out human life is extremely unlikely, we have unengineered examples of bugs that have made great impacts on civilizations. COX: Dr. Crystal? CRYSTAL: The natural examples of what you suggested were, as hundreds of years ago, with smallpox and also with the plague. The plague wiped out one-third of the civilization. We now have treatments for ordinances (ph) like the plague because they were engineered to be resistant. And if they infected a number of people and had the capability of being spread rapidly from individual to individual, it would cause enormous havoc. I agree with the panel -- I don't think it would wipe out civilization, but the consequences to our society would be enormous.

Virus burnout solves the impact

The Guardian in ’03 (“Second Sight”, September 25, http://technology.guardian.co.uk/online/story/0,3605,1048929,00.html)

The parallel with the natural world is illustrative. Take the case of everyone's favourite evil virus, Ebola. This is so virulent that it kills up to 90% of infected hosts within one to two weeks. There is no known cure. So how come the entire population hasn't dropped dead from haemorrhaging, shock or renal failure? The "organism" is just too deadly: it kills too quickly and has too short an incubation period, so the pool of infected people doesn't grow.

Err negative – a virus has never actually killed off any species

Regis ’97 (Ed, Author of “Virus Ground Zero”, New York Times, “Pathogens of Glory”, 5-18, l/N)

Despite such horrific effects, Dr. Peters is fairly anti-apocalyptic when it comes to the ultimate import of viruses. Challenging the widespread perception that exotic viruses are doomsday agents bent on wiping out the human species, he notes that "we have not documented that viruses have wiped out any species." As for the notion that we're surrounded by "new" diseases that never before existed, he claims that "most new diseases turn out to be old diseases"; one type of hantavirus infection, he suggests, goes back to A.D. 960. And in contrast to the popular belief that viral epidemics result from mankind's destruction of the environment, Dr. Peters shows how the elimination of a viral host's habitat can eradicate a killer virus and prevent future epidemics. This is what happened when the Aswan Dam, completed in 1971, destroyed the floodwater habitat of the Aedes aegypti mosquitoes, carriers of Rift Valley fever virus: "After the Aswan Dam was constructed, there was no more alluvial flooding. . . . Without a floodwater mosquito, the virus can't maintain itself over the long haul. . . . By 1980, Rift Valley fever had essentially disappeared in Egypt." Still, Dr. Peters isn't totally averse to doomsday thinking, and in his final chapter he lays out his own fictional disease scenario, in which a mystery virus from Australia suddenly breaks out in a Bangkok slum. Throw in Malthus, chaos theory and the high mutation rates of RNA viruses, and soon he's got the world teetering on the brink of viral holocaust in the finest Hollywood tradition. But he doesn't know quite what to make of his own scenario. He offers "one valid, simplified equation to describe what we can expect from viruses in the future": mutating viruses plus a changing ecology plus increasing human mobility add up to more and worse infectious diseases. Two pages later, though, he says that "it is impossible to gauge how the actions of man will impact on emerging infectious diseases." If that is true, it discredits the very equation he's given us. In the end, he presents no clear or consistent picture of the overall threat posed by the viruses he discusses. The empirical fact of the matter is that today's most glamorous viruses -- Marburg and Ebola -- have killed minuscule numbers of people compared with the staggering death rates of pathogens that go back to disease antiquity. Marburg virus, discovered in 1967, has been known to kill just 10 people in its 30-year history; Ebola has killed approximately 800 in the 20 years since it appeared in 1976. By contrast, malaria, an ancient illness, still kills a worldwide average of one million people annually -- more than 2,700 per day. More than three times as many people die of malaria every day than have been killed by Ebola virus in all of history. Yet it's Ebola that people find "scary"!

Quarantines solve disease

Altman ’05 (Lawrence, reporter for The New York Times, Jeff Bailey, reporter for the New York Times in Chicago, 11-23 "CDC Proposes New RUles in Effort to Prevent Disease Outbreak", section A; column 1, National Desk, p. 22 http://query.nytimes.com/gst/fullpage.html?sec=health&res=9802E7DF1631F930A15752C1A9639C8B63)

Federal officials yesterday proposed the first significant changes in quarantine rules in 25 years in an effort to broaden the definition of reportable illnesses, to centralize their reporting to the federal government and to require the airline and shipping industries to keep passenger manifests electronically for 60 days. The proposals would also clarify the appeals process for people subjected to quarantines to allow for administrative due process and give health officials explicit authority to offer vaccination, drugs and other appropriate means of prevention on a voluntary basis to those in quarantine. The proposals could cost the beleaguered airline industry hundreds of millions of dollars, officials of the Centers for Disease Control and Prevention said. The officials are inviting public comment on the proposals, which are to be published in the Federal Register on Nov. 30, they told reporters in a telephone news conference. The proposals are part of a broader Bush administration plan to improve the response to current and potential communicable disease threats that may arise anywhere in the world. If adopted, the new regulations ''will allow the C.D.C. to move more swiftly'' when it needs to control outbreaks, said Dr. Martin Cetron, who directs the agency's division of global migration and quarantine. The outbreak of severe acute respiratory syndrome (SARS) in 2003 underscored how fast a disease could spread through the world and the need to modernize and strengthen quarantine measures by pointing out gaps in health workers' ability to respond quickly and effectively, Dr. Cetron said. As the C.D.C. joined with cooperative airlines to meet flights and later collect information about passengers who had contact with others who developed SARS, the epidemiologists had to compile and process by hand data collected from flight manifests, customs declarations and other sources. But manifests contained only the name and seat number; customs declarations were illegible, and when readable, the names did not match those on the manifests. ''The time required to track passengers was routinely longer than the incubation period,'' which was two to 10 days for SARS, Dr. Cetron said. ''That was really quite shocking,'' Dr. Cetron said. One proposed change would require airline and ship manifests to be kept electronically for 60 days and made available to the C.D.C. within 12 hours when ill passengers arrive on international and domestic flights. The proposed changes include provisions for maintaining confidentiality and privacy of health information. The outbreak of SARS was stopped in part because of quarantines imposed in some affected countries. Quarantine restricts the movement of a healthy person exposed to someone who has a communicable disease. The quarantine period is determined by the usual length of time that passes from exposure to an infectious agent to the onset of illness. An executive order of the president limits quarantine to nine diseases: cholera, diphtheria, infectious tuberculosis, plague, smallpox, yellow fever, viral hemorrhagic fevers like Ebola, SARS and influenza caused by new strains that could cause a pandemic.

A2: Moon Good – Russia War

Zero internal link – their ev doesn’t say a space race with Russia will escalate to hostile war

**Russia has neither the ability or desire for space weaponization**

**Krepon, Podvig *et al*. 09** (Michael, Pavel, "*The Space Nuclear Nexus*." 2009 Carnegie International Nonproliferation Conference. Washington, D.C.: Carnegie Endowment for International Peace, April 07, 2009)

It would be actually be fairly difficult to do that in practical terms. In terms of actual programs and developments, things are not very good for either space weapons or ASAT in Russia because most of the industrial and organizational infrastructure that supported those programs has been scattered around, and we don’t have either the military service dedicated to this kind of thing but also Russia does not have a unified ministry in the defense industry that would carry enough weight to lobby for this kind of a program. Besides, looking from the other direction, Russia, the discussion about ASAT and space, military uses of space, is actually influenced by the fact that Russia doesn’t really have a lot of space assets to protect. The integration of military satellites into the actual military operations is actually not very good. Again, on a positive note, access to space is basically controlled largely by the space forces, by Roscosmos, the civilian agency, to a certain extent the rocket forces, and none of those institutions actually has great interest or any real investment in any kind of an ASAT capability or any weapon-in-space developments.

Distrust will not spill-over into open conflict

Sakwa 8 (Richard, h ead of the department of Politics and International Relations at the University of Kent, International Afairs 8, March 2008 http://www3.interscience.wiley.com/cgi-bin/fulltext/119391506/PDFSTART)

The end of the Cold Warhas been repeatedly announced, yet the beast stubbornly lives on.97 Nearly two decades after the fall of communism we have once again entered a period of self-reinforcing suspicion and distrust between the major nuclear powers. This does not necessarily mean that the world will enter a period of sustained and institutionalized rivalry between two powers that act as magnetic poles in global affairs. The conditions for a replay of the old Cold War in its classic form are simply not present. Russia and America do not lead rival ideological projects on a global scale; although disagreements over such issues as the appropriate role of multilateral mechanisms do exist, they exist also between NATO allies. Nor are there sustained and entrenched policy differences over such issues as nuclear proliferation, global warming or any number of other fundamental issues facing the world. Russia is just one among a number of potential great powers, and therefore old-fashioned bipolarism is a thing of the past, and Russian–American relations are no longer the axis on which world politics turns. Even the issue that has much exercised the policy community in Washington, Russia’s alleged ‘democratic backsliding’, is a matter of interpretation, and in any case new leaderships in both countries may provide an opportunity for the regime question to become less sharp.98 The term ‘Cold War’, therefore, is a contemporary international relations metaphor for a fundamentally strained relationship that cannot be resolved within the framework of the world views of either party but requires a rethinking of both.

NO US-RUSSIA WAR – 4 REASONS

ARON, DIRECTOR OF RUSSIA STUDIES AT THE AMERICAN ENTERPRISE INSTITUTE, 6

[LEON, “U.S.-RUSSIA RELATIONS THROUGH THE PRISM OF IDEOLOGY”, RUSSIA IN GLOBAL AFFAIRS, VOL 4, NO 3, JULY-SEPT]

Yet, a head-on confrontation and a new Cold War are highly unlikely, at least for four reasons. First, despite their erosion, the aforementioned geo-strategic “assets” are far from being depleted and continue to serve as a kind of frame outlining the basic relations between the two countries. Second, the objectives of Russia’s foreign and defense policies, set in 1992-1993, remain unchanged. They are: Russia as a regional superpower; Russia as a global nuclear superpower; and, most importantly for America, Russia as one of great powers (but not a superpower that would politically compete with the United States worldwide). Although these objectives may irritate Washington now and again, they will hardly evoke its deep anxiety about America’s vital interests. Third, despite the Kremlin’s inclination to flex its muscles, Russia, unlike the Soviet Union and contemporary China, is not a “revisionist” power that constantly seeks to change the global balance of forces in its own favor. Such efforts require an ideology and, as a result, a system of priorities, which Moscow does not have today and will hardly have in the future. What ideology can we speak of when Russia, while passionately defending Iran’s right to the “peaceful development of nuclear energy” and a resistance to “pressure through force,” simultaneously launches a rocket from its Far Eastern space launch site Svobodny that is carrying an Israeli spy satellite intended to monitor Iran’s efforts to develop a nuclear bomb! The share of the GDP spent by Russia, now rolling in petrodollars, on defense (3 percent) is even less than it did in 1992-1997, after the Russian Federation had inherited an absolutely empty treasury from the Soviet Union, and at least ten times less than the Soviet Union did in 1985. On the basis of its purchasing power parity (in absolute figures estimated for 2005), Russia’s defense spending ($47.77 billion) is more than eleven times less than the outlays on defense in the U.S. ($522 billion). Yet, the most important factor of counteraction to a new Cold War is the one that the Kremlin strategists have long dismissed with contempt – namely, public opinion. Neither Americans nor Russians will support any confrontation plans of their elites, as they will not view them as necessary.

**Russia backing down on space weapons**

**Bourdeaux 11** (Richard Boudreaux, reporter for Wall Street Journal, “Russia Says Next U.S. Arms Talks Must Include Others,” article, Wall Street Journal, <http://online.wsj.com/article/SB10001424052748704307404576079953654840710.html>, 1/14/11)

**Russia said further cuts in nuclear weapons sought by the U.S. can be achieved only as part of a multinational accord limiting other types of armaments**, a position that dims the Obama administration's chances for swift progress toward one of its biggest foreign policy goals. Under conditions spelled out Thursday by Foreign Minister Sergei Lavrov, a new round of talks aimed at **slashing Russia's large arsenal of short-range tactical nuclear weapons must involve other nuclear powers and focus as well on conventional warheads and weapons in space**.

A2: Moon Good – Space Debris

### Debris clearing technologies already in development

JamesMason, Jan Stupl, William Marshall, Creon Levit 2011 (A team of scientists led by NASA space scientist James Mason),Cornell University Library, “Orbital Debris-Debris Collision Avoidance”, 9 Mar 20**11**, http://arxiv.org/abs/1103.1690

We investigate the feasibility of using a medium-powered(5kW) ground-based laser combined with a ground-based telescope to prevent collisionsbetween debris objects in low-Earth orbit (LEO), for which there is no current, effective mitigation strategy. The scheme utilizes photon pressure alone as a means to perturb the orbit of a debris object. Applied over multiple engagements, this alters the debris orbit sufficiently to reduce the risk of an upcoming conjunction. We employ standard assumptions for atmospheric conditions and the resulting beam propagation. Using case studies designed to represent the properties (e.g. area and mass) of the current debris population, we show that one could significantly reduce the risk of more than half of all debris-debris collisions using only one such laser/telescope facility. We speculate on whether this could mitigate the debris fragmentation rate such that it falls below the natural debris re-entry rate due to atmospheric drag, and thus whether continuous long-term operation could entirely mitigate the Kessler syndrome in LEO, without need for relatively expensive active debris removal.

### New technology is already developed – no chance of impacts

Gwyneth DickeyZakaib 2011(Science Writer Intern at Nature Publishing Group), NatureNews, “Telescope will track space junk: US military unveils instrument to catalogue debris and protect satellites from collisions.”, April 22, 2011, http://www.nature.com/news/2011/110422/full/news.2011.254.html

A ground-based telescope that can scan the skies faster than any other of its size could help to protect satellites from collisions with space debris and each other. The Space Surveillance Telescope (SST), developed by theUS Defense Advanced Research Projects Agency (DARPA), is to be used to protect US and international assets and commercial and international satellites in orbit around Earth. "We've got a lot of high-value missions up there, and if you're trying to do those missions with a blindfold on, you just don't know what's going to run into you at any time," says Chuck Laing, deputy division chief of the Architecture and Integration branch of Air Force Space Command at Peterson Air Force Base in Colorado. "It's important to know where everything is, how fast it's moving, and in what direction." Researchers are currently tracking an estimated 22,000 artificial objects that are orbiting Earth,from small bits of debris to large satellites.That number is expected to triple in the next 20 years, says Laing. Even a centimetre-sized piece of debris can cause considerable damage to crucial weather, communication or missile-warning systems. The US Air Force keeps a catalogue of all known orbiting objectsthrough its Space Surveillance Network, an integrated system of ground- and space-based telescopes and radar. The network tracks debris to anticipate possible impacts, but better surveillance is needed to cope with the increasing number of objects, says Laing. The SST would focus mostly on the region in which objects in geosynchronous orbit reside, about 35,000 kilometres from Earth.

### Most debris is uncleanable. Russia’s space junk is protected from US cleanup by international law

Jerome Pearson 2010 (President of STAR Inc.; developer of aircraft and spacecraft for DoD and NASA; degrees in engineering and geology; member of the International Academy of Astronautics), Tau Beta Pi, “The ElectroDynamic Debris Eliminator (EDDE): Removing Debris in Space”, Spring 2010, http://www.tbp.org/pages/publications/Bent/Features/SP10Pearson.pdf

One problem is legal. The Outer Space Treaty of 1967, signed by all space-faring nations, says that the launching nation owns its satellites, even if they are defunct and abandoned. Unlike the maritime law, space law does not allow for salvage rights or treasure hunters. To remove debris objects, we need permission from each original owner. Since most of the mass of defunct satellites in orbit was launched by the Soviet Union, we need permission from the successor states of Russia and Ukraine to remove these objects. This leads to the legal problem of liability for damages. If we deliberately cause a space object to enter the atmosphere, we are responsible for any damage or injury it causes. This is why the U.S. and Russia tried to de-orbit the Skylab and Mir space stations over remote areas of the Pacific. Total potential liability could be enormous as a result of the removal of the most dangerous debris objects in LEO that weigh more than 2 kg. Another problem is political. Space is like the commons of the Middle Ages, land that everyone used, no one owned, and no one was responsible for its upkeep. It deteriorated from overuse. Norman R. Augustine, New Jersey Delta ’57, chair of the 2009 NASA spaceflight review panel, calls space our global commons. It is open to everyone for satellite launches, but there is no requirement for launch organizations to capture debris or remove their dead satellites from orbit. No one nation or group is responsible for cleaning space, and there is no international authority empowered to collect taxes or fees to pay the costs of cleaning space. Space is rapidly becoming more dangerous.

### Space Junk is under control and is not a danger to the ISS – NASA testifies

Chloe Albanesius 2011 (Albanesius has been with PCMag.com since April 2007, most recently as East Coast News Editor. She graduated with a bachelor's degree in journalism from American University in Washington, D.C.), PCmag.com, “'Space Junk' Not a Threat to International Space Station, NASA Says”, April 5, 2011, http://www.pcmag.com/article2/0,2817,2383131,00.asp

A "space junk" crisis was averted this afternoon after NASA ruled that a piece of orbital debris making its way through the universe will not get close enough to the International Space Station to warrant concern.The debris, from the Chinese FENGYUN 1C satellite, could have affected the Expedition 27 spacecraft, which launched from Earth last night. "Tracking data now indicates that a piece of orbital debris being monitored by Mission Control Houston will not pass close enough to the International Space Station to warrant the Expedition 27 crew members taking safe haven within their Soyuz TMA-20 spacecraft," NASA said this afternoon. The space agency was monitoring the debris since early this morning, and notified ISS Commander Dmitry Kondratyev at 7am this morning that his crew might have to take cover if the debris remained on track. By 2:41pm, however, Mission Control gave the all-clear, as the space station orbited 220 miles above eastern Asia. NASA said more than 500,000 pieces of debris, or "space junk," is tracked as its orbits the Earth, 20,000 pieces of which are larger than a softball. These pieces are not just meandering by, however; they can travel at speeds up to 17,500 miles per hour. Even something as small as a paint fleck can damage a satellite or spacecraft, NASA said. Despite such large amounts of debris, there have only been a few collisions. In 1996, a French satellite was hit by debris from a French rocket that had exploded 10 years earlier. In 2009, a defunct Russian satellite collided with and destroyed a U.S. commercial satellite, adding 2,000 more pieces of trackable debris to the galaxy. In 2007, meanwhile, a Chinese anti-satellite test, which used a missile to destroy an old weather satellite, added more than 3,000 pieces to the debris problem, NASA said.

### Atlantis mission was unhindered by space debris – no threat posed for further missions

Denise Chow 2011 (SPACE.com Staff Writer), MSNBC, “Soviet debris deemed no threat to space station”, 7/11/2011, http://www.msnbc.msn.com/id/43713326/ns/technology\_and\_science-space/

A piece of space junk from an old Soviet satellite will pose no danger to the International Space Station and the attached shuttle Atlantis, thanks in large part to the weekend docking of the two spacecraft, NASA officials said Monday. "Mission Control has verified that the track of a piece of orbital debris will not be a threat to the International Space Station and space shuttle Atlantis," agency officials said in a statement. "No adjustments to the docked spacecraft’s orbit will be necessary to avoid the debris." The U.S. military's Space Surveillance Network notified NASA of the wandering piece of space trash yesterday, and the agency began tracking the object's orbit to determine if it would fly uncomfortablyclose to the station and require some kind of maneuver avoid a collision.