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

## 1AC---Plan

### The United States federal government should initiate a demonstration mission for mining the moon and near earth objects.

## 1AC---Rare Earth Elements

### Advantage : Rare Earth Elements

### The U.S. has zero domestic capacity in rare earth elements because of reverse brain drain- China dominates the global market

Kosich 10 – Dorothy, writer for Mineweb, March 22, 2010, “Rare Earths R&D funding critical to stemming brain drain in U.S. materials manufacturing,” online: http://www.proactiveinvestors.com.au/companies/news/5830

Without the development of new rare earth mineral supplies and more focused research in materials and manufacturing, Steven J. Duclos, the chief scientist and manager of material sustainability for GE Global Research, warns "supply challengescould seriously undermine efforts to meet the nation's future needs inenergy, healthcare and transportation."

During testimony before the Subcommittee on Investigations and Oversight of the House Committee on Science and Technology this week, Duclos estimates that GE uses "at least 70 of the first 83 elements listed in the Periodic Table of Elements" in the manufacturing of GE products.

"In actual dollars, we spent $40 billion annually on materials," Duclos said. Ten percent of this is for the direct purchase of metals and alloys. In the specific case of the rare earth elements, we use these elements in our healthcare, lightning, energy, motors, and transportation products."

Duclos said GE scientists are working with Yale University researchers who are developing "a more rigorous methodology for assessing the criticality of metals. Through these collaborations, we anticipate being able to predict with much greater confidence the level of criticality of elements for GE uses."

Scientist Karl A. Gshneider, Jr., of the Ames Laboratory of the U.S. Department of Energy and Department of Materials Science and Engineering at Iowa State University, called for a National Research Center on Rare Earths and Energy to be established in this country, and a National Research Center for Magnetic Cooling.

Magnetic cooling is new, advanced green technology for cooling and climate control of buildings and refrigerating and freezing foods.

Gshneider told the House Subcommittee that China has two large research laboratories devoted to rare earth research including mineral extraction, rare earth separation, and processing of oxides into metallic alloys. The Bautou Research Institute of Rare Earths is the largest rare earth research group in the world. It is located about 120 miles from the large rare earth deposit in Inner Mongolia.

He explained that as China flooded the marketplace with low-priced rare earth products in the 1990, producers in the U.S. and the rest of the world shut down. Soon thereafter China began manufacturing higher value rare earth products, include rare earth permanent magnet materials, which forced all U.S. rare earth magnet manufacturers out of business. "This resulted in a brain drainsand scientists and engineers in this field, and also in all high tech areas involving other rare earth products..."

"Some of these experts have moved on to other industries, others have retired, and other have died, basically leaving behind an intellectual vacuum" in the U.S. in terms of REE R&D, Gshneider noted.

"Rare earth research in the USA on mineral extraction, rare earth separation, processing of metal alloys and other useful forms...substitution, and recycling is virtually zero," he stressed.

Mark Smith, CEO of Molycorp Minerals, urged the House Subcommittee to help rebuild the rare earth knowledge infrastructure, as well as provide federal funding support for competitive grants specifically directed at rare earth research.

He noted that the Departments of Defense, Commerce and State are each examining this issue within the unique context of their agencies' work.

"The global rare earth supply concerns facing the U.S. and all other countries outside China are obviously disconcerting, but they arenot insurmountable," Smith declared. "A combination of geologic good fortune andan accelerated effort to ramp up domestic production and rebuild lost manufacturing capabilitiescould provide a solution for the U.S. and ensure that our leading national objectives are not jeopardized."

### Now is the key time to rebuild our domestic supply chain- China’s limit on REE exports will create a supply gap soon

The Guardian 10- Suzanne Goldenberg, the US environment correspondent of the Guardian, 26 December 2010, “Rare earth metals mine is key to US control over hi-tech future,” http://www.guardian.co.uk/environment/2010/dec/26/rare-earth-metals-us

So far as the Obama administration is concerned, the mine can't open soon enough. A US department of energy report warned on 15 December that, in the absence of mines such as this one, America risks losing control over the production of a host of technologies, from smart phones to smart bombs, electric car batteries to wind turbines, because of a virtual Chinese monopoly on the rare earth metals essential to their production. China controls 97% of global rare earth metals production. Such total domination of a strategic resource became impossible to ignore in October when China cut exports of rare earth elements by more than 70% over the previous year, disrupting manufacturing in Japan, Europe and the US. Prices of even the cheapest of the 17 rare earth elements rose 40%. Now America, like Japan and Europe, is desperate to find alternatives. "Reopening domestic production is an important part of a globalised supply chain," David Sandalow, the energy department's assistant secretary for international affairs told a seminar in Washington. For Smith, the official recognition of the strategic importance of the metals was a long time coming. "I've been going out to Washington DC every other week for about two years trying to tell the rare earths story," he said. They are listening in Washington now. At the 15 December seminar at the Centre for Strategic and International Studies, one PowerPoint presentation lingered on a slide that showed only the Chinese flag. The room filled with nervous laughter. By 2015, global demand for rare earths is expected to reach 205,000 tonnes. "If we don't get alternative supplies up and running we are going to have this supply gap that is going to cause a lot of issues," Smith said. Those issues forced their way onto the government's agenda this autumn when China began squeezing raw material exports of rare earth minerals. Some US media reports have speculated China is trying to use its control over the supply lines for political leverage. But a number of analysts say China is trying to get better control over an expensive, dirty and dangerous mining process, and to get more factories to set up shop inside the country. Rare earths are extracted through opencast mining and generate radioactive waste. "I don't believe that China is trying to chop the west off at the knees but it has a growing internal market that is driving the demand," said Gareth Hatch, an analyst at Technology Metal Research. "That reduces the amount they are willing to export." That is where Molycorp – the frontrunner for now in a global race to develop alternative production of rare earth materials – hopes to step in.

### The plan solves by mining REE concentrations on the moon

Spence 10- Edited By Ann Spence, November 16, 2010, “The next frontier? Lunar mining for rare earth elements?” http://ceramics.org/ceramictechtoday/2010/11/16/the-next-frontier-lunar-mining-for-rare-earth-elements/

Lunar mining may be in our not-so-distant future, as evidence of rare earth elements is clear, and China tightens its exports, increasing demand worldwide.“We know there are local concentrations of REE on the moon,” Carle Pieters, a planetary scientist in the Department of Geological Sciences at Brown University, and principal investigator for NASA’s Moon Mineralogy Mapper, told Space.com. “[W]e have not sampled these REE concentrations directly, but can readily detect them along a mixing line with many of the samples we do have.” According to a Missouri University of Science and Technology press release, Leslie Gertsch, a space mining expert and deputy director of the Rock Mechanics and Explosives Research Center at Missouri S&T believes that mining in space is essential to the survival of our species. According to Gertsch, REE are not presently detectable by remote instruments. However, thorium is a known lunar element and leads Gertsch to conclude that associated rare earth elements exist on the moon’s surface due to similar geochemical properties that caused them to crystallize under the same conditions. “Presumably REE mixtures could be produced on the moon and shipped to Earth for more specific separation. Neither potential mining methods nor the economics of this particular approach have been studied, to my knowledge,” Gertsch concluded.

### Asteroids are also rich in REEs, and even the perception of US space mining will cause China to loosen its grip on exports

Bova 10- Ben Bova, writes nonfiction about space exploration, a contributor for Naples Daily News, Nov. 28, 2010, “Rare earth elements are in the news,” http://www.naplesnews.com/news/2010/nov/27/ben-bova-nov-28-2010-rare-earth-elements-are-news/

Cynics believe the Chinese are merely trying to drive up the price of the rare earths. Conspiracy theorists see a plot afoot in Beijing to control a natural resource that is vital for many high-tech industries. Space enthusiasts, though, see an opportunity. The solar system contains millions, perhaps billions, of small chunks of metals and minerals, which are called asteroids. The largest of them, Ceres, is less than 600 miles wide. Most of them are much smaller, tiny chunks of rock left over from the creation of the solar system nearly five billion years ago. Most of the asteroids circle around the Sun between the orbits of Mars and Jupiter, roughly four times farther from the Sun than our own planet Earth. But there are thousands that are much closer to Earth. Some of them actually cross Earth’s orbit. They are called Near Earth Asteroids: NEAs. (Astronomers are not known for poetic nomenclature.) When President Barack Obama scrapped NASA’s plans for returning to the Moon and building permanent bases there, he proposed sending astronauts to one of the NEAs, instead. Now, many of these asteroids happen to be rich in rare earth elements. In fact, most of the rare earth mines on our planet are situated at the sites ofancient asteroid impacts. If we’re going to send astronauts to an asteroid, why not include a geologist who can bring back some samples of rare earths? Why not give the mission a purpose beyond merely exploring for the sake of scientific knowledge? Why not begin to exploit the natural resources that lie among the asteroids? Such an effort could act as an incentive for private industry to move farther into space than merely providing rockets to ferry people and cargo to the International Space Station. It could also show the world — and particularly the Chinese government — that we can move beyond our dependence on their resources (and ploys). Mining rare earths from asteroids would be enormously expensive, at first. But the effort could help to start a transition toward developing space industries. In time, we could see many industrial operations running in space, using virtually free solar energy, while our world becomes cleaner and greener: a residential zone, with industry moving off our planet. Would a move in this direction influence the Chinese government to relax its grip on rare-earth exports? There is a precedent for this sort of thing. In the 1980s, when former President Ronald Reagan proposed the Strategic Defense Initiative (aka “Star Wars”) it started a chain of events that led eventually to the fall of the Soviet Union. We didn’t go ahead with SDI — indeed, we still do not have a credible defense against ballistic missiles. But thepossibility that the U.S. might develop missile defenses helped to crack the Soviet Union apart. The possibility of mining rare earths from asteroids might help influence China, too.

Impacts:

First---Nuclear primacy:

### Rare earth elements are key to all missile guidance systems for first-strike capabilities

Kennedy 10 – J. Kennedy, President of Wings Enterprises, March 2010, “Critical and Strategic Failure of Rare Earth Resources,” online: http://www.smenet.org/rareEarthsProject/TMS-NMAB-paperV-3.pdf

The national defense issues are equally important. Rare earths are critical componentsfor military jet engines, guided missiles and bombs, electrical countermeasures, anti-missile systems, satellite communication systems and armor, yet the U.S. hasno domestic sources.

Innovation Drives Industry – Industry Carries the Economy

Advances in Materials Science are a result of tireless innovation; innovation seeking improvements in the performance and characteristics of material properties or a change in their form or function. Much of this work must eventually translate into commercial and military applications. Today many advances in material science are achieved through the application of rare earth oxides, elements and alloys. This group of elements, also known as the lanthanide series, represents the only known bridge to the next level of improved performance in the material properties for many metallurgical alloys, electrical conductivity, and instrument sensitivity and in some cases a mechanical or physical change in function. These lanthanides hold unique chemical, magnetic, electrical, luminescence and radioactive shielding characteristics. Combined with other elements they can help maintain or alter physical and structural characteristics under changing conditions.

Today, these rare earth elements are essential to every computer hard drive, cell phone, energy efficient light bulb, many automotive pollution control devices and catalysts, hybrid automobiles and most, if not all, military guidance systems and advanced armor.

Tomorrow, they will be used in ultra capacity wind turbines, magnetic refrigeration, zero emission automobiles, superconductors, sub-light-speed computer processors, nano-particle technologies for material and metallurgical applications, structurally amorphous metals, next generation military armor and TERFENOL-D Radar. Americamust leadin these developments.

The entire U.S. defense system is completely interdependent upon REO enhanced technologiesfor our most advanced weapons guidance systems, advanced armor, secure communications, radar, advanced radar systems, weapons triggering systems and un-manned Drones. REO dependent weapons technologies arepredominantly represented in our ‘first strike’ and un-manned capabilities. This national defense issue is not a case of limited exposure for first-strike capabilities. Thisfirst-strike vulnerabilitytranslates intorisk exposure in every level of our national defense system, as the system is built around ourpresumptive technological and first-strike superiority. Yet the DoD has abandon its traditional procurement protocols for “strategic and critical” materials and components for weapons systems in favor of “the principles of free trade.”

### The U.S. is upgrading accuracy of nuclear ICBMs now---key to counterforce and nuclear primacy

Lieber & Press 7 – Keir A. Lieber, Assistant Professor of Political Science at the University of Notre Dame, and Daryl G. Press is Associate Professor of Government at Dartmouth, 2007, “U.S. Nuclear Primacy and the Future of the Chinese Deterrent,” online: http://www.wsichina.org/%5Ccs5\_5.pdf

Furthermore, the United States continues to work to increase the lethality of its nuclear forces, thereby reducing even more the significance of any actual deviations from expected levels of accuracy. For example, the U.S. Navy recently experimented with using Global Positioning System (GPS) signals to provide terminal guidance for Trident II reentry vehicles (which would dramatically improve the warhead’s accuracy) and it is enhancing its Trident II W76 warheads with a new fuze to permit ground-bursts (which will greatly enhance the warhead’s lethality against hardened targets).28 Achieving GPS-like accuracy with submarine-launched ground-burst warheads would mark a tremendous leap in U.S. counterforce capabilities, providing gains in performance that could substitute for potential inaccuracy in other weapon systems. The point is that our analysis is not sensitive to plausible levels of uncertainty about U.S. accuracy, and will become even less sensitive in the future as U.S. weapons grow even more capable.

### Accuracy upgrades are key to ensure counterforce capabilities as the arsenal is inevitably reduced

McDonough 9 – David S. McDonough, Doctoral Fellow at the Centre for Foreign Policy Studies at Dalhousie University, March 2009, “Tailored Deterrence: The ‘New Triad’ and the Tailoring of Nuclear Superiority,” online: http://www.canadianinternationalcouncil.org/download/resourcece/archives/strategicd~2/sd\_no8\_200

Less noticedis thecontinuingmodernization of the existing arsenal. The remaining low-yield Minuteman III ICBM warheads will be replaced by the high-yield MX warheadand further augmented by the inclusion of GPS guidance systems. The SLBM force of highly accurate and high-yield D-5warheads will also benefit from the addition of GPS accuracy and ground-burst capability.Even the bomber force will become armed with stealthy and low-flying cruise missiles – ideal to avoid an adversary’s early warning radar. The nuclear force may indeed be smaller, but it is also becoming more accurate and more lethal, and ideal for disarming counterforce strikes.

### Loss of U.S. nuclear primacy causes global nuclear war

Caves 10 – John P. Caves Jr., Senior Research Fellow in the Center for the Study of Weapons of Mass Destruction at the National Defense University, January 2010, “Avoiding a Crisis of Confidence in the U.S. Nuclear Deterrent,” Strategic Forum, No. 252

Perceptions of a compromised U.S. nuclear deterrent as described above would haveprofound policy implications, particularly if they emerge at a time whena nuclear-armed great power is pursuing a more aggressive strategytoward U.S. allies and partners in its region in a bid to enhance its regional and global clout.

A dangerous period of vulnerability would open for the United States and those nations that depend on U.S. protection while the United States attempted to rectify the problems with its nuclear forces. As it would take more than a decade for the United States to produce new nuclear weapons, ensuing events could preclude a return to anything like the status quo ante.

The assertive, nuclear-armed great power, and other major adversaries, could be willing to challenge U.S. interests more directlyin the expectation that the United States would be less prepared to threaten or deliver a military response that could lead to direct conflict. They will want to keep the United States from reclaiming its earlier power position.

Allies and partnerswho have relied upon explicit or implicit assurances of U.S. nuclear protection as a foundation of their security could lose faith in those assurances. Theycould compensate by accommodating U.S. rivals, especially in the short term, or acquiring their own nuclear deterrents, which in most cases could be accomplished only over the mid- to long term. A more nuclear world would likely ensue over a period of years.

Important U.S. interests could be compromised or abandoned, ora major war could occuras adversaries and/or the United States miscalculate new boundaries of deterrence and provocation. At worst, war could lead to state-on-state employment of weapons of mass destruction (WMD) on a scale far more catastrophic than what nuclear-armed terrorists alone could inflict.

### The U.S. will inevitably fight conventional wars against nuclear-armed adversaries---only nuclear primacy prevents escalation to nuclear war

Lieber & Press 9 - Keir A. Lieber, Assistant Professor of Political Science at the University of Notre Dame, and Daryl G. Press, Associate Professor of Political Science at the University of Pennsylvania, November-December 2009, “The Nukes We Need: Preserving the American Deterrent,” Foreign Affairs, p. 50-51

This second criticism has merit. Nevertheless, the benefits of maintaining effective counterforce capabilities trump the costs. Strong counterforce capabilities should make adversaries expect that escalating a conventional war will lead to a disarming attack, not a cease-fire. Beyond deterrence, these capabilities will provide a more humane means of protecting allies who are threatened by nuclear attack and give U.S. leaders the ability to pursue regime change if an adversary acts in a truly egregious fashion. Moreover, some danger of escalation is unavoidable because the style of U.S. conventional operations will inevitably blind, rattle, and confuse U.S. adversaries. If the United States has powerful counterforce tools, these may dissuade its enemies from escalating in desperate times, and U.S. leaders would have a much more acceptable option if deterrence fails.

The nuclear forces the United States builds today must be able to act as a reliable deterrent, even in much darker times. Many of those who recommend a much smaller U.S. nuclear arsenal—and assign little importance to a nuclear counterforce option—fail to consider the great difficulties of maintaining deterrence during conventional wars. The U.S. nuclear arsenal should retain sufficient counterforce capabilities to make adversaries think very carefully before threatening to use, putting on alert, or actually using a nuclear weapon. Any nuclear arsenal should also give U.S. leaders options they can stomach employing in these high-risk crises. Without credible and effective options for responding to attacks on allies or U.S. forces, the United States will have difficulty deterring such attacks. Unless the United States maintains potent counterforce capabilities, U.S. adversaries may conclude—perhaps correctly—that the United States’ strategic position abroad rests largely on a bluff.

### Second---Green Tech:

### REEs are key to technologies in the green revolution- without mining diversity, we can’t solve warming

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

This transition is already well underway. The world is on the cusp of a clean energy revolution. Here in the United States, the Obama Administration is making historic investments in clean energy. The American Recovery and Reinvestment Act was the largest one-time investment in clean energy in our nation’s history – more than $80 billion. At the Department of Energy, we’re investing our $37 billion in Recovery funds in electric vehicles; batteries and advanced energy storage; a smarter and more reliable electric grid; and wind and solar technologies, among many other areas. Through this investment, we’ll at least double our renewable energy generation and manufacturing capacities by 2012. We’ll also deploy hundreds of thousands of electric vehicles and charging infrastructure to power them; weatherize at least half a million homes; and expand our grid. Other countries are also seizing this opportunity. Indeed, the market for clean energy technologies is growing rapidly all over the world. Today, the Chinese government is launching programs to deploy electric cars in 13 major cities. It’s connecting urban centers with high-speed rail. It’s building huge wind farms, ultra- supercritical advanced coal plants and ultra-high-voltage long-distance transmission lines with low line loss. India has launched an ambitious National Solar Mission, with the goal of reaching 20 gigawatts of installed solar capacity by 2020. In Europe, strong public policies are driving sustained investments in clean energy. Denmark is the world’s leading producer of wind turbines, earning more than $4 billion each year in that industry. Germany and Spain are the world’s top installers of solar photovoltaic panels, accounting for nearly three-quarters of a global market worth $37 billion last year. Around the world, investments in clean energy technologies are growing, helping create jobs, promote economic growth and fight climate change.These technologies will be a key part of the transition to a clean energy future. However today, many of these technologies rely on the special properties of rare-earth metals. There’s no reason to panic, but there’s every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals and other strategic materials.For the clean energy economy to reach its full potential, we must work together to ensure stable supplies of the materials required. That means working together to diversify global supply chains, as well as investing in manufacturing and processing. It means research and development into substitutes. It means finding ways to recycle and re-use scarce materials. U.S. talent and innovative capacity in materials science can be harnessed to create the next generation of rare earth applications and competing technologies. To proactively address the availability of rare earths and other strategic materials required for the clean energy economy, we must take a three-part approach: The first strategy is to globalize supply chains for strategic materials. To paraphrase what Churchill once said about oil: Security rests above all in diversity of supply. To manage supply risk, we need multiple, distributed sources of strategic materials in the years ahead. This means taking steps to encourage extraction, refining and manufacturing here in theUnited States, as well as encouraging our trading partners to expedite the environmentally-sound creation of alternative supplies.

### Warming causes extinction

**Tickell 8**- Oliver, The Guardian, August 11, 2008, “On a planet 4C hotter, all we can prepare for is extinction,” online: http://www.guardian.co.uk/commentisfree/2008/aug/11/climatechange)

We need to get prepared for four degrees of global warming, Bob Watson told the Guardian last week. At first sight this looks like wise counsel from the climate science adviser to Defra. But the idea that we could adapt to a 4C rise is absurd and dangerous. Global warming on this scale would be a catastrophe that would mean, in the immortal words that Chief Seattle probably never spoke, "the end of living and the beginning of survival" for humankind. Or perhaps the beginning of our extinction. The collapse of the polar ice caps would become inevitable, bringing long-term sea level rises of 70-80 metres. All the world's coastal plains would be lost, complete with ports, cities, transport and industrial infrastructure, and much of the world's most productive farmland. The world's geography would be transformed much as it was at the end of the last ice age, when sea levels rose by about 120 metres to create the Channel, the North Sea and Cardigan Bay out of dry land. Weather would become extreme and unpredictable, with more frequent and severe droughts, floods and hurricanes. The Earth's carrying capacity would be hugely reduced. Billions would undoubtedly die. Watson's call was supported by the government's former chief scientific adviser, Sir David King, who warned that "if we get to a four-degree rise it is quite possible that we would begin to see a runaway increase". This is a remarkable understatement. Theclimate system is already experiencing significant feedbacks, notably the summer melting of the Arctic sea ice. The more the ice melts, the more sunshine is absorbed by the sea, and the more the Arctic warms. And as the Arctic warms, the release of billions of tonnes of methane – a greenhouse gas 70 times stronger than carbon dioxide over 20 years – captured under melting permafrost is already under way. To see how far this process could go, look 55.5m years to the Palaeocene-Eocene Thermal Maximum, when a global temperature increase of 6C coincided with the release of about 5,000 gigatonnes of carbon into the atmosphere, both as CO2 and as methane from bogs and seabed sediments. Lush subtropical forests grew in polar regions, and sea levels rose to 100m higher than today. It appears that an initial warming pulse triggered other warming processes. Many scientistswarn that this historical event may be analogous to the present: the warming caused by human emissions could propel us towards a similar hothouse Earth.

[Watson is PhD in Chemistry, Award for Scientific Freedom and Responsibility from the American Association for the Advacement of Science]

## 1AC---Nuclear Forensics

### Advantage : Nuclear Forensics

### U.S. nuclear forensics capabilities are collapsing due to lack of He3

Wald 9 – Matthew L. Wald, International Herald Tribune Correspondent, November 24, 2009, “Shortage Of Ingredient Mires Bomb Detection,” The International Herald Tribune, News Section, Pg. 4, Lexis

The U.S. Department of Homeland Security has spent $230 million to develop better technology for detecting smuggled nuclear bombs but has had to stop deploying the new machines because the UnitedStateshas run out of a crucial raw material, experts say. The ingredient is helium 3, an unusual form of the element that is formed when tritium, an ingredient of hydrogen bombs, decays. But the government mostly stopped making tritium in 1989. ''I have not heard any explanation of why this was not entirely foreseeable,'' said Representative Brad Miller, Democrat of North Carolina, who is the chairman of a House subcommittee that is investigating the problem. An official from the Homeland Security Department testified last week before Mr. Miller's panel, the Investigations and Oversight Subcommittee of the House Science Committee, that demand for helium 3 appeared to be 10 times the supply. Some government agencies, Mr. Miller said, did anticipate a crisis, but the Homeland Security Department appears not to have gotten the message. The department had planned a worldwide network using the new detectors, which were supposed to detect plutonium or uranium in shipping containers. The government wanted 1,300 to 1,400 machines, which cost $800,000 each, for use in ports around the world to thwart terrorists who might try to deliver a nuclear bomb to a big American city by stashing it in one of the millions of containers that enter the United States every year. At the White House, Steve Fetter, an assistant director of the Office of Science and Technology Policy, said the helium 3 problem was short-term because other technologies would be developed. But, he said, while the government had a large surplus of helium 3 at the end of the Cold War, ''people should have been aware that this was a one-time windfall and was not sustainable.'' Helium 3 is not hazardous or even chemically reactive, and it is not the only material that can be used for neutron detection. The Homeland Security Department has older equipment that can look for radioactivity, but it does not differentiate well between bomb fuel and innocuous materials that naturally emit radiation - like cat litter, ceramic tiles and bananas - and sounds false alarms more often. Earlier this year, the Pacific Northwest National Laboratory, part of the U.S. Energy Department, said in a report, ''No other currently available detection technology offers the stability, sensitivity and gamma/neutron discrimination'' of detectors using helium 3. Helium 3 is used to detect neutrons, the subatomic particles that sustain the chain reaction in a bomb or a reactor. Plutonium, the favorite bomb-making material of most governments with nuclear weapons, intermittently gives off neutrons, which are harder for a smuggler to hide than other forms of radiation. The declining supply is also needed for physics research and medical diagnostics. Mr. Miller estimated that demand for helium 3 was about 65,000 liters per year through 2013 and that total production by the only two countries that produce it in usable form, the United States and Russia, was only about 20,000 liters.

### U.S. supply of He3’s key to international nuclear monitoring

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

National and Homeland SecurityThe demand for helium-3 for national and homeland security purposes falls into two main categories: the detection of smuggled radiological and special nuclear material and the monitoring of known special nuclear materialto ensure its security.53The Department of Defense, Department of State, NNSA, and DHS all have deployed radiation detection equipment to detect smuggled radiological and nuclear material.54 Through programssuch as Cooperative Threat Reduction, the Second Line of Defense, and the Radiation PortalMonitor program, these agencies have deployed thousands of radiation portal monitors both domestically and overseas. Each portal uses approximately 50 liters of helium-3 as the basis for its neutron detection capability. Some of the programs have been in place since before 2001.Others, such as those operated through DHS, were established later. The broad expansion of thesedeployments has provided the greatest demand for helium-3 and been the largest drain on thehelium-3 stockpile.The Department of Defense and NNSA also use helium-3 in neutron detectors to ensure thatstores of special nuclear material are fully accounted for. Accurate neutron counting over longtime periods is one way to monitor the continued presence of materials such as plutonium. Inaddition, the United States contributes helium-3 to meet the nuclear security and monitoring needs of the International Atomic Energy Agency (IAEA).Department of Defense guidance and navigation systems for munitions, missiles, aircraft, and surface vehicles include ring laser gyroscopes that use helium-3. Testing and qualification are under way on an alternative gas for this purpose.55

### Credible nuclear forensics prevents over-reaction by the U.S. in the wake of a nuclear terror event---that stops massive retaliation

Dunlop and Smith 6 – William Dunlop, retired senior scientist at Lawrence Livermore National Laboratories, led LLNL’s Arms Control and International Non-Proliferation programs and was a scientific adviser to the U.S. delegation involved in negotiations on the Comprehensive Test Ban Treaty, and Harold Smith, distinguished visiting scholar and professor at the Goldman School of Public Policy, University of California at Berkeley, October 2006, “Who Did It? Using International Forensics to Detect and Deter Nuclear Terrorism,” Arms Control Today, online: http://www.armscontrol.org/print/2129

Such determinations, if credibly obtained and distributed, could prove vital. If it were made clear, a priori, that the supplier of the nuclear material and/or weapon would be held responsible, nuclear forensics might deter potential suppliers. After an attack, nuclear forensics could be combined with other forensics methodologies and information tying involved individuals to places and events. Together this data could help establish the route from the supplier to the user and perhaps facilitate elimination of the supply chain. Furthermore, because the samples that might be collected are very small and have a mixture of isotopes with short, medium and long half-lives,[6] a significant amount of time, measured in days, is needed before the presence of some isotopes with longer half-lives can be measured with certainty. Hence, the time required to make some of these key determinations imposes a temporary moratorium on potentially catastrophic reactions by political leaders, who can legitimately inform their constituencies that appropriate action must wait until the evidence is clear.

### Massive U.S. retaliation triggers full-scale nuclear war

Harvard Law Review8 [“NOTE: THE INCENTIVE GAP: REASSESSING U.S. POLICIES TO SECURE NUCLEAR ARSENALS WORLDWIDE,” 121 Harv. L. Rev. 1864]

Upon closer analysis, however, an expanded deterrence doctrine based solely on military retaliation raises serious concerns. As an initial matter, the entire approach depends on the assumption that the United States has the ability to quickly and reliably identify the state of origin of a nuclear weapon after it detonates. n98 Without this ability, the United States would have to delay its retaliatory response and risk undermining the credibility of its threat. Worse yet, pressure to maintain a credible deterrent might force the United States into a "commitment trap" n99 whereby it proceeds with retaliation against a state that has not been proven guilty by forensic analysis. Moreover, even if progress on nuclear forensics eliminated such problems, questions would still remain regarding what evidentiary standard the United States must meet before holding a state responsible, how it could structure the attribution process to avoid accusations of bias by other states, and how political leaders could be trained to make decisions that require highly technical, scientific knowledge. A second major problem is that fulfilling the commitment to retaliate would likely require the United States to incur major costs or endanger important interests. The most obvious scenario here involves the case in which Russia is the negligent state responsible for an attack on the United States. Fulfilling the retaliatory commitment here requires attacking a potential ally and risks provoking substantial counterattacks, possibly leading to full-scale war between two nuclear powers. Given these circumstances, it is difficult to believe that the United States would ever attack Russia. More generally, the problem is that in many cases following through on the threat of retaliation might actually decrease American security or otherwise impose costs that outweigh [\*1885] the deterrence benefits. Thus, because retaliation may be strategically unwise for the United States, other states will question the credibility of the American threat.

### Credible nuclear forensics deters nuclear terror in the first place---prevents state transfers of nuclear material

Phillips 7 – Matthew Phillips, senior analyst for DeticaDFI, a national security consulting firm in Washington, D.C., 2007, “Uncertain Justice for Nuclear Terror: Deterrence of Anonymous Attacks Through Attribution,” Orbis, Vol. 51, No. 3, p. 429-446

The prospect of North Korea or Iran (after achieving sufficient nuclear capability) transferring nuclear material or a nuclear weapon to terrorists is a serious, if uncertain, threat. Although North Korea reached an apparent disarmament agreement earlier this year with the United States and the other participants in the six-party talks, Kim Jong II's record of deception tempers optimism about the ultimate success of that agreement. A U.S.-designated state sponsor of terrorism, North Korea has major economic problems that could lead it to sell its nuclear weapons, materials or technology to the highest bidder. As for Iran, its state ties to terrorist organizations are well-documented, and it continues to defy international pressure to end uranium enrichment. Only states have the capability to produce fissile material for nuclear weapons, so nuclear-capable states that share terrorists’ hostility to the UnitedStates pose a potentially devastating threat. If terrorists obtained a nuclear weapon or fissile material to assemble an improvised nuclear device, vulnerabilities in U.S. port and border security could allow them to transport such a weapon into the United States covertly. A resulting attack using a nuclear weapon could result in hundreds of thousands or even millions of deaths. With no “return address” tying the attack to the state that provided the nuclear materials to the terrorists, such a method of attack could be attractive to states eager to inflictcatastrophic destruction on theUnited States while avoiding retaliation. Deterrence of such states could be uncertain at best.

Some analysts have suggested that deterrence of nuclear terrorism could be strengthened through a robust attribution capability.1 They argue that if the UnitedStates could identify the source of nuclear materials with a high degree of confidence after an attack, it could ensure the certainty of a devastating response against that source and thus deter states from providing nuclear materials to terrorists. This article will argue that the United States must develop the best possible nuclear attribution technology, at the very least to support response actions after an attack. If the unthinkable happened, such technology would be crucial for identifying the source of the material and preempting follow-on attacks. But the technology's prospects for deterrence are uncertain—at least based on current capabilities—and expectations must be tempered. Depending on advances in the technology and how policymakers make use of it, improved attribution capabilities might enhance deterrence,and deterrence certainly should remain a key component of U.S. national security strategy. But because of the many technological and policy uncertainties that could surround an attribution effort, policymakers should not rely entirely on this technology as a failsafe means to deter nuclear terrorism.

### State transfers are the only scenario for nuclear terror

Levi 7 [Michael A, PhD in war studies, University of London, David M. Rubenstein senior fellow for energy and the environment at the Council on Foreign Relations. former fellow on foreign policy at the Brookings Institute, “On Nuclear Terrorism”, Harvard University Press, In cooperation with Council on Foreign Relations, Pp 15]

No material occurring in nature can be used to make a nuclear bomb, which requires either enriched uranium or plutonium.Uranium mined from the ground must be processed extensively—enriched—before it can be used in a bomb. Plutonium does not occur naturally aside from minus­cule quantities and must be produced in a nuclear reactor. Both capabili­ties are widely agreed to be beyond the reach of even the most sophis­ticated terrorists.'Thus state stockpiles of these nuclear materials and weapons are the gateways to nuclear terrorism.If nuclear weapons and materials can be locked up by capable, well-behaved states, and if those un­able or unwilling to lock up materials or weapons can be denied them, **nuclear terrorism can be made impossible.**This sort of strategy is so compelling that it should form the foundation of any sensible approach to preventing nuclear terrorism. Only nine countries have nuclear weapons. Policymakers are confident that in seven of them—the United States, Britain, France, Russia, China, India, and Is­rael—no government imaginable would ever want to allow terrorists access to a bomb or to the materials needed to make one. A more contentious debate exists over what the other two states, Pakistan and North Korea, might do with their arsenals, but many believe that they would not part with them either.Many more countries retain civilian stocks of highly enriched uranium (HEU) or plutonium, the indispensable ingredi­ents of nuclear bombs. Fourteen states without nuclear weapons are esti­mated to have at least twenty-five kilograms (about fifty pounds) of HEU each, the minimum amount required for a bomb according to the Inter­national Atomic Energy Agency.2 Another twenty-six have at least one kilo­gram (about two pounds) of the material. Three countries without nuclear weapons also have sufficient plutonium with low enough radioactivity to e used in a bomb.' Although these numbers may appear to indicate a widespread problem, they actually describe a limited challenge. In contrast with, for example, conventional explosives, nuclear weapons and materials are available only at a relatively small, known, group of facilities that in theory can either lock their materials down or end their operations if adequate security proves impossible. Meanwhile only one state, Iran, explicitly threatens to acquire highly enriched uranium or nuclear weapons in the near future, in theory a problem that can be managed using a mix of inter­national diplomacy, inducements, economic pressure, or military action.

### Risk of nuclear terror’s high---Al Qaeda’s resilient and motivated

Kanani 11 - Rahim Kanani, Founder And Editor In Chief Of World Affairs Commentary, July 29, 2011, “New al-Qaeda Chief Zawahiri Has Strong Nuclear Intent,” Online: http://blogs.forbes.com/rahimkanani/2011/06/29/new-al-qaeda-chief-zawahiri-has-strong-nuclear-intent/

Rigid, arrogant, unpopular and lacking the necessary charisma to reenergize a battered global terrorist organization, Dr. Ayman al-Zawahri has been continually regarded by U.S. officials and veteran terrorism analysts as incapable of following in the footsteps of Osama bin Laden. Perhaps, but underestimating his ability to orchestrate widespread terror is a dangerous consequence of marginalizing his learned skillset, for we must not discount his former position as al-Qaeda’s deputy chief and operational commander for years. We should be especially worried about the threat of nuclear terrorism under Zawahiri’s leadership. In a recent report titled “Islam and the Bomb: Religious Justification For and Against Nuclear Weapons”, which I researched for and contributed to, lead author Rolf Mowatt-Larssen, former director of intelligence and counterintelligence at the U.S. Department of Energy, argues that al-Qaeda’s WMD ambitions are more powerful than ever. And that “this intent no longer feels theoretical, but operational.” “I believe al-Qaeda is laying the groundwork for a large scale attack on the United States, possibly in the next year or two,” continues Mowatt-Larssen in the opening of the report issued earlier this year by the Belfer Center for Science and International Affairs at Harvard Kennedy School. “The attack may or may not involve the use of WMD, but there are signs that al-Qaeda is working on an event on a larger scale than the 9/11 attack.” Most will readily dismiss such claims as implausible and unlikely, and we hope they are right, but after spending months with Mowatt-Larssen, who also served as the former head of the Central Intelligence Agency’s WMD and terrorism efforts, scrutinizing and cross-referencing Zawahiri’s 268-page treatise published in 2008 titled “Exoneration”, the analytics steered us towards something far more remarkable than expected. “As I read the text closely, in the broader context of al-Qaeda’s past, my concerns grew that Zawahiri has written this treatise to play a part in the ritualistic process of preparing for an impending attack,” states Mowatt-Larssen. “As Osama bin Laden’s fatwa in 1998 foreshadowed the 9/11 attack, Ayman Zawahiri’s fatwa in 2008 may have started the clock ticking for al-Qaeda’s next large scale strike on America. If the pattern of al-Qaeda’s modus operandi holds true, we are in the middle of an attack cycle.” Among several important findings, Zawahiri sophisticatedly weaves identical passages, sources and religious justifications for a nuclear terrorist attack against the United States previously penned by radical Saudi cleric Nasir al Fahd. Indeed, the language used, research cited, and arguments put forth are nothing short of detailed and deliberate. Reading as both a religious duty to kill millions of Americans and a lengthy suicide note together, this piece of literature is something we must take seriously with Zawahiri now at the helm of al-Qaeda. The time may have come for al-Qaeda’s new CEO to leave a legacy of his own. Concluding the author’s note, Mowatt-Larssen states, “Even if this theory proves to be wrong, it is better to overestimate the enemy than to under­estimate him. Conventional wisdom holds that al-Qaeda is spent—that they are incapable of carrying out another 9/11. Leaving aside whether this view is correct, for which I harbor grave doubts, we will surely miss the signs of the next attack if we continue to overestimate our own successes, and dismiss what terrorists remain capable of accomplishing when they put their minds to it.” We must remember that Zawahiri’s arrogance and rigidness are not substitutes for determination and will.

### The impact is extinction

Hellman 8[Martin E. Hellman, emeritus prof of engineering @ Stanford, “Risk Analysis of Nuclear Deterrence” SPRING 2008 THE BENT OF TAU BETA PI, http://www.nuclearrisk.org/paper.pdf]

The threat of nuclear terrorism looms much larger in the public’s mind than the threat of a full-scale nuclear war, yet this article focuses primarily on the latter. An explanation is therefore in order before proceeding. A terrorist attack involving a nuclear weapon would be a catastrophe of immense proportions: “A 10-kiloton bomb detonated at Grand Central Station on a typical work day would likely kill some half a million people, and inflict over a trillion dollars in direct economic damage. America and its way of life would be changed forever.” [Bunn 2003, pages viii-ix]. The likelihood of such an attack is also significant. Former Secretary of Defense William Perry has estimated the chance of a nuclear terrorist incident within the next decade to be roughly 50 percent [Bunn 2007, page 15]. David Albright, a former weapons inspector in Iraq, estimates those odds at less than one percent, but notes, “We would never accept a situation where the chance of a major nuclear accident like Chernobyl would be anywhere near 1% .... A nuclear terrorism attack is a low-probability event, but we can’t live in a world where it’s anything but extremely low-probability.” [Hegland 2005]. In a survey of 85 national security experts, Senator Richard Lugar found a median estimate of 20 percent for the “probability of an attack involving a nuclear explosion occurring somewhere in the world in the next 10 years,” with 79 percent of the respondents believing “it more likely to be carried out by terrorists” than by a government[Lugar 2005, pp. 14-15]. I support increased efforts to reduce the threat of nuclear terrorism, but that is not inconsistent with the approach of this article. Because terrorism is one of the potential trigger mechanisms for a full-scale nuclear war, the risk analyses proposed herein will include estimating the risk of nuclear terrorism as one component of the overall risk. If that risk, the overall risk, or both are found to be unacceptable, then the proposed remedies would be directed to reduce which- ever risk(s) warrant attention. Similar remarks apply to a number of other threats (e.g., nuclear war between the U.S. and China over Taiwan). his article would be incomplete if it only dealt with the threat of nuclear terrorism and neglected the threat of full- scale nuclear war. If both risks are unacceptable, an effort to reduce only the terrorist component would leave humanity in great peril. In fact, society’s almost total neglect of the threat of full-scale nuclear war makes studying that risk all the more important. The cosT of World War iii The danger associated with nuclear deterrence depends on both the cost of a failure and the failure rate.3 This section explores the cost of a failure of nuclear deterrence, and the next section is concerned with the failure rate. While other definitions are possible, this article defines a failure of deterrence to mean a full-scale exchange of all nuclear weapons available to the U.S. and Russia, an event that will be termed World War III. Approximately 20 million people died as a result of the first World War. World War II’s fatalities were double or triple that number—chaos prevented a more precise deter- mination. In both cases humanity recovered, and the world today bears few scars that attest to the horror of those two wars. Many people therefore implicitly believe that a third World War would be horrible but survivable, an extrapola- tion of the effects of the first two global wars. In that view, World War III, while horrible, is something that humanity may just have to face and from which it will then have to recover. In contrast, some of those most qualified to assess the situation hold a very different view. In a 1961 speech to a joint session of the Philippine Con- gress, General Douglas MacArthur, stated, “Global war has become a Frankenstein to destroy both sides. … If you lose, you are annihilated. If you win, you stand only to lose. No longer does it possess even the chance of the winner of a duel. It contains now only the germs of double suicide.” Former Secretary of Defense Robert McNamara ex- pressed a similar view: “If deterrence fails and conflict develops, the present U.S. and NATO strategy carries with it a high risk that Western civilization will be destroyed” [McNamara 1986, page 6]. More recently, George Shultz, William Perry, Henry Kissinger, and Sam Nunn4 echoed those concerns when they quoted President Reagan’s belief that nuclear weapons were “totally irrational, totally inhu- mane, good for nothing but killing, possibly destructive of life on earth and civilization.” [Shultz 2007] Official studies, while couched in less emotional terms, still convey the horrendous toll that World War III would exact: “The resulting deaths would be far beyond any precedent. Executive branch calculations show a range of U.S. deaths from 35 to 77 percent (i.e., 79-160 million dead) … a change in targeting could kill somewhere between 20 million and 30 million additional people on each side .... These calculations reflect only deaths during the first 30 days. Additional millions would be injured, and many would eventually die from lack of adequate medical care … millions of people might starve or freeze during the follow- ing winter, but it is not possible to estimate how many. … further millions … might eventually die of latent radiation effects.” [OTA 1979, page 8] This OTA report also noted the possibility of serious ecological damage [OTA 1979, page 9], a concern that as- sumed a new potentiality when the TTAPS report [TTAPS 1983] proposed that the ash and dust from so many nearly simultaneous nuclear explosions and their resultant fire- storms could usher in a nuclear winter that might erase homo sapiens from the face of the earth, much as many scientists now believe the K-T Extinction that wiped out the dinosaurs resulted from an impact winter caused by ash and dust from a large asteroid or comet striking Earth. The TTAPS report produced a heated debate, and there is still no scientific consensus on whether a nuclear winter would follow a full-scale nuclear war. Recent work [Robock 2007, Toon 2007] suggests that even a limited nuclear exchange or one between newer nuclear-weapon states, such as India and Pakistan, could have devastating long-lasting climatic consequences due to the large volumes of smoke that would be generated by fires in modern megacities. While it is uncertain how destructive World War III would be, prudence dictates that we apply the same engi- neering conservatism that saved the Golden Gate Bridge from collapsing on its 50th anniversary and assume that preventing World War III is a necessity—not an option

## 1AC---Space Leadership

### Advantage : Space Leadership

### Lunar resources are key to U.S. leadership and great power status---competitors are rising

Hatch 10-Bejnamin D. Hatch, Emory International law review, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” http://www.iew.unibe.ch/unibe/rechtswissenschaft/dwr/iew/content/e3870/e3985/e4139/e6403/sel-topic\_4-hatch\_ger.pdf

Until recently, Russia was the only country, other than the United States, that had actually sponsored manned spaceflight. The Soviet Union was responsible for the first artificial satellite to orbit the Earth as well as the first animal space test in 1957. n84 **While Russia has never landed a person on the Moon, the Kremlin has announced plans to put a cosmonauton the Moon by 2025, with a permanent Moon base to follow shortly thereafter**. n85 Apparently, Russia had offered to have a cooperative Moon base with the United States, but its offer was rejected, n86 although further details as to why have not been made available. n87 **Russia has openly admitted that its aims for lunar exploration are tied to the extraction of Helium-3. n88**Moreover, individuals within the Russian government have questioned American motives and suggested that NASA's Constellation Program's true lunar aim is Helium-3 extraction. n89 Erik Galimov of the Russian Academy of Sciences seemed to best articulate what the Kremlin was thinking, when he opined that NASA's plan would "enable the US to establish its control of the energy market 20 years from now and put the rest of the world on its knees as hydrocarbons run out." n90 [\*241] 3. The People's Republic of China On October 15, 2003, China became the third country to successfully put a human into outer space. n91**Chinaintends to have a permanent facility that orbits the Moon by 2020 n92 and to conduct a moonwalk by 2024**. n93**China views the exploration of the Moon as competitive and beneficial,** as made clear by Ouyang Ziyuan, the head of the Chinese lunar program, when he stated**: "We will provide the most reliable report on helium-3 tomankind... . Whoever first conquers the moon will benefit first."** n94 According to Ouyang, "when obtaining nuclear power from helium-3 becomes a reality, the resource on the moon can be used to generate electricity for more than 10,000 years for the whole world." n95 4. Europe While the only states that have placed humans in outer space are the United States, Russia, and China, they are not the only members of the club of spacefaring states. The nations of Europe, while not technically a state, do share a number of common agencies, one of which is the European Space Agency ("ESA"). n96 Although the ESA is not affiliated with the European Union, the members of the ESA include nearly all Western European states. n97**The ESA has ambitions to not only send humans into space but also to participate in the development of theMoon.** [\*242] The ESA launched its first lunar satellite in September 2003. n98 The satellite's mission was successfully completed upon its planned crash into the Moon's surface in September 2006. n99 This first, small step for the ESA will not be the last. The ESA's new Aurora Programme is an international effort with the purpose of deploying humans and robots on the Moon and Mars in the foreseeable future. n100 Part of this development will be the construction of lunar bases. According to the current schedule, the ESA will construct a "global robotic village" on the Moon in 2016, to be followed in eight years by a manned base. n101 5. The Republic of India India, like China, has both an overpopulation problem n102 and an ambitious design on space. **India successfullylaunched its first lunar probe in November** 2008. n103 **It intends to conduct its first manned spaceflight by 2014and a manned lunar mission by 2020,** which would put India ahead of regional rival China in reaching the Moon. n104 **While India is motivated by the potential for Helium-3 mining**, its space development has an additional focus - national security. n105 India's Chief of the Army Staff stated that the space race between India and China needed to be accelerated so that India could counter Chinese attempts to militarize space. n106 6. Japan Japan launched lunar probes in 2007, n107 and one Japanese Aerospace Exploration Agency ("JAXA") official has been quoted as saying that "the [\*243] building of a manned moon base is part of our long-term plan, looking to about 20 years from now." n108 A plan to have a Moon base in place by 2025 was submitted to the Japanese government in 2005. n109 However, funding difficulties may delay or defeat Japanese lunar ambitions. n110 7. Summary **All of the leading world powers, and those states which aspire to enter "great power" status, are interested in theMoon.Given the American rejection of proposed Russian cooperation and the statements by the Indian militarychief of staff, it is clear that the controversial theories about Helium-3 and fusion are leading to a global spacerace, with at least the head of the Chinese lunar program convinced that the first one there will win the prize**. n111 Yet, getting to the Moon is just the first step. As one article has put it, there will be a lunar land grab. n112 With as many as five or six players, **the Moon has the potential to be the battleground for the next "Great Game**." n113 As in any other game, there need to be mutually agreed upon rules that will guide players' conduct. The only problem is that the current body of law that regulates outer space is ill-suited to provide a functional set of rules for the disposition of the Moon, as Part II will demonstrate.

### This is particularly true now---China’s ramping up their lunar development program

Sasha 6-9-Deng Sasha, Editor for xinhuanet news, 6-9-11, “China’s second moon orbiter Chang’e 2 goes to outer space,” <http://news.xinhuanet.com/english2010/china/2011-06/09/c_13920425.htm>

BEIJING, June 9 (Xinhua) -- **China's second moon orbiter Chang'e-2 on Thursday set off from its moon orbit for outer space about 1.5 million km away from the earth**, Chinese scientists said Thursday. The orbiter left its moon orbit at 5:10 p.m. and it will take about 85 days for the orbiter to reach outer space, according to the State Administration of Science,Technology and Industry for National Defence (SASTIND). The orbiter had finished all its tasks within its designed life span of six months by April 1. Scientists decided to let it carry out additional exploratory tasks as the orbiter still had fuel in reserve. Traveling into outer space from the moon's orbit is the most important task among five additional ones, according to the SASTIND. "**It's the first time in the world for a satellite to be set off from the moon in remote outer space," said Zhou Jianliang, deputy chief engineer of the Chang'e-2 measure and control system of the Beijing Aerospace Control Center (BACC).** Moon exploration means about 400,000 km away from the earth, but outer space exploration means 1.5 million km, posing great challenges to the country's technology in measure and control, telecommunications, data transaction and orbit design, scientists said. Before flying away, the orbiter had finished two additional tasks as of May 23. One was to take photos of the northern and southern poles of the moon. The other was to descend again to the perilune orbit, about 15 km away from the surface, to catch high-resolution images of the Sinus Iridum, or Bay of Rainbows, the proposed landing ground for future moon missions. Scientists hope the satellite can continue operations until the end of next year. **"We are developing outer space measure and control stations in outer space and they will be capable to carry out tasks by the end of the second half next year**," said an SASTIND scientist, who declined to be named. At that time, the satellite can be used to test the two stations' functions, the scientist said. Challenges exist as Chang'e-2 was not designed for the additional task and it is now in extended service without extra capacities to deal with abnormal risks, Zhou said. Meanwhile, long-distance brings many problems like weakening signals and difficulties in measure and control, Zhou said. The Chang'e probes are named after a legendary Chinese moon goddess who flew to the moon. **Besides the current operations, China's ambitious three-stage moon mission will include a moon landing and launch of a moon rover around 2012 in the second phase. In the third phase, another rover will land on the moon and return to earth with lunar soil and stone samples for scientific research around 2017.** The country has no plan or timetable for a manned moon landing for now. China launched its first lunar probe, Chang'e-1, in October 2007. **It became the third country after Russia and the United States to send a person into space in 2003**. Two more manned space missions followed with the more recent in 2008 involving the country's first human space walk.

### Even the perception of U.S. losing the moon undermines international leadership

Vorenberg 08-Sue Vorenberg,Reported on new science and technology developments across New Mexico. Covered health issues and breaking news on a variety of topics, “Scientists: U.S. power at stake in space race,” Feb 12, 2008, http://www.santafenewmexican.com/Local%20News/Space-Technology-and-Applications-International-Forum-Scientist

ALBUQUERQUE — The underlying political message of space exploration and development is that our nation is powerful and strong, scientists at a space conference here said Tuesday. Presidential candidates seem focused on using NASA's budget for things other than space exploration, but that would send the wrong message to growing nations like China, said two speakers at the Space Technology and Applications International Forum. The U.S. remains the only country that has landed on the moon. But under NASA's current budget, China is likely to get there before the U.S. returns. "We must beat the People's Republic of China to the moon," said John Brandenburg, a senior propulsion scientist at Orbital Technologies Inc. in Wisconsin and a former scientist at Sandia National Laboratories. "A race to the moon is not a land war in Asia. And a race to the moon is one we can win." Beating China to the moon might actually stop that country from invading Taiwan, he said, because it will make the U.S. look stronger to the international community. "We can't win a land war in Asia," Brandenburg added. And while the idea of increasing NASA's budget might not be popular, using NASA to send that sort of message to other countries is something the current crop of political candidates needs to consider, said Tom Taylor, vice president of Lunar Transportation Systems Inc. in Las Cruces. "I worry about some of the politics we see in this election year, and that politicians are looking at NASA's budget as a way to educate the masses rather than to push forward with space exploration," he said. Deterring wars is often more psychological than reality-based, Brandenburg said, and a U.S. presence on the moon sends a strong signal that our nation is still a technological powerhouse. "Our efforts in space are an indication of our wealth," Brandenburg said. "If we don't progress in space, people see us as a paper tiger. When we're in space, we're seen as a titanium tiger." Skylab's premature descent through the atmosphere in July 1979 might have encouraged Iranian militants in November 1979 to take over the U.S. embassy in Tehran and capture hostages, he said, because it appeared that U.S. power was fading. "If we look weak in space, bad things tend to happen on Earth," Brandenburg said. One of the biggest concerns is that the space shuttle program will stop in 2010, and the U.S. will have no way to get to the international space station — other than hitching a ride with the Russians — for at least four years as the next generation of U.S. space vehicles comes online, he said. If we're not first to go back to the moon, other countries will get there first in the not-so-distant future, perhaps in the next 20 years or so, Taylor said. And those countries could grab up access to helium 3 — a source of clean, powerful fusion energy that could replace the entire power generation structure on Earth. "While it's a little early to speculate, helium 3 is worth about $12 billion per 2,000 pounds — if we could mine it on the moon, it would change our entire nuclear industry," Taylor said. "If other countries get there first, I fear that our nation will drop into some lesser status." From a pure resource perspective, mining helium 3 could turn the U.S. into the top power producer in the world, Brandenburg said. "Once you get helium 3 on the moon, the moon becomes the new Persian Gulf," he said. "It's worth about 5,000 Saudi Arabias." And while in the end, everything comes down to tight budgets in Washington, the two scientists say they still hope politicians will keep the bigger picture in mind and consider the next round of the space race is not something we want to lose. "Resources are always tight in any society," Brandenburg said. "But you have to remember that exploration almost always leads to greater wealth."

### The plan’s vital to every aspect of overall leadership

Schmitt, Daga, and Plesica 09- Harrison H. Schmitt, Andy Daga, Jeff Plescia, Dr. Schmitt was selected as a scientist-astronaut by NASA in June 1965. He was instrumental in providing Apollo flight crews with detailed instruction in lunar navigation, geology, and feature recognition. Dr. Schmitt was appointed NASA Assistant Administrator for Energy Programs in May 1974/Andy Daga has extensive experience in advanced technology R&D in the energy and aerospace sectors/Jeff Plesica is a research scientist at the Jet Propulsion Laboratory -- the home of NASA's robotic missions to Mars. He has an M.S. and Ph. D. in geophysics from the University of Southern California and a B.S. in geology from the University of Miami, Dec. 2009, “Geopolitical Context of Lunar Exploration and Settlement,” http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf)

In spite of the difficulties that have faced Constellation, history tells us that an aggressive program to return Americans to deep space, initially the Moon and then on to Mars, must form an essential component of national policy. The current course of United States in space appears to be to have no national capability to launch its astronauts, at all. Americans would find it unacceptable, as well as devastating to human liberty, if we abandon leadership in deep space to the Chinese, Europe, or any other nation or group of nations. Potentially equally devastating would be loss of access to the energy resources of the Moon as fossil fuels diminish on Earth. In the harsh light of history, it is frightening to contemplate the long-term, totally adverse consequences to the standing of the United States in modern civilization of a decision to abandon deep space. Space does not represent just another large-scale science arena that can be abandoned limited only to the science leadership consequences the United States has suffered in recent decades. What, then, should be the focus of national space policy in order to maintain leadership in deep space? Some propose that we concentrate only on Mars. This would be naïve and self-defeating. The country is simply not technically ready to go to Mars at present, and it will be a long time until we are ready to do so. Returning to the Moon, however, provides the fastest path for humans to go to Mars. Without the experience of returning to the Moon, we will not have the engineering or physiological insight for many decades to either fly to Mars or land there. Without lunar water resources, radiation protection for the long voyage to Mars may not be possible. Without the development of lunar helium-3 fusion technology applied to interplanetary propulsion, we may not be able to reduce the transit time to Mars to an acceptable duration. Without lunar operational experience, including learning to operate outside of communications with Earth, we vastly increase the risk of early Martian flights. Without lunar oxygen and water, Earth launch payloads to Mars may be prohibitively large and expensive, not to mention the continued uncertainties about sustainable resources on Mars. Without lunar rocket fuel resources, that is, hydrogen, oxygen and/or methane, we may not be able to land on Mars because of complicating presence of just some atmosphere and not a lot. Indeed, 4 without returning to the Moon, future opportunities of leadership, including a much greater potential for international cooperation in scientific endeavors related to the Moon and beyond, cannot be realized. Others suggest going to an asteroid. As important to human survival on Earth as asteroid diversion may someday be, just going there is hardly a stimulating policy initiative; and it is a capability that comes automatically with a return to the Moon. Suggestions also have been made for missions to Lagrange points – a mission which has aptly been referred to “as mission to nowhere - except for their potential as a location for observatories. One should note that, between 1968 and 1973 during the Apollo Program, we had the rocket capability necessary to reach a comet or asteroid on an impact trajectory toward Earth, something the Space Shuttle would be incapable of doing. With the Apollo Saturn V, had it been necessary, we could have placed a propulsion source on such a body and altered its path so as to miss the Earth; a much better solution than to just blow it up. Former President George W. Bush began development of a Saturn V-class capability with the Constellation Program's Ares V rocket. The Ares V or an up-rated Saturn V, combined with a helium-3 fusion propulsion system, would be a giant step toward protecting the Earth in the future. Implications Returning to the Moon and to deep space constitutes the right course for the United States. Human exploration of space embodies basic instincts — the exercise of freedom, betterment of one’s conditions, and curiosity about nature. These instincts have been manifested throughout history in desires for new homelands, trade and knowledge. For Americans particularly, such instincts lie at the very core of our unique and special society of immigrants. Over the last 150,000 years or more, human exploration of Earth has yielded new homes, livelihoods, know how and resources as well as improved standards of living and increased family security. In historical times, governments (e.g., Portugal, England, Spain, and the United States) have directly and indirectly played a role in encouraging exploration efforts. Private groups and individuals often have taken additional initiatives to explore newly discovered or newly accessible lands and seas. Based on their specific historical experience, Americans can expect that the benefits sought and won in the past also will flow from their return to the Moon, future exploration of Mars, and the long reach beyond. To realize such benefits, however, Americans must regain its rapidly disappearing leadership role 5 human activities in deep space. With a permanent resumption of the exploration of deep space, one thing is certain: Our efforts will be comparable to those of our ancestors as they migrated out of Africa and into a global habitat. Further, a permanent human presence away from Earth provides another opportunity for the expansion of free institutions, with all their attendant rewards, as humans face new situations and new individual and societal challenges. ConclusionThe competitive international venue remains at the Moon. Returning there now meets the requirements for a U.S. space policy that maintains deep space leadership, as well as providing major new scientific returns and opportunities. Without a lunar focus, the nation’s human space activity will consist of PowerPoint presentations about what might be done and not about what will be done. Properly conceived and implemented, however, returning to the Moon prepares the way for a new generation to go to Mars. The current Constellation Program contains most of the technical elements necessary to implement a policy of deep space leadership, particularly development of a heavy-lift launch vehicle, the Ares V. In addition, Constellation includes a large upper stage for transfer to the Moon and other destinations, two well-conceived spacecraft for transport and landing of crews on the lunar surface (Orion and Altair), strong concepts for exploration and lunar surface systems, and enthusiastic engineers and managers to make it happen if adequately supported. The one major missing component of a coherent and sustaining architecture may be a welldeveloped concept for in-space refueling of spacecraft and upper rocket stages. On the other hand, the experience base for developing in-space refueling capabilities clearly exists based on a variety of past activities, including ISS construction. If we continue to abandon leadership in deep space to other nations or group of nations, particularly a non-democratic regime, the ability for the United States and its allies to protect themselves and liberty for the world will be at great risk and potentially impossible. To others would accrue the benefits — psychological, political, technical, economic and scientific — that the United States harvested as a consequence of Apollo’s success 40 years ago. This lesson has not been lost on our ideological and economic competitors. American leadership absent from space? Is this the future we wish for our progeny?

### **Hegemony solves war—there is no alternative**

Kagan, 07 -senior fellow at the Carnegie Endowment for International Peace (Robert, “End of Dreams, Return of History”, 7/19, http://www.realclearpolitics.com/articles/2007/07/end\_of\_dreams\_return\_of\_histor.html)

This is a good thing, and it should continue to be a primary goal of American foreign policy to perpetuate this relatively benign international configuration of power. The unipolar order with the United States as the predominant power is unavoidably riddled with flaws and contradictions. It inspires fears and jealousies. The United States is not immune to error, like all other nations, and because of its size and importance in the international system those errors are magnified and take on greater significance than the errors of less powerful nations. Compared to the ideal Kantian international order, in which all the world's powers would be peace-loving equals, conducting themselves wisely, prudently, and in strict obeisance to international law, the unipolar system is both dangerous and unjust. Compared to any plausible alternative in the real world, however, it is relatively stable and less likely to produce a major war between great powers. It is also comparatively benevolent, from a liberal perspective, for it is more conducive to the principles of economic and political liberalism that Americans and many others value. American predominance does not stand in the way of progress toward a better world, therefore. It stands in the way of regression toward a more dangerous world. The choice is not between an American-dominated order and a world that looks like the European Union. The future international order will be shaped by those who have the power to shape it. The leaders of a post-American world will not meet in Brussels but in Beijing, Moscow, and Washington. The return of great powers and great games If the world is marked by the persistence of unipolarity, it is nevertheless also being shaped by the reemergence of competitive national ambitions of the kind that have shaped human affairs from time immemorial. During the Cold War, this historical tendency of great powers to jostle with one another for status and influence as well as for wealth and power was largely suppressed by the two superpowers and their rigid bipolar order. Since the end of the Cold War, the United States has not been powerful enough, and probably could never be powerful enough, to suppress by itself the normal ambitions of nations. This does not mean the world has returned to multipolarity, since none of the large powers is in range of competing with the superpower for global influence. Nevertheless, several large powers are now competing for regional predominance, both with the United States and with each other. National ambition drives China's foreign policy today, and although it is tempered by prudence and the desire to appear as unthreatening as possible to the rest of the world, the Chinese are powerfully motivated to return their nation to what they regard as its traditional position as the preeminent power in East Asia. They do not share a European, postmodern view that power is passé; hence their now two-decades-long military buildup and modernization. Like the Americans, they believe power, including military power, is a good thing to have and that it is better to have more of it than less. Perhaps more significant is the Chinese perception, also shared by Americans, that status and honor, and not just wealth and security, are important for a nation. Japan, meanwhile, which in the past could have been counted as an aspiring postmodern power -- with its pacifist constitution and low defense spending -- now appears embarked on a more traditional national course. Partly this is in reaction to the rising power of China and concerns about North Korea 's nuclear weapons. But it is also driven by Japan's own national ambition to be a leader in East Asia or at least not to play second fiddle or "little brother" to China. China and Japan are now in a competitive quest with each trying to augment its own status and power and to prevent the other 's rise to predominance, and this competition has a military and strategic as well as an economic and political component. Their competition is such that a nation like South Korea, with a long unhappy history as a pawn between the two powers, is once again worrying both about a "greater China" and about the return of Japanese nationalism. As Aaron Friedberg commented, the East Asian future looks more like Europe's past than its present. But it also looks like Asia's past. Russian foreign policy, too, looks more like something from the nineteenth century. It is being driven by a typical, and typically Russian, blend of national resentment and ambition. A postmodern Russia simply seeking integration into the new European order, the Russia of Andrei Kozyrev, would not be troubled by the eastward enlargement of the EU and NATO, would not insist on predominant influence over its "near abroad," and would not use its natural resources as means of gaining geopolitical leverage and enhancing Russia 's international status in an attempt to regain the lost glories of the Soviet empire and Peter the Great. But Russia, like China and Japan, is moved by more traditional great-power considerations, including the pursuit of those valuable if intangible national interests: honor and respect. Although Russian leaders complain about threats to their security from NATO and the United States, the Russian sense of insecurity has more to do with resentment and national identity than with plausible external military threats. 16 Russia's complaint today is not with this or that weapons system. It is the entire post-Cold War settlement of the 1990s that Russia resents and wants to revise. But that does not make insecurity less a factor in Russia 's relations with the world; indeed, it makes finding compromise with the Russians all the more difficult. One could add others to this list of great powers with traditional rather than postmodern aspirations. India 's regional ambitions are more muted, or are focused most intently on Pakistan, but it is clearly engaged in competition with China for dominance in the Indian Ocean and sees itself, correctly, as an emerging great power on the world scene. In the Middle East there is Iran, which mingles religious fervor with a historical sense of superiority and leadership in its region. 17 Its nuclear program is as much about the desire for regional hegemony as about defending Iranian territory from attack by the United States. Even the European Union, in its way, expresses a pan-European national ambition to play a significant role in the world, and it has become the vehicle for channeling German, French, and British ambitions in what Europeans regard as a safe supranational direction. Europeans seek honor and respect, too, but of a postmodern variety. The honor they seek is to occupy the moral high ground in the world, to exercise moral authority, to wield political and economic influence as an antidote to militarism, to be the keeper of the global conscience, and to be recognized and admired by others for playing this role. Islam is not a nation, but many Muslims express a kind of religious nationalism, and the leaders of radical Islam, including al Qaeda, do seek to establish a theocratic nation or confederation of nations that would encompass a wide swath of the Middle East and beyond. Like national movements elsewhere, Islamists have a yearning for respect, including self-respect, and a desire for honor. Their national identity has been molded in defiance against stronger and often oppressive outside powers, and also by memories of ancient superiority over those same powers. China had its "century of humiliation." Islamists have more than a century of humiliation to look back on, a humiliation of which Israel has become the living symbol, which is partly why even Muslims who are neither radical nor fundamentalist proffer their sympathy and even their support to violent extremists who can turn the tables on the dominant liberal West, and particularly on a dominant America which implanted and still feeds the Israeli cancer in their midst. Finally, there is the United States itself. As a matter of national policy stretching back across numerous administrations, Democratic and Republican, liberal and conservative, Americans have insisted on preserving regional predominance in East Asia; the Middle East; the Western Hemisphere; until recently, Europe; and now, increasingly, Central Asia. This was its goal after the Second World War, and since the end of the Cold War, beginning with the first Bush administration and continuing through the Clinton years, the United States did not retract but expanded its influence eastward across Europe and into the Middle East, Central Asia, and the Caucasus. Even as it maintains its position as the predominant global power, it is also engaged in hegemonic competitions in these regions with China in East and Central Asia, with Iran in the Middle East and Central Asia, and with Russia in Eastern Europe, Central Asia, and the Caucasus. The United States, too, is more of a traditional than a postmodern power, and though Americans are loath to acknowledge it, they generally prefer their global place as "No. 1" and are equally loath to relinquish it. Once having entered a region, whether for practical or idealistic reasons, they are remarkably slow to withdraw from it until they believe they have substantially transformed it in their own image. They profess indifference to the world and claim they just want to be left alone even as they seek daily to shape the behavior of billions of people around the globe. The jostling for status and influence among these ambitious nations and would-be nations is a second defining feature of the new post-Cold War international system. Nationalism in all its forms is back, if it ever went away, and so is international competition for power, influence, honor, and status. American predominance prevents these rivalries from intensifying -- its regional as well as its global predominance. Were the United States to diminish its influence in the regions where it is currently the strongest power, the other nations would settle disputes as great and lesser powers have done in the past: sometimes through diplomacy and accommodation but often through confrontation and wars of varying scope, intensity, and destructiveness. One novel aspect of such a multipolar world is that most of these powers would possess nuclear weapons. That could make wars between them less likely, or it could simply make them more catastrophic.

It is easy but also dangerous to underestimate the role the United States plays in providing a measure of stability in the world even as it also disrupts stability. For instance, the United States is the dominant naval power everywhere, such that other nations cannot compete with it even in their home waters. They either happily or grudgingly allow the United States Navy to be the guarantor of international waterways and trade routes, of international access to markets and raw materials such as oil. Even when the United States engages in a war, it is able to play its role as guardian of the waterways. In a more genuinely multipolar world, however, it would not. Nations would compete for naval dominance at least in their own regions and possibly beyond. Conflict between nations would involve struggles on the oceans as well as on land. Armed embargos, of the kind used in World War i and other major conflicts, would disrupt trade flows in a way that is now impossible. Such order as exists in the world rests not merely on the goodwill of peoples but on a foundation provided by American power. Even the European Union, that great geopolitical miracle, owes its founding to American power, for without it the European nations after World War ii would never have felt secure enough to reintegrate Germany. Most Europeans recoil at the thought, but even today Europe 's stability depends on the guarantee, however distant and one hopes unnecessary, that the United States could step in to check any dangerous development on the continent. In a genuinely multipolar world, that would not be possible without renewing the danger of world war. People who believe greater equality among nations would be preferable to the present American predominance often succumb to a basic logical fallacy. They believe the order the world enjoys today exists independently of American power. They imagine that in a world where American power was diminished, the aspects of international order that they like would remain in place. But that 's not the way it works. International order does not rest on ideas and institutions. It is shaped by configurations of power. The international order we know today reflects the distribution of power in the world since World War ii, and especially since the end of the Cold War. A different configuration of power, a multipolar world in which the poles were Russia, China, the United States, India, and Europe, would produce its own kind of order, with different rules and norms reflecting the interests of the powerful states that would have a hand in shaping it. Would that international order be an improvement? Perhaps for Beijing and Moscow it would. But it is doubtful that it would suit the tastes of enlightenment liberals in the United States and Europe. The current order, of course, is not only far from perfect but also offers no guarantee against major conflict among the world's great powers. Even under the umbrella of unipolarity, regional conflicts involving the large powers may erupt. War could erupt between China and Taiwan and draw in both the United States and Japan. War could erupt between Russia and Georgia, forcing the United States and its European allies to decide whether to intervene or suffer the consequences of a Russian victory. Conflict between India and Pakistan remains possible, as does conflict between Iran and Israel or other Middle Eastern states. These, too, could draw in other great powers, including the United States. Such conflicts may be unavoidable no matter what policies the United States pursues. But they are more likely to erupt if the United States weakens or withdraws from its positions of regional dominance. This is especially true in East Asia, where most nations agree that a reliable American power has a stabilizing and pacific effect on the region. That is certainly the view of most of China 's neighbors. But even China, which seeks gradually to supplant the United States as the dominant power in the region, faces the dilemma that an American withdrawal could unleash an ambitious, independent, nationalist Japan. In Europe, too, the departure of the United States from the scene -- even if it remained the world's most powerful nation -- could be destabilizing. It could tempt Russia to an even more overbearing and potentially forceful approach to unruly nations on its periphery. Although some realist theorists seem to imagine that the disappearance of the Soviet Union put an end to the possibility of confrontation between Russia and the West, and therefore to the need for a permanent American role in Europe, history suggests that conflicts in Europe involving Russia are possible even without Soviet communism. If the United States withdrew from Europe -- if it adopted what some call a strategy of "offshore balancing" -- this could in time increase the likelihood of conflict involving Russia and its near neighbors, which could in turn draw the United States back in under unfavorable circumstances. It is also optimistic to imagine that a retrenchment of the American position in the Middle East and the assumption of a more passive, "offshore" role would lead to greater stability there. The vital interest the United States has in access to oil and the role it plays in keeping access open to other nations in Europe and Asia make it unlikely that American leaders could or would stand back and hope for the best while the powers in the region battle it out. Nor would a more "even-handed" policy toward Israel, which some see as the magic key to unlocking peace, stability, and comity in the Middle East, obviate the need to come to Israel 's aid if its security became threatened. That commitment, paired with the American commitment to protect strategic oil supplies for most of the world, practically ensures a heavy American military presence in the region, both on the seas and on the ground. The subtraction of American power from any region would not end conflict but would simply change the equation. In the Middle East, competition for influence among powers both inside and outside the region has raged for at least two centuries. The rise of Islamic fundamentalism doesn't change this. It only adds a new and more threatening dimension to the competition, which neither a sudden end to the conflict between Israel and the Palestinians nor an immediate American withdrawal from Iraq would change. The alternative to American predominance in the region is not balance and peace. It is further competition. The region and the states within it remain relatively weak. A diminution of American influence would not be followed by a diminution of other external influences. One could expect deeper involvement by both China and Russia, if only to secure their interests. 18 And one could also expect the more powerful states of the region, particularly Iran, to expand and fill the vacuum. It is doubtful that any American administration would voluntarily take actions that could shift the balance of power in the Middle East further toward Russia, China, or Iran. The world hasn 't changed that much. An American withdrawal from Iraq will not return things to "normal" or to a new kind of stability in the region. It will produce a new instability, one likely to draw the United States back in again. The alternative to American regional predominance in the Middle East and elsewhere is not a new regional stability. In an era of burgeoning nationalism, the future is likely to be one of intensified competition among nations and nationalist movements. Difficult as it may be to extend American predominance into the future, no one should imagine that a reduction of American power or a retraction of American influence and global involvement will provide an easier path.

## 1AC---Solvency

### Solvency:

### The technology needed for lunar mining already exists

Wall 10- Mike Wall, SPACE.com Senior Writer, 30 October 2010, “Want to Mine the Solar System? Start With the Moon,” http://www.space.com/9430-solar-system-start-moon.html

Indeed, some companies are already drawing up plans to mine moon water for this very purpose. Shackleton Energy Company, for example, hopes to be selling rocket fuel in orbit by 2020, according to its founder Bill Stone, who was not a member of the conference panel. Such a timeline may seem ambitious, but the technology to start up a primarily robotic lunar mining operation exists today, panel members said. Mining robots could be controlled from Earth. "We've reached the point of teleoperations now that I think it's feasible to mine the moon," Baiden said. The moon's close proximity to Earth means that communication between man and machine could happen almost in real time — the lag would be just a second or two, Spudis added. Water mining would be the first step, most panelists agreed. After that, other resources may well be exploited, too. Methane and ammonia, which also get trapped in cold craters, could be tapped for their carbon and nitrogen, necessary ingredients for any long-term lunar settlement. And whenever nuclear fusion becomes a viable energy source, entrepreneurs could go after the moon's stores of helium-3, a prime fusion fuel, the scientists said.

### A mining demonstration is necessary to get the private sector on board

Wall 10- Mike Wall, SPACE.com Senior Writer, 30 October 2010, “Want to Mine the Solar System? Start With the Moon,” http://www.space.com/9430-solar-system-start-moon.html

Most panelists agreed that economics will ultimately drive such extractive enterprises. Private industry, rather than government, will be doing most of the heavy lifting. However, government leadership and investment will likely be needed to get these businesses off the ground, several panelists said. Some people in the aerospace industry are skeptical about the feasibility of extraterrestrial mining operations, Spudis said. To get them onboard, government should demonstrate the necessary technologies and know-how. "Let the government lead the way, and let the private sector follow," Spudis said. Government could also prime the pump for private industry, some panelists said, spurring demand for rocket fuel sold from orbiting filling stations. "An appropriate government investment can catalyze it," Greason said. "Government shows the initial demand and the private sector figures out how to provide the supply." The panel agreed about the transformative potential of extraterrestrial resource extraction. Once business gets a foothold in space, and it becomes obvious how much money there is to be made, space will open up to humanity. The sky is no longer the limit. "Once you do that, you have economic escape velocity," Greason said. "If we can get there, the stars are ours."

### A NASA demonstration of lunar mining spurs private investment- the technology to do so exists now

Spudis 10- Paul D. Spudis, a Senior Staff Scientist at the Lunar and Planetary Institute in Houston, Texas, November 6, 2010, “Can NASA Get Its Groove Back?” http://blogs.airspacemag.com/moon/2010/11/can-nasa-get-its-groove-back/

The current administration’s decision to abandon NASA’s mission of resource utilization on the Moon needs to be revisited.The ability of the United States to routinely access cislunar space through the use of the Moon and its resources needs to be well understood and addressed.We cannot afford to remain complacent about the Moon while other countries move forward to reap the rewards of lunar return.The United States needs to make smart investments that will pay long-term dividends.Lunar return is one of those economic and technological investments.The majority of the panel of engineers and scientists invited to speak at the recent Space Manufacturing conference meeting at NASA’s Ames Research Center (sponsored by the Space Studies Institute) held the view that lunar mining was the logical next move and that government needed to “prime the pump” and demonstrate that this was possible before private enterprise would follow.We need private sector money to fully pursue the purpose and realize the potential of space exploration.NASA needs to show that resource utilization is possible on the Moon.Once we understand how to access and develop lunar resources, private enterprise will capitalize on these findings.As the door to a sustainable space faring infrastructure finally swings open, the tyranny of the rocket equation will be broken.It is time for America to find its groove again.It is time to extol the right stuff and pursue goals of national excellence.Setting a goal that may be obtained in 30 years is not a space program.A return to the Moon to learn how to use its resources is achievable using existing technology and within the decade-long timescales demanded by our political process.

### NASA should make near earth asteroid mining a priority by initiating a mining demonstration

Crandall et all 11- William BC Crandall, MBA, Founder of Space Wealth, Larry Gorman, Ph.D, Professor of Finance Cal Poly, San Luis Obispo, Peter Howard, Ph.D, Senior Scientist for Exelixis, 23 February 2011, “Is Profitable Asteroid Mining A Pragmatic Goal?” http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf

Economic resources in space are of three types: Location, energy, and matter. Some near-Earth locations already support profitable industrial engagements. Low-Earth and geosynchronous-Earth orbits host hundreds of revenue-generating satellites (worldwide industry revenues in 2008: >$140 billion).19 Beyond Earth’s atmosphere, solar radiation is abundant; it powers most satellites. Orbiting space-based solar power systems (SBSP) may be able to deliver huge quantities of clean, sustainable energy to Earth.20 But to date, nothing from the vast reaches beyond Earth orbit has ever been involved in an economic exchange. To incrementally expand our current off-planet economy, the next resource is clear: Near-Earth asteroids. To take this next step, we need our space agencies to make asteroid mining a priority, and demonstrate how it can done. Agencies should support SBSP, but it should not be a top priority for two reasons. First, SBSP already attracts interest from commercial firms and defense-related institutions.21 Second, even if SBSP supplied 99% of the world’s electricity, we’re still just in Earth orbit. We haven’t begun to tap the mineral wealth of the inner solar system. We need out space agencies to reach out—with robots, certainly; perhaps with humans— to find, get hold of, and bring back an economically significant chunk of matter, and sell it on the open market. We need them to prime the pump for economically and ecologically sustainable, post-Earth-as-a-closed-system, industrial societies. Our space agencies need to enable a revolutionary transformation in the material culture of our home planet. They need to design and launch positive economic feedback systems that utilize off-planet resources. Space agencies need to develop the skills and knowledge required to draw material resources through extraterrestrial supply chains, and put them to use in terrestrial systems of production. Once learned, space agencies need to transfer these skills and understandings to individuals in industry. Civil space agencies also need to help design, publish, and promote the inner-solar-system knowledgebases that will prepare today’s students for profitable extraterrestrial careers.22 We need our civil space agencies to do these things, because we need the metals that are available in asteroid ore to support our technological societies on Earth, so that they may become ecologically sustainable over the decades and centuries to come.

# \*\*\*Solvency---Tech/Feasibility\*\*\*

## Solvency---Asteroid Mining

Asteroid mining tech’s viable now---massive financial returns trigger innovation and mining solves resource wars

Big Think – 11, Big Think.com, network of 2,000 Big Think fellows and guest speakers, who comprise the top thinkers and doers from around the globe, 5/5/11, “The First Trillionares Will Make Their Fortunes in Space” http://bigthink.com/ideas/38186

Just as explorers during the [Age of Discovery](http://en.wikipedia.org/wiki/Age_of_Discovery) established new trade routes in pursuit of resources such as gold, silver and spices, the future explorers of space will be chasing unimaginable riches. As Peter Diamandis told the [International Space Development Conference](http://isdc.nss.org/), “There are twenty-trillion-dollar checksup there, waiting to be cashed!” These cosmic cash cows are so-called [Near-Earth asteroids](http://en.wikipedia.org/wiki/Near-Earth_object#Near-Earth_asteroids) that contain a wide range of precious resources. Sure, this may sound a lot like the movie [Avatar](http://www.imdb.com/title/tt0499549/), in which the RDA Corporation mined the mineral [unobtanium](http://en.wikipedia.org/wiki/Unobtainium) on the planet of Pandora. But this is no pie-in-the-sky idea. Twenty trillion USD is the estimated market value of a relatively small metallic asteroid that was first calculated by [John S. Lewis](http://www.lpl.arizona.edu/Support/faculty/faculty.php?nom=Lewis) in his book [Mining The Sky: Untold Riches from the Asteroids, Comets, and Planets](http://www.amazon.com/Mining-Sky-Untold-Asteroids-Planets/dp/0201328194). Lewis argued that "using presently available or readily foreseeable technologies, we can relieve Earth of its energy problem, make astronomical amounts of raw materials available, and raise the living standard of people worldwide." [Peter Diamandis](http://bigthink.com/peterdiamandis), who founded the non-profit [X Prize Foundation](http://www.xprize.org/) to create a rewards incentive program to bring about "radical breakthroughs for the benefit of humanity," believes the enormous financial opportunities in space will spur innovation. He notes that everything we hold of value, "the things we fight wars over," such as metals, minerals and real estate, exist "in infinite quantities in space."

### The resources available on Near Earth Asteroids are infinite, and easy to mine

Sonter, February 9, 2006 “Asteroid Mining: Key to the Space Economy” (Mark, B.Sc, Dip.Ed (UNSW), Physics & Geology, M.App.Sc (Medical Physics), Queensland Institute of Technology, 1979) <http://www.space.com/2032-asteroid-mining-key-space-economy.html>

Professor John Lewis has pointed out (in Mining the Sky) that the resources of the solar system (the most accessible of which being those in the [Near Earth Asteroids]) can permanently support in first-world comfort some quadrillion people.  In other words, the resources of the solar system are essentially infinite... And they are there for us to use, to invest consciousness into the universe, no less.  It's time for humankind to come out of its shell, and begin to grow!!

So both for species protection and for the expansion of humanity into the solar system, we need to characterize these objects and learn how to mine and manage them. Once we learn how to work on, handle, and modify the orbits of small near-earth objects, we will have achieved, as a species, both the capability to access the vast resources of the asteroids, and also the capability to protect our planet from identified collision threats.Since the competing source of raw materials is "delivery by launch from Earth," which imposes a launch cost per kilogram presently above $10,000 per kg, this same figure represents the upper bound of what recovered asteroidal material would be presently worth in low earth orbit.

### Mining Asteroids is economically feasible, and is most likely to garner government support for funding and implementation

Hickman – 99, John Hickman, Ph. D.Associate Professor of GovernmentDepartment of Government and International Relations Berry College, November 1999, “The Political Economy of Very Large Space Projects” http://www.jetpress.org/volume4/space.pdf

Mining also serves as the primary economic rationale in Donald Cox and James Chestik’s (1996: 138−146,211−272) proposal to colonize the asteroids.Planetary defense against asteroids and comets which mightstrike the Earth, transportation facilities intermediate between Earth and Mars, research facilities, and tourismand retirement homes all provide additional reasons for making asteroids the first focus for human expansion into space.Although Cox and Chestik offer little detail about financing their proposal, this may be excused because the probable incremental nature of exploiting the asteroids is likely to mean that attracting capital should be comparatively less difficult than for other very large space development projects.Each asteroid mining venture might be financed separately and the total capital necessary for mining the asteroids could be raised over time and in smaller amounts.Robotic mining of asteroids passing near the Earth might be within the technological and economic reach of private firms and government space agenciesin the next century.Subsequent robotic mining ventures of bodies farther from the Earth might build on that initial experience.Yet rather than open a new frontier for human settlement, such incremental economic development via roboticmining might foreclose it.Private investors and government space agencies might be content to limit spacedevelopment to those ventures which yield economic returns in the short term.Given better returns oninvestments on Earth and demands for government spending for public services, the occasional robotic mining ventures on near Earth asteroids might be the most ambitious space development project ever undertaken.Itis difficult to see why such investments would generate other economic activity in space.Part of the problemis that robots might be too cost−effective.

### Beginning asteroid mining’s easier and more profitable than mining the moon

Lewis And Lewis 5 – John S. Lewis, Professor of Planetary Science and Co-Director, Space Engineering Research Center, University of Arizona. Ph. D. in Chemistry and Cosmochemistry, University of California, San Diego, Christopher F. Lewis, J.D. J. Reuben Clark Law School, Brigham Young University, 2005, “A PROPOSED INTERNATIONAL LEGAL REGIME FOR THE ERA OF PRIVATE COMMERCIAL UTILIZATION OF SPACE,” 37 George Washington University International Review 745, Lexis: pg.

B. Asteroid Resources

Approximately 1,400 NEAs with diameters greater than one kilometer (and a million with diameters greater than 100 meters) are presently in orbits that cross or graze Earth's orbit around the Sun. About 20 percent of these are energetically easier to reach and land on than the Moon. Some of these asteroids are extinct comet nuclei with water contents ranging up to about 50 percent; some are huge crystals of iron-nickel alloy; others belong to well over a dozen different composition classes. The NEA Amun, about two kilometers in diameter, contains far more metal than the total amount used by the human race since the beginning of the Bronze Age. Its Earth-surface market value is tens of trillions of dollars, larger than the annual gross global product of Earth.

Many NEAs can return materials to Earth at a much lower energy cost than that of returning a similar mass to Earth from the Moon. In extreme cases, the energy advantage of asteroid material return relative to lunar return reaches 2500:1.>

## Solvency---Lunar Mining

### Lunar prospecting can begin now

Taylor and Martel 03- G. Jeffrey Taylor, Ph. D in geology from Rice University and Director of the Hawai`i Space Grant Consortium, Linda M. V. Martel, instructor for Hawai ‘i Institute of Geophysics and Phetology, 2003, Adv. Space Res. Vol. 31, No. 11, pp. 2403-2412

Abundant data . Lunar prospecting can begin immediately. We have a wealth of data from previous missions (Table 3) that can be used to identify targets for future detailed exploration. The Lunar Orbiter missions (numbered I through V) acquired a global data set of black and white photographs of the lunar surface. Spatial resolution varies, but these images are extremely valuable for geologic studies and for providing geologic context for other data. The Apollo missions returned a total of 382 kg of lunar samples from six places, and the Luna missions returned smaller (but still invaluable) amounts of sample from three locations. These materials have allowed us to make quantitative assessments of potential resources (Table 2) and provide ground truth for remote sensing measurements. We have also received additional lunar samples at no cost: lunar meteorites. Although we do not know where on the Moon they came from, these samples provide additional data on rock types and elemental abundances on the Moon.

### Lunar mining’s viable, profitable, and triggers countless spinoff benefits

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 22

Section 8. ConclusionThe Moon’s importance in both past and future human development is vital and will continue to be so. Since ancient cultures viewed its pale sphere, it has captured the minds of countless generations, and will continue to do so. Its location and properties are an ideal testing space to adapt human technologies toward the rigors of further space exploration. Utilizing the resources available on the Moon, new physical and technological frontiers can be established including but not limited to fusion power, Space solar power, and lunar propellants. History has shown that it is possible to accomplish great things, such as the Apollo landings, in a relativelyshort time given the incentive. The challenges of the 21stcentury deserve a 21stcentury solution. With climbing energy demands across the globe, we must look to new sources of energy outside the norm in order to fulfill this growing demand. Likewise, the need for new sources of raw materials will be a growing endeavor throughout the next century. Because of this, a local source of these materials, the Moon, is vital to our future needs. To allow these needs to be met, government has to provide an appropriate environment which allows for development and utilization of lunar resources, something that is vague at best today. This development must have both a robotic and a human element in order to be successful. Through the utilization of lunar materials, a self-sustaining lunar base is feasible, and will eventually be developed. With a lunar base, lunar materials can be mined, processed, and manufactured into utilizable exports,enhancing the vitality of a cislunar economy. Also, new research into the leading edges of certain branches of sciences will occur with the development of the Moon, enhancing humanities 24scientific knowhow. Although there are many difficulties associated with the financial and technological aspect of lunar development, they are problems that can be resolved.The 21stcentury will likely see more resource difficulties than in the past. It will be vital for humanity to be able to access a greater quantity of recourses. The Moon provides an excellent opportunity to provide a great deal of these resources, further research, and increase cislunar manufacturing capabilities. It will be vital to tap the energies of the free market in order to maximize these operations. Despite its difficulties, the Moon is the first stepping stone towards the future development of humanity. As mentioned in Appendix 1, the cost of the Columbus voyage today was over 60 million dollars. If the Apollo program was the Moon‟s version of the Columbus voyages, we must now undertake on the “Jamestown expedition” to develop the Moon. As seen with the new world today, such developments are well worth their initial costs. With knowledge gained from the development of the Moon, humanity can count on an increase in the access to space, increased high-tech spinoffs, and an improved life on Earth. In conclusion, humanity progress towards the future only limited by what we limit ourselves too. We cannot allow ourselves to fall back to an agrarian state because of a lack of ingenuity; we must take steps to further humanities development, and today that step is the exploration and development of the Moon and its resources.

### Permanent lunar bases to process resources are feasible and profitable

Chester 99 – Rodney Chester, Courier Mail Correspondent, July 3, 1999, “Can We Mine The Moon?,” Courier Mail, News Section, Lexis: pg. 6

<We changed the potential course of human civilization, if not of human evolution, by breaking the psychological and technological barriers that have, up until then, held us to Earth. For 27 years, Harrison "Jack" Schmitt has been known as the only scientist to have gone to the Moon and the last man to step on to the lunar surface. And they are both titles he is happy to lose should his call for man to return to the Moon and stay there for good be heeded. Schmitt was the lunar module pilot for the 1972 Apollo 17 mission, which became the last step in one of the greatest displays of both technology and the human desire for exploration. Schmitt, who turns 64 today, is surprised that no one has gone to the Moon since he left 27 years ago. "When we went to the Moon in 1972 we knew that it was the last of the Apollo series to the Moon," he says. "But I think that it's safe to say that we would not have predicted it would be more than 25 years before anyone went back." During that time, the American government has lost not the technology but the preparedness to send people to the Moon. Schmitt believes the only way man can return to the Moon is through a commercial operation seeking to turn a lunar mission into profit. With a commercial incentive to send man back to the Moon, "certainly within 10 years we could be back on the Moon". And that incentive is already there, in the form of a light isotope of helium that is present in the Moon's soil. As a scientist, Schmitt does not make assumptions. He does not agree with some colleagues who say the recent discovery of high levels of hydrogen at the Moon's poles is proof of water. He says it is just proof of hydrogen. Likewise, he does not accept there is proof that fossil fuels have caused a global climate change. "Nevertheless, it is not prudent to continually depend on fossil fuels for the rapidly accelerating demand for energy that will occur in the next century," he says. "If for no other reason than they are going to be more valuable to future generations as chemicals than they are as fuels to us. "Human beings on Earth are going to need vastly increased amounts of energy in the next century than we have immediate access to today. "The Moon is sitting there offering us a quite reasonable solution if we decide to go out there and get it." Schmitt says for 4 billion years, the Moon has been turning solar winds into a light isotope of helium (Helium 3), which is an environmentally benign fuel for fusion power. He says to process that helium would be a simple matter of building a unit on the Moon capable of heating lunar soil to about 700 degrees, using the energy of solar power. The soil would then release hydrogen, which could be converted into water or rocket fuel, and this light isotope of helium. The irony of the situation is that the Apollo mission, which had the scientific goal of determining the origin of the Moon, did not realize the value of the dusty, lunar surface. "We didn't know, comprehend at all, that this was a potential resource for us until about 1985 when some engineering physicists, having become frustrated with the fuels currently available for nuclear fusion, suddenly discovered we had found this element in the lunar soil," Schmitt says. "It was just a different group of people looking at the same data and coming to a different conclusion. "That's a characteristic of science. You often don't know the value of your exploration for many, many years afterwards." Having processed the soil at a lunar base, it would then be a matter of bringing the liquid helium back to Earth. About 100kg would supply a large power plant for a year and about 3 tons would supply America with its entire electricity needs for a year. While the Apollo program achieved its public goal of taking man to the Moon, Schmitt says it has not resolved its science objectives. "We have a first-order understanding about the Moon but we are still in an intense debate about its origin, about all of the messages it may be sending us about the early history of the Earth, and about issues such as the resources that may be," he says. "There is a great deal more science that could be done." Many people now believe the Moon was the result of a planet colliding with the Earth in the early days of the solar system, which caused an ejection of dust that collated into the Moon. But, Schmitt says, some of the evidence does not support the theory. He believes the Moon evolved independently of the Earth in roughly the same part of the solar system, and was then captured in the Earth's orbit. ALONG with supplying a future energy source, a permanent lunar base could be the launching pad for the next great conquest of space. Schmitt says a lunar base providing the Earth with an energy source "is an absolute necessity before we will have the economic and technical capabilities to go on to Mars". "I think we definitely should have Mars as a long-term objective but I do not think we will get there until we have gone to the Moon and made a permanent base," he says. Assessing the worth of the Apollo project, Schmitt points to the diverse range of social, scientific and technological spin-offs that were a result. "We changed the potential course of human civilization, if not of human evolution, by breaking the psychological and technological barriers that have, up until then, held us to Earth," he says. "The opportunity is now before us to establish human enclaves at least on the Moon and Mars during the next century." Until man travelled into space, the world had never seen the now familiar images of the blue globe floating in the vast, black darkness. And, Schmitt believes, being able to view the Earth as a whole for the first time accelerated the modern concern about the future of the planet's environment. Travelling to the Moon also gives humans another advantage over the previous residents of this third rock from the Sun. When an asteroid collided with the Earth 65 million years ago, dinosaurs became extinct. "We now have, particularly if we do what I suggested in going back to the Moon, the technology and also the capability to intercept such an object once it was clear that it might hit the Earth. "So we can protect ourselves and the Earth from such an event. The dinosaurs couldn't, we can. "We are not taking any steps in particular to do that but that is within our reach." But as this science pioneer continues to spread the message of the golden age of the NASA space program, he points to future opportunities rather than the past as the highlight of the Apollo program: "Ultimately, this discovery of an energy source will outweigh almost anything else that has happened.">

### Space Mining Good – Resources derived from nearby locations, even when found on Earth, are significantly cheaper to harvest in space. The economic lure is compounded by easy access, resource richness and extractability, and short mission flight times.

Lewis And Lewis 5 – John S. Lewis, Professor of Planetary Science and Co-Director, Space Engineering Research Center, University of Arizona. Ph. D. in Chemistry and Cosmochemistry, University of California, San Diego, Christopher F. Lewis, J.D. J. Reuben Clark Law School, Brigham Young University, 2005, “A PROPOSED INTERNATIONAL LEGAL REGIME FOR THE ERA OF PRIVATE COMMERCIAL UTILIZATION OF SPACE,” 37 George Washington University International Review 745, Lexis: pg.

<II. A Brief Introduction to Space Resources n6

Resources derived from nearby locations in space are of value because they make vast quantities of intrinsically cheap materials, such as water, metals, and propellants, available for use in future large-scale space operations without the enormous expense of lifting them out of Earth's deep gravity well. The ability to operate independent of resupply from Earth also makes possible the retrieval and importation of high-value materials to Earth.

Among the most attractive resources for exploitation and use in space are water for production of hydrogen-oxygen propellants, ferrous metals for use in building space structures, and bulk radiation shielding for the protection of explorers and colonists. Some space resources, such as scientific samples or precious and strategic [\*747] metals, have a high enough unit value to allow profitable importation to Earth. Delivery of beamed solar energy or fusion reactor fuels such as helium-3 and deuterium to Earth-surface markets may ultimately dominate space commerce. The economic attractiveness of these various commodities is compounded by several factors, including: (1) ease of access to the resources from Earth in terms of energy needed per kilogram or propulsive velocity requirements; (2) resource richness (concentration) and extractability; (3) ease of transportation from the proposed mine site to the intended place of utilization; and (4) mission flight times, which impact venture capital decisions based on the time cost of money. The various proposed sources of extractable resources, including the Moon, NEAs, the Martian moons Phobos and Deimos, the asteroid belt, and the giant planets, are by no means similar in any of these respects.>

### Lunar Mining Good – There are several plausible lunar resources for exploitation: water-ice, oxygen and hydrogen deposits, and helium-3. All of these resources will be key in future space exploration by providing energy sources, fuel propellants, and life-support materials.

Lewis And Lewis 5 – John S. Lewis, Professor of Planetary Science and Co-Director, Space Engineering Research Center, University of Arizona. Ph. D. in Chemistry and Cosmochemistry, University of California, San Diego, Christopher F. Lewis, J.D. J. Reuben Clark Law School, Brigham Young University, 2005, “A PROPOSED INTERNATIONAL LEGAL REGIME FOR THE ERA OF PRIVATE COMMERCIAL UTILIZATION OF SPACE,” 37 George Washington University International Review 745, Lexis: pg.

<A. Lunar Resources

The current plans for the Space Exploration Initiative envision an early return to the Moon as a precursor to human exploration of Mars. The Moon presents a challenging environment for resource extraction because the surface is similar in composition to the slag discarded in metallurgical operations on Earth. Furthermore, the gravity well of the Moon is deep enough to require substantial masses of propellant for safe landing and departure. Nonetheless, using extraction processes suited to local conditions and materials, and in situ propellant production on the Moon, there exist several plausible targets for exploitation.

First, there is evidence from Earth-based radar studies and spacecraft observations that an accumulation of considerable amounts of water-ice in permanently shadowed crater bottoms exists near both lunar poles. This water, condensed from vapor liberated by impacting comets and water-bearing asteroids, is not native to the Moon. The concentration and the horizontal and vertical distribution of ice in the shadowed regions, are not well known. Precursor unmanned missions to assess the ice are urgently required. It is possible that the concentration of water-ice is so low that economical extraction is out of the question. If precursor missions find abundant and accessible ice, however, this water could be of enormous economic importance in the exploration of the Moon, providing both propellants for rocket engines and life-support materials (such as water and oxygen) for visiting astronauts.

 [\*748] Second, manned outposts anywhere on the Moon would require shielding against cosmic radiation and micrometeoroid impacts. Burying habitation modules under a meter or two of unprocessed lunar regolith (impact-shattered surface layer) can meet this need.

Third, both oxygen and hydrogen are present in the dry lunar regolith at all latitudes. Oxygen bound up in iron oxide minerals such as ilmenite (FeTiO<3>) or olivine ((Fe,Mg)<2>SiO<4>) can be extracted as water vapor by heating these minerals with hydrogen brought from Earth. The water vapor produced by this reaction is condensed and electrolyzed into hydrogen, recycled, and the oxygen is liquefied. These elements can then be used for life support or as a rocket propellant. The highest concentrations of FeO and, hence, extractable oxygen, are found in the circular mare basins on the near side of the Moon. The yield of extractable oxygen in these basins can approach 2 percent of the mass of regolith.

Hydrogen, implanted into regolith grains by the solar wind, is present in much lower concentrations, rarely reaching 50 parts per million (0.005 %). Accordingly, economically important amounts of hydrogen can only be extracted by heating huge masses of regolith (20,000 tonnes of regolith to produce a single tonne of hydrogen).

Fourth, some suggest that the Moon could be a source of the light helium isotope helium-3, which is an attractive candidate as a fuel (along with deuterium) in fusion power reactors. The same solar wind irradiation that implants hydrogen into the regolith also implants solar helium, which contains a small trace of the desired helium-3 isotope. Recovering a single tonne of helium-3 requires perfect extraction and recovery of all the gas from 100 million tonnes of regolith, a seemingly implausible amount. Nonetheless, the energy content of the recovered helium-3 is so large that the process may still make economic sense. The lunar regolith apparently contains enough helium-3 to power Earth's industries for several centuries, comparable to the known coal reserves on Earth.

Finally, Professor David R. Criswell of the University of Houston proposes constructing large solar-cell arrays on the surface of the Moon, made from indigenous lunar materials, to collect solar power and convert it into electricity to be beamed down to receivers on Earth as microwave energy. n7>

### Space Mining Good – Firms, nations, and the international community as a whole have reason to invest in space resources because of large returns on investment and the potential to provide an innovative solution to current energy needs.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg.

<A. Why Mine Outer Space?

Discussions surrounding the topic of space mining inevitably lead to one basic question: why would a firm, nation, or the international community as a whole want to invest the immense resources needed to mine outer space? There are at least two answers to that question. First, mining outer space has the strong potential to yield large returns on investment. These returns take the form of revenue generated from selling the commodities derived from mining n149 as well as from advances in science and technology and the creation of new jobs. n150 The latter returns are what economists commonly call "positive externalities." Second, mining outer space has the strong potential to provide innovative solutions to the international community's current energy needs. n151>

### Space Mining Good – Firms and nations will mine in space if profits are available. Trading space commodities will generate human capital and infrastructure needed for space exploration, colonization, and improved technology.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg.

<1. Outer Space's Potential to Yield Large Returns on Investment

Firms and nations will not mine outer space unless they believe that their activities will yield profits. n152 Many gases and minerals that exist in outer space (e.g., hydrogen, magnesium, and silicon) also exist on Earth. n153The limited introduction of another source for commodities that exist in current markets would be beneficial to the market and the firm or nation supplying the commodity. However, introducing another source for these commodities too quickly would flood the supply and cause a steep drop in price. n154 The drop in price would cause the return to be significantly smaller than the investment. Rational producers would theoretically work to ensure the introduction occurs at an appropriate pace to preserve the market. In fact, production will likely not begin until the market is ready for introduction of space commodities and firms begin to act accordingly. n155 [\*505] Earth's resources are finite. Mining outer space provides an alternative source of resources that will slow the depletion of resources on Earth.

Aside from the revenue that trading outer space commodities will generate, the second, and perhaps greater, return on investment is the positive externalities associated with the human capital needed to develop outer space mining programs. Outer space exploration in general and mining in particular will require technology that has not yet been invented and the modernizing of lessons and technology learned from past space exploration. n156 Vast public and private resources will be needed to educate a new generation of scientists and engineers. n157 The most direct results will be experienced in the ailing aerospace industry, n158 but ultimately, industries far removed from outer space mining will benefit from the sharp increase in the number of jobs that are geared toward innovation.n159 The Apollo program's investment in American industry yielded similar results. n160Sectors ranging from healthcare to consumer electronics all received an economic boost from the billions of dollars spent in the quest to send the first humans to the Moon. n161>

### **Easy to get to moon**

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

The Moon is easily reachable, requiring the same energy needed to reach GEO; typical travel times to and from the Moon are between 3 to 5 days. It is an airless, silent world that nonethelesscontains usable resources of material and energy to enablespace travel and habitation. The Moon rotates slowly once every 28 days, thus having a day-night cycle of 14 days. Such a lengthy day-time enables us to collect solar energy for an uninterrupted block of time, potentially enabling the production of energy on the surface of the Moon to export to the Earth. An array of solar collectors on the Moon, positioned on opposite hemispheres, could provide enough energy to address a significant fraction ofthe world’s needs. The key to making such a system work is fabricating solar arrays and their supporting hardware directly from lunar materials. This circumvents the show-stopping feature of traditional space Solar Power System (SPS) satellites—the high cost of launching multiple square kilometers of arrays into Earth orbit. To avoid this cost, we will use material that is already on the Moon.

### Solvency-Mining moon is key to exploration of space

Coldman 07-Stefano Coldman, Reporting on NASA programs, shuttle missions, scientific satellites launches.
Worked as a consultant for the European and Italian Space agencies and Italian industry, Dec. 07, “Mining the Moon,” http://www.popularmechanics.com/science/space/moon-mars/1283056

Perhaps the most daunting challenge to mining the moon is designing the spacecraft to carry the hardware and crew to the lunar surface. The Apollo Saturn V spacecraft remains the benchmark for a reliable, heavy-lift moon rocket. Capable of lifting 50 tons to the moon, Saturn V's remain the largest spacecraft ever used. In the 40 years since the spacecraft's development, vast improvements in spacecraft technology have occurred. For an investment of about $5 billion it should be possible to develop a modernized Saturn capable of delivering 100-ton payloads to the lunar surface for less than $1500 per pound.

Returning to the moon would be a worthwhile pursuit even if obtaining helium-3 were the only goal. But over time the pioneering venture would pay more valuable dividends. Settlements established for helium-3 mining would branch out into other activities that support space exploration. Even with the next generation of Saturns, it will not be economical to lift the massive quantities of oxygen, water and structural materials needed to create permanent human settlements in space. We must acquire the technical skills to extract these vital materials from locally available resources. Mining the moon for helium-3 would offer a unique opportunity to acquire those resources as byproducts. Other opportunities might be possible through the sale of low-cost access to space. These additional, launch-related businesses will include providing services for government-funded lunar and planetary exploration, astronomical observatories, national defense, and long-term, on-call protection from the impacts of asteroids and comets. Space and lunar tourism also will be enabled by the existence of low-cost, highly reliable rockets.

With such tremendous business potential, the entrepreneurial private sector should support a return to the moon, this time to stay. For an investment of less than $15 billion--about the same as was required for the 1970s Trans Alaska Pipeline--private enterprise could make permanent habitation on the moon the next chapter in human history.

### Lunar Resource Regime Solvency – The significant political conflict of the twenty-first century will be over the control of non-renewable resources and the Moon represents a potential solution to this impending energy crisis and will be an important region in the coming future.

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg.229-230

<TEXT:

 [\*229]

The dominant political conflict of the twenty-first century will likely be over control of non-renewable resources. n1 Recently, a wealth of literature has appeared alleging that the world's resource-rich states have been overstating their oil and non-energy mineral reserves. n2Those reserves that have been properly catalogued are also being rapidly depleted. n3This depletion will not only have catastrophic effects on local economies, but it will also lead to an increase in global violence and neo-imperialism in lesser developed but resource-rich states. n4

In preparation for the inevitable worsening scarcity of available energy resources, states and non-governmental organizations are researching and investing in alternative fuel sources. n5 While experts debate the merits of [\*230] "green" energies that seek to harness natural forces (like wind, geothermal, hydroelectric, and solar power), many developed states are beginning to look toward another part of nature as a potential solution to the impending energy crisis - the Moon.

This Comment will do four things. First, it will show that the Moon is and will increasingly be an important area of international law, especially given current plans by six different state actors to travel to and occupy the Moon within the next thirty years.Second, it will discuss the current state of lunar law, pointing out both textual deficiencies in the current agreements defining and governing the Moon as an international common space and observing overarching policy concerns which should compel governments to desire a new, functional, legal system for the Moon. Third, it will survey theoretical and actual approaches to resource management, noting the successes and failures of each approach. Fourth, it will conclude by providing recommendations, based on the analysis in the third Part, for the contents of a new lunar proprietary regime.>

### General Solvency – Resources derived from nearby locations, even when found on Earth, are significantly cheaper to harvest in space. The economic lure is compounded by easy access, resource richness and extractability, and short mission flight times.

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<II. A Brief Introduction to Space Resources n6

Resources derived from nearby locations in space are of value because they make vast quantities of intrinsically cheap materials, such as water, metals, and propellants, available for use in future large-scale space operations without the enormous expense of lifting them out of Earth's deep gravity well. The ability to operate independent of resupply from Earth also makes possible the retrieval and importation of high-value materials to Earth.

Among the most attractive resources for exploitation and use in space are water for production of hydrogen-oxygen propellants, ferrous metals for use in building space structures, and bulk radiation shielding for the protection of explorers and colonists. Some space resources, such as scientific samples or precious and strategic [\*747] metals, have a high enough unit value to allow profitable importation to Earth. Delivery of beamed solar energy or fusion reactor fuels such as helium-3 and deuterium to Earth-surface markets may ultimately dominate space commerce. The economic attractiveness of these various commodities is compounded by several factors, including: (1) ease of access to the resources from Earth in terms of energy needed per kilogram or propulsive velocity requirements; (2) resource richness (concentration) and extractability; (3) ease of transportation from the proposed mine site to the intended place of utilization; and (4) mission flight times, which impact venture capital decisions based on the time cost of money. The various proposed sources of extractable resources, including the Moon, NEAs, the Martian moons Phobos and Deimos, the asteroid belt, and the giant planets, are by no means similar in any of these respects.>

### General Solvency – Firms and nations will mine in space if profits are available. Trading space commodities will generate human capital and infrastructure needed for space exploration, colonization, and improved technology.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg.

<1. Outer Space's Potential to Yield Large Returns on Investment

Firms and nations will not mine outer space unless they believe that their activities will yield profits. n152 Many gases and minerals that exist in outer space (e.g., hydrogen, magnesium, and silicon) also exist on Earth. n153The limited introduction of another source for commodities that exist in current markets would be beneficial to the market and the firm or nation supplying the commodity. However, introducing another source for these commodities too quickly would flood the supply and cause a steep drop in price. n154 The drop in price would cause the return to be significantly smaller than the investment. Rational producers would theoretically work to ensure the introduction occurs at an appropriate pace to preserve the market. In fact, production will likely not begin until the market is ready for introduction of space commodities and firms begin to act accordingly. n155 [\*505] Earth's resources are finite. Mining outer space provides an alternative source of resources that will slow the depletion of resources on Earth.

Aside from the revenue that trading outer space commodities will generate, the second, and perhaps greater, return on investment is the positive externalities associated with the human capital needed to develop outer space mining programs. Outer space exploration in general and mining in particular will require technology that has not yet been invented and the modernizing of lessons and technology learned from past space exploration. n156 Vast public and private resources will be needed to educate a new generation of scientists and engineers. n157 The most direct results will be experienced in the ailing aerospace industry, n158 but ultimately, industries far removed from outer space mining will benefit from the sharp increase in the number of jobs that are geared toward innovation.n159 The Apollo program's investment in American industry yielded similar results. n160Sectors ranging from healthcare to consumer electronics all received an economic boost from the billions of dollars spent in the quest to send the first humans to the Moon. n161>

## Solvency---Robotic Mining

### Mining in Space is only possible with robotic technology, which is advancing every 18 months, and which is exponentially cheaper than human deployments (super long pdf)

Hickman – 99, John Hickman, Ph. D.Associate Professor of GovernmentDepartment of Government and International Relations Berry College, November 1999, “The Political Economy of Very Large Space Projects” http://www.jetpress.org/volume4/space.pdf

After several decades of experience with lunar and planetary exploration, it is reasonable to project that using robots in space will be more cost effective than using people in space for the same tasks.The relative cost effectiveness of using robots over humans in space is a function of the accelerating speed of machine computation, now commonly believed to double every 18 to 24 months, and the lower costs of protecting and maintaining machinery over living flesh in space.Robots will grow ever more competent in performing complex tasks while humans will continue to need lots of expensive protection in space.Work requiringhigher level decision−making is likely to performed via remote tele−operation by humans on Earth.Ifmining or other tasks in space can be undertaken by cost effective robots, why would rational decision makersin private firms or space agency use cost ineffective humans in space?The development problem here is thatsending robots rather than humans into space would mean a smaller human workforce in space.A frontierin space “settled” solely or primarily by robots is clearly very far from what most space developmententhusiasts envision.Their intuition is that the successful development of space requires that large numbersof humans work and live in space.That intuition is supported by something we know about pioneers.Theydevelop economic, political, emotional, and philosophical interests which are different from the interests ofthe people in their place of origin.A new frontier may produce economic opportunities, demands forself−government, emotional attachment to place, and philosophical belief in the moral value of pioneering asa way of life.People working and living in permanent space settlements are likely to develop reasons forcapital investment in space development which have little to do with the profit maximizing decision makingof capital lenders and investors on Earth.

### Robotic Exploration Good – Many sources of initial return on investment for lunar robotic missions exist including media rights, product advertising, and sample return which will catalyze private investment in early lunar exploration.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 7-8

<Section 4. Near Term Utilization and Development of the MoonThe following steps comprise a potential path to the future utilization of the Moon with a focus on economic justification leading to a permanent lunar presence. The focus of this section is on private investment and development of the Moon. Government involvement will be undoubtedly important initially but as has been seen in the past there are very few cases of sustained government funding for such a massive and ambitious program. As seen with the International space station, programs that are not funded appropriately do not accomplish their set goals and are scaled back to match available funding (Wilson). This negates the benefits of the program and ends up being costly for associated programs in the long run. Robotic Return The next step in lunar development will be taken not by a human, but by robotic explorers. Robots will precede humans for many reasons, most notably because it is far less expensive to send a robot to the surface of the Moon and leave it there than it is to send humans 8to the surface of the Moon and bring them home. While there is much debate on the merits of Human vs. Robot missions, the ability of robots to be left on the surface after their missionlowers the mission‟s energy costs substantially (Aeronautics). These explorers will be very important in the early stages of this goal. Funding sources for these early missions will be critical. Possible sources of funding include carrying scientific payloads for customers. These payloads could be funded by research institutions, government agencies, or private companies. Lunar research, which will be covered in more depth later, is a potential mass-less export from the Moon that could be carried out on these missions. Other sources of initial return on investment for lunar robotic missions include media rights, product advertising, and potentially novelty delivery and sample return. Media rights include possible high definition media of the lunar surface. Product advertising potential exists for companies wishing to be the “first” on the Moon or have their name be associated with “exploring the frontier”. Undoubtedly the first private missions to successfully land and return data will receive significant publicity, a commodity that over $150 Billion dollars are spent on in the US alone each year (TNS Media Intelligence). Another potential funding source is physical lunar samples, which are a priceless commodity that could fetch significant sums of money in public auction. For example, in 2004, four interns at NASA stole around 100 grams of Moon rocks. These rock’s selling prices were discussed to be around $800.00 per gram (Goldstein). Another situation is the theft of a 1.142 gram lunar rock from Malta (CollectSPACE). This rock was valued at anywhere between 5 to 10 million dollars (Associated Press). These few possible sources of income, combined with many more options will be the initial driving force in private lunar exploration.>

### Robotic Exploration Good – Because of a need for reducing the costs and uncertainty associated with lunar missions, unmanned robotic missions are a prerequisite to manned mission to the Moon. Robots will provide a foundation for technological advances and infrastructure which will help later manned missions succeed.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 7-9

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As these robotic missions progress, robotic explorers will begin to take on a more specific role of scouting and prospecting for resources. Once resource concentrations are 9confirmed, the development of the Moon will begin its next phase; resource extraction and utilization. Unmanned robotic missions will likely serve to lay the groundwork for this utilization. In addition to prospecting missions, robots will be needed to prove extraction techniques and develop a better understanding of the lunar operating environment, an understanding that will be necessary for the development of future generations of lunar equipment. These operations will provide knowledge on the transport and control properties of lunar regolith (moon dirt) as this material will be vital in habitat protection and resource utilization. Before a commercially funded man mission can return to the Moon, robots should be used to begin construction of the lunar base. This is important so that when humans arrive, basic infrastructure will be awaiting them and most importantly they will have a safe and protected living area immediately upon arrival.>

## Solvency---Demonstration Project

### Public Demonstration Solvency – Because of a need for reducing the costs and uncertainty associated with lunar missions, unmanned robotic missions are a prerequisite to manned mission to the Moon. Robots will provide a foundation for technological advances and infrastructure which will help later manned missions succeed.

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### Public Demonstration Solvency – One challenge to lunar mining is designing launch spacecraft. Newly developed Saturn V’s could carry 100-ton payloads for less than $1,500 per year. Private enterprise will be willing to invest in lunar commercialization with an original investment of $15 billion.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<NEW SPACECRAFT Perhaps the most daunting challenge to mining the moon is designing the spacecraft to carry the hardware and crew to the lunar surface. The Apollo Saturn V spacecraft remains the benchmark for a reliable, heavy-lift moon rocket. Capable of lifting 50 tons to the moon, Saturn V’s remain the largest spacecraft ever used. In the 40 years since the spacecraft’s development, vast improvements in spacecraft technology have occurred. For an investment of about $5 billion it should be possible to develop a modernized Saturn capable of delivering 100-ton payloads to the lunar surface for less than $1500 per pound. Returning to the moon would be a worthwhile pursuit even if obtaining helium-3 were the only goal. But over time the pioneering venture would pay more valuable dividends. Settlements established for helium-3 mining would branch out into other activities that support space exploration. Even with the next generation of Saturns, it will not be economical to lift the massive quantities of oxygen, water and structural materials needed to create permanent human settlements in space. We must acquire the technical skills to extract these vital materials from locally available resources. Mining the moon for helium-3 would offer a unique opportunity to acquire those resources as byproducts. Other opportunities might be possible through the sale of low-cost access to space. These additional, launch-related businesses will include providing services for government-funded lunar and planetary exploration, astronomical observatories, national defense, and long-term, on-call protection from the impacts of asteroids and comets. Spaceand lunartourism also will be enabled by the existence of low-cost, highly reliable rockets. With such tremendous business potential, the entrepreneurial private sector should support a return to the moon, this time to stay. For an investment of less than $15 billion—about the same as was required for the 1970s Trans Alaska Pipeline—private enterprise could make permanent habitation on the moon the next chapter in human history.>

## Solvency---Misc

### Must take small steps to build sustained capability with lunar resources

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

A key approach to implementing this new framework to spaceis to take small, incremental, and cumulative steps which all contributeto realizing the overall strategic goals. Small steps arerequired by the projected minimal funding increases and by theneed to transition toward a permanent lunar presence, without destroying the current assets and capabilities available to help build its foundation. The changes must also be incremental andcumulative to build sustained capability. We can no longer afford to dissipate precious national assets on uncoordinated and isolated space flights, but should instead craft a program in which each mission builds-upon and adds to new spacefaring capability.

Over the next few years, NASA must simultaneously completethe construction of the International Space Station (ISS),safely retire the Space Shuttle, and develop and build the CrewExploration Vehicle (CEV) and associated, transportation elementsto lay the groundwork for a return to the Moon.8 This multifaceted task is possible if a strategic approach is designed where small pieces fit together into a coherent, logical whole. Each cumulative step each capability, needs to become a piece of the larger puzzle. Early small robotic missions, designed to investigate the Moon—each one giving some initial capability or key piece of strategic knowledge—will later develop into networks of spacecraft operating as larger systems. As an example of this approach, small satellites collecting data in lunar orbit, such as maps of lunar resources, could later be boosted up to and left in stable, high lunar orbits to serve as a communications relay-surface navigation system for later flights to the Moon.

# \*\*\*Solvency---Legal Regime\*\*\*

## Solvency---U.S.-Led Legal Structure for Lunar Development

### Lunar Resource Regime Good – A mechanism for the creation of a LRR exists within the Moon Treaty in article 11 and 18 which would allow for the creation of a collective organization among the major “space powers” or a user-based international organization focused on lunar mining activities.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 277-280

<There are a variety of ways, discussed above, in which the United States could seek to establish such an acceptable international lunar resource regime. Perhaps the simplest and most promising would be approaches involving collective accession by the United States and other major "space powers" to the Moon Agreement under conditions or arrangements that assure the incorporation of an acceptable lunar resource regime within the Moon Agreement pursuant to articles 11 (5) and 18 of that agreement. An additional initiative, well worth exploring, is the possibility of the formation by the United States, other "space powers," and other interested nations of a user-based international organization or entity—open to all nations and perhaps private enterprises—to undertake the collective development and conduct of lunar He-3 and other resource mining activities, as well as perhaps at least some aspects of the development and management of terrestrial He-3-l»ascd fusion energy itself. Such a collective enterprise might be established on its own or perhaps incorporated within the framework of the Moon Agreement under article 18 of that agreement.>

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### Property rights- It’s legal to mine the moon

Wall 11- Mike Wall, Senior writing at SPACE.com, 13 January 2011, “Moon Mining Idea Digs Up Lunar Legal Issues,” http://www.space.com/10621-moon-mining-legal-issues.html

Companies hoping to mine the moon's huge stores of water ice can likely do so legally, experts say, though firms may want to hold off until new legislation grants them explicit title over whatever lunar muck they dredge up. The Outer Space Treaty of 1967 seems to permit extractive activities on the moon and other celestial bodies, according to space-law experts. But it's not entirely clear that mining companies would own the stuff that they extract. That fuzziness could be a problem for outfits contemplating a moon mining endeavor, which could have initial costs running into the tens of billions of dollars. "As far as title goes, it's a gray area," international lawyer and space-law expert Timothy Nelson, who works for the firm Skadden in New York City, told SPACE.com. "And from a risk perspective, lack of clarity means it doesn't exist." [Q & A: One Company's Moon Mining Plan]

### Property rights- space can be mined as long as sovereignty is not claimed

Wall 11- Mike Wall, Senior writing at SPACE.com, 13 January 2011, “Moon Mining Idea Digs Up Lunar Legal Issues,” http://www.space.com/10621-moon-mining-legal-issues.html

The good news: It's legalThe good news for outfits such as SEC is that moon-mining operations appear to be legal, experts say. The Outer Space Treaty of 1967 — which forms the basis of international space law and has been signed by the United States and other major spacefaring nations — prohibits countries from exercising territorial sovereignty over the moon or other celestial bodies. But it doesn't prohibit resource extraction. "Experienced space lawyers interpret the treaty to allow mining," space-law expert Wayne White, who works in the aerospace industry, told SPACE.com. "I have never seen anybody argue that you couldn't use mineral resources." White and Nelson both referenced the Moon Treaty of 1979, which sought to set up a regime governing how the moon's resources would be used. The Moon Treaty remains more or less irrelevant today; it has been ratified by just a handful of nations, none of them big players in spaceflight and space exploration. "If the Moon Treaty wants to regulate how we use natural resources in outer space, then that presumes that it's legal to do so under the Outer Space Treaty," White said. Nelson compared the legal status of moon mining to that of fishing in the high seas, beyond national borders and claims. "The idea that you can't claim sovereignty is not necessarily incompatible with the right to go conduct mining operations," Nelson said. "The high seas are not subject to any sovereignty, but people can go and fish there."

## Solvency---Now Key---Cooperative Regime

### Lunar Resource Regime Good – However problematic the question of He-3-based energy is, now is the time to craft collective solutions to prevent future problems dealing with space base development.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 297-299

<However problematic and seemingly remote, the question of the exploitation of He-3 and other lunar resources warrants the U.S. government's—and international lawyers'—present focus. While President Obama's recent proposal to eliminate funding for NASA's Moon-bound Constellation program raises doubts as to whether NASA will, at least in the immediate future, implement the previous administration's program,IB? it seems likely that the United States, and at least some other nations, will eventually establish bases on the Moon—and perhaps on Mars or other planets or their moons. Beginning now to think about and craft collective solutions to the issues which may well arise from such programs may not only facilitate such national activities but avoid difficulties and disputes in the future. Moreover, international cooperation in developing—and making available

## Solvency---Legal Certainty Key

### Moon Treaty Bad – Even if the Moon Treaty holds no international credibility, the Moon Treaty represents the sentiments of some countries with respect to lunar resources and is a further obstacle to the establishment of lunar mining.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 5-6

<The United Nations Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, also known as the Moon Treaty is another form of international regulation that is worth brief discussion. Most importantly the Moon Treaty has not been ratified or signed by any major space-faring country and thus is practically meaningless. However specific parts of the treaty are worth mention to show the sentiments of some countries with respect to lunar resources. Article 11section 3 states; “Neither the surface nor the subsurface of the Moon, nor any part thereof or natural resources in place, shall become property of any State, International intergovernmental or non-governmental organization, national organization Or non-governmental entity or of any natural person.” (United Nations)7This wording, although it carries no international weight, is very troublesome. How is a company to run a business on the Moon without the ability to own the natural resources that it extracts? Because of this volatility and uncertainty with the rights of companies under international law to utilize other bodies, large scale investment is greatly impeded.Likely this is a topic that will be resolved as it happens and this decision will likely be based strongly on Earth precedents. This information is included to show the current basis of international law with respect to the economic development of the Moon and represents future obstacles legally and politically to a permanent presence there.>

## Solvency---Unilateral U.S. Licensing---OST Bad

### OST Bad – Wording in the United Nations Outer Space Treaty such as “carried on for the benefit of all peoples” represent an obstacle to private investment in lunar mining as private companies will not take the high risk of prospecting a region without a guarantee of right to the region.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 5-6

<Figure 1.Comparison of the Earth’s Gravity to that of the Moon’s5Section 3. Government’s role in Lunar DevelopmentJust as the early colonies of the Americas were governed by the laws and protected by the armies of Europe, future lunar assets and colonies will require similar assistance from the governments of Earth. Humanity will only remain permanently on the Moon if there are profits to be made there. Thus much of the development of the Moon will require large investments and long term financial commitments from private corporations and investors to be successful. These investments must be protected and sanctioned by government bodies. Space law isthus extremely important and has the potential to be a very significant challenge in the development of the Moon.According to the United Nations Outer Space Treaty, which was signed by all major space-faring nations, countries are responsible for spacecraft that launch from their territory. Due to this clause the decision of a “Launching State” is very important. Because countries are liable for craft launched from their territory, various countries have established differing laws governing launches and spacecraft (Benkö). Once a private company has acquired the support of a “Launching State”, their craft can be launched on its mission. If this mission is to a location such as the Moon, then many questions linger about what operations can take place and who owns materials and mineral rights. The UN Outer Space Treaty states that, “the exploration and use of space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development” (United Nations). Socialist wording such as this poses the single biggest threat to future development of the Moon. Contrary to this wording some have proposed that lunar resources are analogous to fish caught in international waters. While the fish is in the water 6nobody owns it, but when the fish is caught and brought onto a boat, the fish becomes property of the fisherman who caught it (Richards). Others however raise the worry of mining rights and the financial risk associated with prospecting that must be protected. Wording such as that in Article 1 of the OST that states that the Moon, “shall be free for exploration and use by all States…and there shall be free access to all areas of celestial bodies.” (United Nations).This wording raises the question of how a company is to protect mining rights to an area if it must also leave free access to all areas. Terrestrial mining requires large investment in prospecting to decide where to build a mine(Hållsten). Without safeguards on this prospecting investment, few companies will take the risk if they are not guaranteed rights to the resources once found. These hurdles may be further defined and interpreted in the future, but have the potential to stand in the way of development and represent additional risk that investors will be forced to assume for an already ambitious endeavor.>

### AT: Moon treaty means plan can’t happen

Carswell 02-Bill Carswell, Sourcing at Momentive Performance Materials, Key Raw Material Buyer at Momentive Performance Materials, Key Raw Material / Logisitcs Sourcing at Momentive Performance Materials (formerly GE Silicones), April 18, 02, http://www.sps.aero/Key\_ComSpace\_Articles/CSA-006\_Moon\_Rush.pdf

The "Outer Space Treaty" is the governing United Nations document for international, statesponsored space activities. Nearly all of the UN member nations have ratified this treaty.

Another treaty**, the "Moon Treaty," has also been opened for signature by the United Nations. However, due to its provisions prohibiting the ownership of natural real estate in space, the treaty was virtually ignored by the world community**. **Only nine countries have ratified it and just five others have signed it**. **The cold shoulders it received from the primary spacefaring nations have all but sealed its fate as an irrelevant document in the larger scheme of space development**. Both of these treaties, the Outer Space Treaty and the Moon Treaty, have generated much discussion and speculation regarding the impact they might have on space, especially lunar, development.

The problem with these discussions is that once an organization decides, for whatever reason, **to begin extracting, processing and using or selling the lunar regolith**, for example, **it's very unlikely that either of these treaties will influence that decision**. **The following scenario illustrates this point.**

China presents an interesting example for a lunar development scenario. **China is** not a third world country when it comes to their space program capabilities. They are **very close to being able to put a human in orbit, and as Jane's Online reports, they are aggressively moving to be able to do just that. Furthermore, China has evidenced its willingness to invest in other space activities.**

Lunar Enterprise Daily recently reported that Chinese President Jiang Zemin has made the first official announcement of his country's intentions to build human-attended space stations. Another recent report in a SpaceDaily article on Xynergy Corporation's plans to demonstrate space-to-earth power beaming states, "China has agreed to purchase a power plant (solar power satellite) system of its own upon completion of the CSPIE's (Corporate Space Power Industries and Electric, Inc., a Xynergy partner) first successful demonstration. China has a special interest due to its environmental problems."

**If China does decide to undertake space-to-earth power beaming, the scenario could easily have them capitalizing on lunar resources to accomplish their goals.** After the first demonstration with Xynergy they would have to begin looking at the economics of large-scale activities.

Clearly, **at this point it makes sense to start using lunar materials for space activities**. Four separate studies, two funded by NASA and two funded by the Space Studies Institute, agreed that "at least 90% of solar power satellites could be built from nonterrestrial materials at great reduction to overall system cost."

Obviously many technical challenges remain to be overcome before that much of the system can be manufactured in space and it must be acknowledged that the cost estimates in these studies were carried out based strictly on mass consideration without regard to technology development and production costs.

However, it **would be reasonable to start with the processing of lunar regolith into crude structural support materials for the photovoltaic farms, or using lunar water for station-keeping fuel.** These would be very simple processes taking very little in the form of on-orbit sophistication. As these processes matured and the infrastructure needed to support them properly were developed, more complicated processing techniques could be employed, such as manufacturing photovoltaic cells from lunar regolith.

**Once these space power and lunar resource utilization activities have begun, other countries will feel compelled to match those efforts**. The response of the United States is an example worth considering. When a credible effort is undertaken to begin using the resources of the moon to develop a significant power collection and transmission capability in space, **the United States will respond for several reasons.**

The first is that its general public general public will feel threatened. The public likely will not understand the intricate details of the technical and political issues, but it will be afraid of the idea that another nation might capture and control "the high ground." The military will rightfully fear that any state with control of that much power in space is a force to be concerned about. **They will demand that the United States build its own power farms in space as well.**

Finally the entrenched, established business communities will finally develop a credible economic model based on real cost numbers and be driven by the profit motive to join the effort. Other nations are also likely to join the fray as well. Japan, according to press reports, is already planning a solar power satellite demonstration project**. The next space race, the moon rush, will have begun. And this time it will be here to stay.**

**Where do the Outer Space and Moon treaties fit into all of this? The Moon Treaty doesn't, really. Realistically it's a meaningless document that isn't going to deter the majority of the spacefaring nations from using lunar resources.**

### AT: Outer Space treaty means U.S. will not develop on moon

Carswell 02-Bill Carswell, Sourcing at Momentive Performance Materials, Key Raw Material Buyer at Momentive Performance Materials, Key Raw Material / Logisitcs Sourcing at Momentive Performance Materials (formerly GE Silicones), April 18, 02, http://www.sps.aero/Key\_ComSpace\_Articles/CSA-006\_Moon\_Rush.pdf

These are precisely the reasons why most countries refused to accept the Moon Treaty. But with three member countries having ratified or signed it, the European Space Agency may have a problem participating in the moon rush when it finally takes place.

**Most space-faring nations, however, have ratified the Outer Space Treaty, including The Russian Federation, the United States and China. But even with these ratifications in place the treaty may have little effect on attitudes toward lunar development.**

As evidenced by its actions in the International Space Station program **The United States in particular seems willing to abrogate international treaties and agreements when they become inconvenient**. But, if one assumes for the sake of argument that all member states will make a conscientious effort to abide by the letter, if not the spirit, of the Outer Space Treaty, what might be the implications?

According to some analysts, such as Glenn Harlan Reynolds, **the Outer Space Treaty doesn't impose any egregious restrictions on the commercial development of the moon.The Outer Space Treaty prohibits national appropriation, not private appropriation of lunar resources.** In fact it was this very loophole, according to Reynolds, that was the main driver behind the drafting of the Moon Treaty**. If this is the case then it appears that the Outer Space Treaty presents no real impediment to lunar resource utilization by commercial entities**.

But there are those who disagree with this analysis. Virgiliu Pop cogently sums up the arguments of that opposing camp, concluding that for a private appropriation of land to survive it must be endorsed by a state, but that state endorsement of a private appropriation is interpreted legally as a form of state appropriation and is therefore disallowed by the Outer Space Treaty. Therefore, in order for a private appropriation to succeed, according to Pop, the state that is sponsoring, and more importantly protecting, the landowner must abrogate the Treaty. But Pop does not discuss the scenario of a private appropriation by an organization not seeking the endorsement, and therefore the protection, of a sovereign state.

Many companies have, over the years, sent expeditions to the far corners of the world without state-sponsored protection. It seems reasonable that someday a company will decide to accept the risk of sending an expedition to the moon without state-sponsored protection, especially since the moon has no hostile populations to threaten an excavating crew.

It is easy to envision a scenario in which a forward-looking, space-faring and developing country like China, or maybe even India, undertaking a lunar development activity and sparking the next great space race, the moon rush. **The Moon Treaty is no impediment, and the Outer Space Treaty is acknowledged as debatable on the issue of private appropriation of lunar materials. With low-cost space-to-earth solar power beaming projects already on two drawing boards, the time seems to be rapidly approaching when the use of lunar materials for space power satellite construction will become a reality.**

The biggest obstacle to these lunar activities will not be the legal issues behind the Outer Space and Moon Treaties, but the materials processing capabilities that have yet to be demonstrated. Therefore an aggressive effort is recommended to begin using the International Space Station to demonstrate the lunar materials processing techniques that will be needed in the future.

# \*\*\*Helium-3 Advantages\*\*\*

## He3 Advantage---Uniqueness

### Helium-3 Good – A shortage of He-3 on Earth will lead to a slew of impacts. The White House and DoE’s poor coordination of tracking He-3 supply and demand have created a national crisis which are already negatively impacting international proliferation efforts, scientific research, new imaging technology, and oil well services.

Lobsenz 10 – George Lobsenz, Executive Editor of Energy Daily, April 23, 2010, “DoE Helium Shortage Hits Nuke Security, Oil, And Gas Industry,” Defense Daily, Vol. 246 No. 16, Lexis

<The Energy Department's failure to recognize an impending supply squeeze for helium-3--a nonradioactive gas produced in the agency's nuclear weapons complex--has created a national crisis requiring White House intervention and threatening key U.S. nuclear and homeland security programs, a wide range of medical and scientific research activities and development of U.S. oil and natural gas resources, a House subcommittee was told yesterday. The testimony before the House Science and Technology Committee's investigations and oversight subcommittee revealed that DoE and other federal officials only fully grasped the situation in 2008, and that fast-dwindling helium-3 supplies forced the government last year to begin rationing the gas, which has unique neutron detection and refrigerant capabilities that cannot be provided by other substances in some research and industrial applications. And in a growing snowball of real-world impacts, the sudden helium shortage already has: --Disrupted international nonproliferation efforts led by the International Atomic Energy Agency that use helium-based devices to track and safeguard sensitive nuclear materials; --Slowed Department of Homeland Security (DHS) and DoE programs to deploy radiation detection machines at airports, seaports and border crossings --Delayed a huge swath of cutting-edge scientific research, ranging from superconductivity to nanotechnology to quantum computing; --Curtailed operations at some neutron-scattering facilities overseas, although similar DoE facilities such as the Spallation Neutron Source at Oak Ridge, Tenn., have sufficient helium for planned operations through fiscal year 2014. --Jeopardized progress on new lung imaging techniques that promise better treatment methods for respiratory disease; and --Forced oil well services companies to scramble for helium-3 devices that are critical to assessing and developing underground oil and gas reservoirs, including the nation's fast-growing shale gas fields.Officials from all those industrial and research sectors, as well as a General Electric [GE] official in charge of that company's radiation detector production unit, said they only learned of the helium-3 shortage last year and now were scrambling to develop alternative technologies and, where possible, recycling methods for helium-3.>

### Helium-3 Good – A shortage of He-3 on Earth will lead to a slew of impacts. The White House and DoE’s poor coordination of tracking He-3 supply and demand have created a national crisis which is already negatively impacting international proliferation efforts, scientific research, new imaging technology, and oil well services.

Lobsenz 10 – George Lobsenz, Executive Editor of Energy Daily, April 23, 2010, “DoE Helium Shortage Hits Nuke Security, Oil, And Gas Industry,” Defense Daily, Vol. 246 No. 16, Lexis

<At the same time, DHS and DoE officials said an interagency group formed by the White House National Security Council was trying to stretch out DoE's shrinking supply of about 50,000 liters of helium by tightening allocations to all sectors and ramping up federal research and development of alternative technologies.The government officials and Thomas Anderson, product line leader of GE Energy's Reuter Stokes Radiation Measurement Solutions unit, said alternatives could be developed relatively soon for some applications, most notably for homeland security radiation detectors, which account for most of the rising demand for helium-3. However, they said helium-3 would be harder to replace in other applications, particularly oil and gas development, which requires the high sensitivity and reliability of helium-based devices in often rugged underground conditions in deep wells. "It is likely that without helium-3, exploration for new reserves, development drilling of existing fields, and logging of both new and existing wells will be severely curtailed until an alternative technology is developed," Anderson said in his written testimony to the subcommittee. >

### No Helium-3 Now – Our access to the Russian nuclear weapons arsenal for He-3 is dwindling as Russia cuts off He-3 exports while DoE failures in recognizing declining stockpiles have created a national crisis in demand for He-3.

Lobsenz 10 – George Lobsenz, Executive Editor of Energy Daily, April 23, 2010, “DoE Helium Shortage Hits Nuke Security, Oil, And Gas Industry,” Defense Daily, Vol. 246 No. 16, Lexis

<The government officials and Anderson said the most promising new source of helium-3 was to be found at commercial nuclear plants that use the Canadian deuterium-uranium, or CANDU, reactors. A byproduct of those reactors is tritium, a radioactive gas that produces the helium-3 isotope as it naturally decays in radioactivity. The officials said a substantial reserve of tritium is at reactors operated by Ontario Power Generation at its Darlington plant, and that the U.S. government already is working with the Canadian government to determine the feasibility of extracting helium-3 from that reserve.DoE has a central role in the helium-3 crisis because it is the producer and manager of the U.S. government's supply of tritium, which is needed for nuclear warheads. The gas, which is included in warheads to boost their explosive power, decays in radioactivity relatively quickly, with a half-life of 12.3 years. Thus, it must be replaced in warheads regularly to maintain its potency. DoE operated dedicated tritium production reactors until the late 1980s, when the aging facilities were shut down for safety reasons. Rather than build expensive new reactors for a rapidly shrinking nuclear arsenal, DOE contracted with the Tennessee Valley Authority to produce tritium in its Watts Bar reactor, with the tritium then extracted from irradiated fuel rods at DoE's Savannah River Site in South Carolina. The sole domestic source of helium-3 is from aging tritium reservoirs removed from U.S. warheads. And because tritium is a weapons-usable nuclear material subject to tight international controls, the only other commercial source of helium is the tritium stockpile developed by Russia for its nuclear weapons arsenal. William Brinkman, director of DoE's Office of Science, told the subcommittee department officials first began recognizing the helium problem in 2006 when they were briefed by DHS' Domestic Nuclear Detection Office (DNDO) about its plan for a major roll-out of radiation detectors nationwide to address terrorist threats. Brinkman said DoE officials recognized the radiation detectors would push up demand for helium-3, but that the scope of the shortage was not seen until an August 2008 workshop attended by all interested federal agencies, industrial sectors and research institutions. The workshop determined that U.S. demand was approaching 70,000 liters annually--more than DoE's total reserve of about 50,000 liters at present. At about the same time, U.S. officials learned that Russia was stopping its helium-3 exports and keeping all of the gas for its own use. That eliminated the 25,000 liters of Russian helium-3 that had been entering the U.S. market each year. DoE and DHS quickly decided not to allocate any more gas to domestic radiation detectors--the largest source of new demand--and DoE began investigating the Canadian tritium supplies and launched research on new helium- 3 production methods, such as distillation from natural gas or new reactor-based irradiation. The White House National Security Council formed an interagency group on the matter in July 2009 and determined projected U.S. demand in 2010 was 76,330 liters. At the same time, it found existing DoE supply was at 47,600 liters, with annual production estimated at 8,000 liters a year. The interagency task force then moved to sharply reduce demand through a rationing program, resulting in a greatly reduced 2010 demand projection of 14,557 liters, Brinkman said. The helium shortage did not become publicly known last year, when the problem emerged during an investigation by the House Science and Technology Committee's investigations subcommittee into technical issues delaying the deployment of DHS' radiation detectors. The subcommittee is now investigating how DoE failed to recognize the helium-3 problem earlier. "The finite, and declining, nature of the helium-3 stockpiles should have been readily apparent to the Department of Energy, which manages and markets the nation's helium-3 supply...," Subcommittee Chairman Brad Miller (D-N.C.) told Energy Secretary Steven Chu in a March 3 letter seeking internal DoE documents on the issue. "However, the department took no steps to push for controls on the amount of helium-3 going into the marketplace until 2009. The failure to identify this situation in a more timely fashion, as well as an apparent failure to alert users who rely on helium-3 that a shortage was imminent, has created a national crisis....">

### No Helium-3 Now – The White House has decided to prevent the DHS from using He-3 supplies obstructing research into next generation radiation portal monitors or advanced spectroscopic portals which can identify harmful substances and prevent false alarms.

Biesecker 9 – Calvin Biesecker, Terror Response Technology Report Writer For Defense Daily, November 18, 2009, “Helium-3 Shortage For Radiation Portal Monitors Is Severe, DHS Warns,” Defense Daily, Vol. 244 No. 33, Lexis

<The White House has convened an interagency policy committee to address the nation's shortage of Helium-3 (He-3) gas used in a variety of applications, including neutron detector tubes that are part of radiation portal monitors (RPM), and decided in September that no new He-3 will be given for RPM production for now, a Department of Homeland Security (DHS) official told Congress yesterday. The shortage of He-3 is "severe," Dr. William Hagan, acting deputy director for the Domestic Nuclear Detection Office (DNDO), told the House Science Subcommittee on Investigations and Oversight. Demand will "outstrip supply by a factor of 10," he said.He-3, which is a non-radioactive gas given off as a byproduct of tritium decay--tritium being a key component in nuclear weapons--is required to produce currently deployed RPMs and the next-generation systems, called Advanced Spectroscopic Portals (ASPs). The gas is also a critical component in medical imaging systems, the oil and gas industry and high-energy research. DNDO for several years has been funding research into alternatives to He- 3 but once it settles on one, it could take another one to two years to test and evaluate to ensure that it works in RPMs, Hagan said. Some options include separating He-3 found in natural gas wells or acquiring it from other countries, he said. "Most likely" an alternative to He-3 will have to be found, Hagan said. But the shortage of He-3 is making it difficult to do a cost-benefit analysis between the ASP and the current generation of RPMs, Hagan said. That cost benefit analysis is one of the key data points that will be factored into whether DHS decides to move forward with full-rate production of ASPs, whether the systems are used in both primary and secondary screening of containers entering the U.S. or possibly just secondary applications. Before a production decision is made, the ASP program also has to go through a third round of Field Validation Testing with Customs and Border Protection, which is the end user of the system, followed by operational test and evaluation, which will be carried out by independent test branch of the DHS Science and Technology Directorate. A third round of field tests is needed after the second round in July found continued problems with one of the systems in development. Those problems include alerting for special nuclear materials when, in fact, none were in the cargo being inspected and not alerting the operator when a system shut down, thereby causing a number of cargo containers to pass through potentially unscreened (Defense Daily, Nov. 17). In this case, an existing RPM was also used. Hagan said that DNDO and the contractor, in this case Raytheon [RTN], have found a fix for both problems. He said the system shut down was only on one system and that the alert message to the operator was confusing. That message on the operator's console will be simplified, he said. Regarding the false positives, Hagan said a replay tool was used to test the fix and has shown that the vast majority of the problems have been fixed. The replay tool was verified by Johns Hopkins Applied Physics Laboratory but a Government Accountability Official testified that it would be better to have a standards body such as ANSI validate the tool. Todd Owen, CBP's executive director for Cargo and Conveyance Security, said his agency believes that DNDO has made the proper fixes to the ASP system and is ready to begin the next round of field validation tests during the first quarter of 2010. In addition to Raytheon, Thermo Fisher Scientific [TMO] is also developing an ASP system for DNDO. However, Thermo Fisher has not advanced to the field testing phase due to continue technical issues that are being sorted out. Current generation RPMs alert for potential radiation threats but can't identify the material. ASP systems are supposed to be able to provide, alert and identify the radiological material, allowing CBP to reduce the numbers of containers that are both sent for secondary screening and, in some cases, have to be physically searched.>

### No Helium-3 Now – Helium-3 supplies are dropping rapidly in comparison to demand and the money invested by the Department of Homeland Security in radioactivity detection machines may go to waste. Given our current production, we will soon run out of He-3 supplies.

Wald 9 – Matthew L. Wald, International Herald Tribune Correspondent, November 24, 2009, “Shortage Of Ingredient Mires Bomb Detection,” The International Herald Tribune, News Section, Pg. 4, Lexis

<The U.S. Department of Homeland Security has spent $230 million to develop better technology for detecting smuggled nuclear bombs but has had to stop deploying the new machines because the United States has run out of a crucial raw material, experts say. The ingredient is helium 3, an unusual form of the element that is formed when tritium, an ingredient of hydrogen bombs, decays. But the government mostly stopped making tritium in 1989. ''I have not heard any explanation of why this was not entirely foreseeable,'' said Representative Brad Miller, Democrat of North Carolina, who is the chairman of a House subcommittee that is investigating the problem. An official from the Homeland Security Department testified last week before Mr. Miller's panel, the Investigations and Oversight Subcommittee of the House Science Committee, that demand for helium 3 appeared to be 10 times the supply. Some government agencies, Mr. Miller said, did anticipate a crisis, but the Homeland Security Department appears not to have gotten the message. The department had planned a worldwide network using the new detectors, which were supposed to detect plutonium or uranium in shipping containers. The government wanted 1,300 to 1,400 machines, which cost $800,000 each, for use in ports around the world to thwart terrorists who might try to deliver a nuclear bomb to a big American city by stashing it in one of the millions of containers that enter the United States every year. At the White House, Steve Fetter, an assistant director of the Office of Science and Technology Policy, said the helium 3 problem was short-term because other technologies would be developed. But, he said, while the government had a large surplus of helium 3 at the end of the Cold War, ''people should have been aware that this was a one-time windfall and was not sustainable.'' Helium 3 is not hazardous or even chemically reactive, and it is not the only material that can be used for neutron detection. The Homeland Security Department has older equipment that can look for radioactivity, but it does not differentiate well between bomb fuel and innocuous materials that naturally emit radiation - like cat litter, ceramic tiles and bananas - and sounds false alarms more often. Earlier this year, the Pacific Northwest National Laboratory, part of the U.S. Energy Department, said in a report, ''No other currently available detection technology offers the stability, sensitivity and gamma/neutron discrimination'' of detectors using helium 3. Helium 3 is used to detect neutrons, the subatomic particles that sustain the chain reaction in a bomb or a reactor. Plutonium, the favorite bomb-making material of most governments with nuclear weapons, intermittently gives off neutrons, which are harder for a smuggler to hide than other forms of radiation. The declining supply is also needed for physics research and medical diagnostics. Mr. Miller estimated that demand for helium 3 was about 65,000 liters per year through 2013 and that total production by the only two countries that produce it in usable form, the United States and Russia, was only about 20,000 liters. >

### No Helium-3 Now – Over 35,000 GE Helium-3 detectors are installed globally which experience heavy use. With the DoE’s He-3 reserves depleting to less than one year’s supply and with no replacement technology in existence, applications including nuclear safeguards, homeland security, and oil exploration are in jeopardy.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

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Helium-3 gas-filled neutron detectors are used to accurately account for nuclear materials during handling and processing. Over 35,000 GE Helium-3 detectors are installed in systems deployed around the world today to monitor for the illicit trafficking of smuggled nuclear materials. I look forward to providing you with GE’s perspective on the consequences of the Helium-3 supply crisis.

According to information presented at the Helium-3 Workshop hosted by the American Association for the Advancement of Science on April 6, 2010, the Department of Energy’s Helium-3 reserves have been depleted to approximately 50,000 liters, with future production rates expected to be less than 10,000 liters per year. With global demand now on the order of 70,000 liters per year, the total DOE reserve represents less than a one-year supply of Helium-3. As a consequence, GE is confronting the reality that Helium-3 for use in neutron detectors may soon no longer be available.

In my testimony, I will address two points. First, a drop-in replacement technology for Helium-3 does not exist today. Furthermore, as many as six different neutron detection technologies may be required to best address the performance requirements of the neutron detection applications GE has served historically with technology using Helium-3. Significant research is required immediately, and Federal funding is essential to accelerate development of new neutron detection technologies, and thereby preserve the remaining Helium-3 supply for other uses. Second, an adequate supply of Helium-3 must be made available by DOE and the Interagency Project Team (IPT) to support critical applications such as nuclear safeguards, homeland security and oil exploration while alternate technologies are developed.>

### Helium-3 Good – No replacement technology for He-3 exists today. The technological and funding barriers to developing alternative technologies for He-3 in respect to nuclear safeguarding and oil exploration will be immense and challenging to overcome. Without plenty of federal funding, the nation may experience serious effects of a He-3 shortage.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Alternative Technologies.A drop-in replacement for Helium-3 does not exist today. Federal research funding is essential to supplement private sector efforts to accelerate development of replacement technologies. I have discussed four applications that currently rely on Helium-3 neutron detectors. I have also briefly described the detector performance attributes required in each. Many of the applications share similar attributes, yet each has its own subtle differences. Up to six different neutron detection technologies may be required to replace Helium-3 detectors in these four applications.Three different technologies may be needed to support homeland security systems alone. The systems deployed for homeland security today range in size from large area portal systems and lightweight backpack instruments, to low-power pager-sized equipment. Neutron scattering detectors are even more complex due to the speed, timing and position measurement accuracies needed to support their research. 9 Alternate technologies for nuclear safeguards and the extremely harsh conditions encountered during oil exploration also present unique development challenges. GE has been actively involved in developing alternate neutron detection technologies. GE’s initial efforts have been focused on developing a replacement technology for portal monitors. RPMs have been the largest consumer of Helium-3 during the past seven years. GE recently completed development of a Boron-10 lined gas-filled neutron detection technology that meets the American National Standards Institute (ANSI), ANSI N42.35-2006 performance requirements for portals. This was an accelerated project, which from initial concept to first production is on track to be completed in 18 months. For this project, our Twinsburg team worked with scientists at the GE Global Research Center and leveraged production processes based on best practices from GE Consumer and Industrial businesses. GE is on schedule to begin production of Boron-10 lined neutron detection portal panels in July of this year. The research and new product development programs for the four neutron detection applications described will be challenging. Each new technology must the reliable and consistently meetthe performance requirements needed for accurate neutron measurements under all system operating conditions. The technology must be scalable to fit the instrument and have a reasonable service life. Finally, the technology must be practical to manufacture in sufficient quantities at a reasonable cost, with consistent quality and performance. GE is well qualified to research and develop new neutron detection technologies. However, research and development programs of this scope are very expensive. DNDO has released Broad Agency Announcements (BAA) and a Request for Information (RFI) to seek information and provide funding for alternate neutron detection technologies for homeland security systems. I am not aware of similar programs at DOE. Nuclear safeguards, oil exploration, and neutron scattering facilities fall under different offices10within DOE. Federal funding to support research in each of these areas is needed if replacement technologies are to be in place in time to avoid serious effects of the Helium-3 shortage.>

### No Helium-3 Now – There is a global shortage of He-3 now which is negatively impacting many fields of research because our only source of He-3 on Earth is our nuclear weapons arsenal.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<IntroductionThe world is experiencing a shortage of helium-3, a rare isotope of helium with applications inhomeland security, national security, medicine, industry, and science. Federal officials havetestified that the shortage is acute and, unless alternatives are found, will affect federalinvestments in homeland security, scientific research, and other areas. Scientists have expressedconcern that the shortage may threaten certain fields of research. This report discusses the natureof the shortage; federal actions undertaken so far to address it; current and potential sources ofhelium-3 and options for increasing the supply; current and projected uses of helium-3 andoptions for reducing the demand; and options for allocating the supply if it continues to fall shortof demand.What Is Helium-3?Helium-3 is an isotope of helium, an inert, nontoxic, nonradioactive gas. Most helium ishelium-4. The natural abundance of helium-3, as a fraction of all helium, is very small: onlyabout 1.37 parts per million.1 Rather than rely on natural abundance, the federal governmentmanufactures helium-3 through nuclear decay of tritium, a radioactive isotope of hydrogen.How Is Helium-3 Made?By far the most common source of helium-3 in the United States is the U.S. nuclear weaponsprogram, of which it is a byproduct. The federal government produces tritium for use in nuclearwarheads. Tritium decays into helium-3.2 This means that the tritium needs of the nuclearweapons program, not demand for helium-3 itself, determine the amount of helium-3 produced.>

### No Helium-3 Now – The IPC has concluded that further allocation of He-3 would be severly restricted for several agencies, especially the Department of Homeland Security which can no longer receive He-3 for use in radiation-sensing systems as of 2009.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<How Do Consumers of Helium-3 Obtain Supplies?Helium-3 does not trade in the marketplace as many materials do. It is produced as a byproduct ofnuclear weapons maintenance and, in the United States, is then accumulated in a stockpile fromwhich supplies are either transferred directly to other agencies or sold publicly at auction. TheU.S. producer of helium-3 is the National Nuclear Security Administration of the Department ofEnergy (DOE). The seller for the public auctions is the DOE Office of Isotope Production andResearch.Although public, the helium-3 auction process has not necessarily been competitive. Most auctionsales have been to just two companies: Spectra Gases, Inc., now part of the Linde Group, and GEReuter Stokes, Inc. Many of the auctions have had just one purchaser. Spectra Gases owns theonly facility in the United States that is licensed by the Nuclear Regulatory Commission toremove trace amounts of tritium from raw helium-3, which is necessary for most uses. Despitedeclining supply and increasing demand, the auction price of helium-3 has been relatively steady,at less than $100 per liter.Before about 2001, production of helium-3 exceeded consumption. In the past decadeconsumption has risen rapidly, in part because of the deployment of neutron detectors usinghelium-3 at the U.S. border to help secure the nation against smuggled nuclear and radiologicalmaterial. Thus starting in about 2001, and more rapidly since about 2005, the stockpile has beendrawn down. By 2009, the government and others recognized that ongoing demand would soonexceed the remaining supply.In March 2009, the Departments of Energy, Homeland Security, and Defense formed anIntegrated Product Team to examine helium-3 supply and demand. The team concluded thatfurther allocations of helium-3 from the federal stockpile would be made only by interagencyagreement. In July 2009, the White House National Security Staff established an interagencypolicy committee (IPC) to investigate helium-3 strategies. In September 2009, the IPC concludedthat the auctions should cease, that no further allocations should be made to DHS for radiationportal monitors, and that allocations to agencies and others would henceforth be based on threecriteria: whether alternatives to helium-3 exist for the planned application; whether theapplication increases national or homeland security; and whether the required helium-3 is neededto complete prior investments in infrastructure.>

### No Helium-3 Now – Because He-3 is not traded in a free marketplace the price of He-3 does not reflect the marginal cost of additional supply allowing demand to outpace supply and fueling the global shortage we are experiencing.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<Congressional Research Service 3What Is the Public Policy Problem?If helium-3 traded in a free marketplace, price could mediate supply and demand, with theavailable supply of helium-3 being allocated on the basis of the willingness of users to pay theprice. Because of the peculiar market arrangement for helium-3, however, supply and demand areeffectively disjoined; the price does not reflect the marginal cost of additional supply. In fact, theprice of helium-3 appears to be much lower than the likely cost of additional supply, so it is notsurprising that demand is exceeding supply. In the face of demand outrunning supply, therefore,the supply of helium-3 is currently being allocated by the interagency policy committee on thebasis of criteria derived from an assessment of national needs. As a result, a set of interrelatedpublic policy issues arise: (1) whether it is in the public interest to augment supply, and if so, howbest to do so; (2) whether it is in the public interest to curtail demand, and if so, how best to doso; (3) whether the current process for allocating existing supplies of helium-3 is acceptable andin the public interest; and (4) whether, looking to the future, an alternative process for allocatingexisting helium-3 supplies is warranted—such as a revised set of allocation criteria derived fromfurther assessment of needs and priorities, or a market-based process based on aligning price withmarginal cost.>

### No Helium-3 Now – Heavy usage of He-3 for radiation-detection means future demand will significantly increase from our current demand further outpacing available supply. Technologies for utilizing alternative materials or accessing He-3 sources are not currently available.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<Until 2001, helium-3 production by the nuclear weapons program exceeded the demand, and theprogram accumulated a stockpile. After the terrorist attacks of September 11, 2001, the federalgovernment began deploying neutron detectors at the U.S. border to help secure the nation againstsmuggled nuclear and radiological material. The deployment of this equipment created newfederal demand for helium-3. Use of the polarized helium-3 medical imaging technique alsoincreased. Annual demand for helium-3 quickly exceeded the annual supply. As a result, thestockpile shrank. After several years of demand exceeding supply, federal officials realized thatinsufficient helium-3 was available to meet the likely future demand.The federal government andothers have projected that future demand for helium-3 will significantly increase in future years,causing the disparity between supply and demand to grow.Other sources of helium-3 exist, both domestically and internationally. Drawing on these sourcesmight require the development of new technologies and approaches, as well as addressingpotential international export control concerns. The magnitude of the alternative sources and theease with which helium-3 could be extracted is unclear. Similarly, demand for helium-3 might bereduced through rationing or the development of alternative technologies, but these alternatives are not yet readily available.>

### No Helium-3 Now – The IPT and IPC have placed restrictions on further allocations of He-3 to many governmental and non-governmental agencies. The results of this prioritization process has resulted in several activities not having helium-3 needs met leading to unfulfilled international obligations and agreements.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<In March 2009, DOE, DHS, and DOD formed an interagency Integrated Product Team (IPT) toexamine helium-3 supply and demand and related technology R&D. The IPT determined thatfurther allocations of helium-3 would be made only by interagency agreement.7In July 2009, the White House National Security Staff established an interagency policycommittee (IPC), with broad federal representation, to investigate strategies for decreasinghelium-3 demand and increasing helium-3 supply and to make recommendations about allocationof the existing supply.8 In September 2009, the IPC determined that DHS would receive noadditional allocation of helium-3 for use in radiation portal monitors.9 The IPC also determinedthat auctions of helium-3 held in the stockpile would cease. Instead of auctions, the IPC wouldallocate the available helium-3 to agencies and others based on three criteria: whether alternativesto helium-3 exist for the planned application; whether the application increases national orhomeland security; and whether the required helium-3 is needed to complete prior investments ininfrastructure.The consequence of such a prioritization process is necessarily that lower-priority activities willnot have their helium-3 needs met. For example, DHS has had to delay the deployment schedulefor the Radiation Portal Monitor program. Some small users, such as academic researchers, haveseen the price of helium-3 increase dramatically because of its scarcity.10 Some internationalobligations and agreements have not been fulfilled due to these allocation decisions.11>

### No Helium-3 Now – He-3 supply is mainly comprised from American and Russian sources now and annual production of He-3 from alternative sources is uncertain at best. Producing He-3 may be impractical even if the sources are rich in He-3.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<Helium-3 SupplyAt present, helium-3 is only produced as a byproduct of the manufacture and purification oftritium for use in nuclear weapons. The supply of helium-3 therefore derives mostly, perhapsentirely, from two sources: the U.S. and Russian governments.15 Otherpotential sources ofhelium-3 do exist, but using these sources would present varying degrees of technical and policychallenges. Congress has several options for increasing the supply of helium-3, either fromconventional sources or by encouraging the development of new sources. Among the importantcharacteristics of all these potential sources are their likely cost and the amount of helium-3 theycould potentially supply. The potential annual production of helium-3 from alternative sources isuncertain. This uncertainty results from incomplete characterization of the sources, variability inhelium-3 content, and other factors, such as the willingness of public or private entities to investin infrastructure to enable production at a particular scale. Even for potentially large sources,producing helium-3 from these sources may be impractical on cost grounds.>

### Lunar Helium-3 Unique – Even with expansive He-3 reserves in the natural gas industry, accessing cheaply produced He-3 will not be possible to meet our energy needs considering that only 26,000 liters could be produced cheaply while more than 70,000 liters would be demanded.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<40 Another source estimates $34 per liter, again excluding thecost of infrastructure and equipment.41 The difference between these two estimates appears to betheir different assumptions about heat exchange efficiency, an issue whose resolution may requiredevelopment of a prototype processing system. Over and above these energy costs, the cost of a helum-3 extraction plant is estimated to be tens of millions of dollars.42Although U.S. helium-3 reserves and resources are large, the rate at which refiners already extract commodity helium from natural gas limits the amount of helium-3 that could be available per year at the lower cost range ($34 or $300 per liter plus infrastructure and equipment). Accordingto one expert, separating helium-3 from all domestically produced helium would make available about 26,000 liters of helium-3 per year.43 Producing more than this amount would draw on natural gas that would not otherwise be processed to extract commodity helium, and as a result, the higher cost estimate ($12,000 per liter plus infrastructure and equipment) would apply.>

### Lunar Helium-3 Unique – Even if the USFG increased domestic tritium production the He-3 supply would not increase for several years restricting the potential of solutions on Earth.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<TimelinessEven if the federal government increased domestic tritium production immediately, the helium-3supply would not increase immediately for two reasons. First, the TPBARs used for tritiummanufacture are irradiated for a full reactor refueling cycle, which is typically about 18 months.46More importantly, once additional tritium is produced, only about 5.5% of it decays into helium-3each year because of its 12.3-year half-life. These two factors combine to significantly impededomestic production of tritium as a short-term solution. Years of additional tritium productionwould need to occur before it would yield a sizeable annual supply of additional helium-3.>

## He3 Advantage---Solvency---Lunar Mining

### Helium-3 Good – Reasonable extensions of existing technology can be used to mine Moon regolith for the extraction of solar components without disrupting the natural lunar environment significantly.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 252-254

<How would lunar He-3 be extracted and transported to Earth?29 Because the solar wind components are weakly bound to the lunar regolith,30 it should be relatively easy to extract them utilizing reasonable extensions of existing technology. In one proposed scenario, once a lunar base is established, robotic lunar mining vehicles fitted with solar heat collectors would: (1) traverse appropriate areas of the Moon's surface—probably, in particular, the lunar in aria, or "seas"—scooping up the loose upper layer of the lunar regolith and sizing it into small particles; (2) utilize solar energy to process and heat the collected regolith to the temperatures necessary to release, separate, and collect in a gaseous state the Hc-3, along with certain other solar-wind elements embedded in the regolith particles; (3) discharge the spent regolith back to the lunar surface; and (4) return with the collected He-3 and other gaseous byproducts to the lunar base.11

The collected He-3 gas could then be liquefied in the lunar cold and transported to Earth, perhaps in remotely-operated shuttles.'2 Importantly, this type of mining operation could result in the collection not only of He-3 but also significant amounts of hydrogen, oxygen, nitrogen, carbon dioxide, and water, all potentially very useful—indeed, perhaps indispensable—for the maintenance of a lunar base or further outer space activities such as expeditions to Mars or other planets." Since He-3 is believed to comprise only a small proportion of the lunar regolith. it will probably be necessary to process large amounts of lunar regolith in order to obtain the quantities of He-3 necessary to sustain a large-scale terrestrial He-3-based power program. However, the extraction of He-3 and other solar wind components from the lunar soil seems in itself unlikely to have a significant detrimental impact on the lunar environment because the regolith will be discharged back to the Moon's surface immediately after processing.\*1>

### US Must Act Now – US leadership can take us back to the moon. An American entrepreneurial spirit will drive government and private efforts to effectively mine lunar He-3.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<That vision seemed impossibly distant during the decades in which manned space exploration languished. Yes, Americans and others made repeated trips into Earth orbit, but humanity seemed content to send only robots into the vastness beyond. That changed on Jan. 14, 2004, when President George W. Bush challenged NASA to “explore space and extend a human presence across our solar system.” It was an electrifying call to action for those of us who share the vision of Americans leading humankind into deep space, continuing the ultimate migration that began 42 years ago when President John F. Kennedy fi rst challenged NASA to land on the moon. We can do so again. If Bush’s initiative is sustained by Congress and future presidents, American leadership can take us back to the moon, then to Mars and, ultimately, beyond. Although the president’s announcement did not mention it explicitly, his message implied an important role for the private sector in leading human expansion into deep space. In the past, this type of public-private cooperation produced enormous dividends. Recognizing the distinctly American entrepreneurial spirit that drives pioneers, the President’s Commission on Implementation of U.S. Space Exploration Policy subsequently recommended that NASA encourage private space related initiatives. I believe in going a step further. I believe that if government efforts lag, private enterprise should take the lead in settling space. We need look only to our past to see how well this could work. In 1862, the federal government supported the building of the transcontinental railroad with land grants. By the end of the 19th century, the private sector came to dominate the infrastructure, introducing improvements in rail transport that laid the foundation for industrial development in the 20th century. In a similar fashion, a cooperative effort in learning how to mine the moon for helium-3 will create the technological infrastructure for our inevitable journeys to Mars and beyond.>

### Helium-3 Good – Helium-3 will make exploration of our Moon economically feasible. Only a lack of He-3 prevents us from meeting our energy needs, not a lack of engineering skills.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<A REASON TO RETURN Throughout history, the search for precious resources—from food to minerals to energy—inspired humanity to explore and settle ever-more-remote regions of our planet. I believe that helium-3 could be the resource that makes the exploration of our moon both feasible and desirable. Although quantities suffi cient for research exist, no commercial supplies of helium-3 are present on Earth. If they were, we probably would be using them to produce electricity today. The more we learn about building fusion reactors, the more desirable a helium- 3-fueled reactor becomes. Researchers have tried several approachesto harnessing the awesome power of hydrogen fusion to generate electricity. The stumbling block is finding a way to achieve the temperatures required to maintain a fusion reaction. All materials known to exist melt at these surface-of-thesun temperatures. For this reason, the reaction can take place only within a magnetic containment field, a sort of electromagnetic Thermos bottle. Initially, scientists believed they could achieve fusion using deuterium, an isotope of hydrogen found in seawater. They soon discovered thatsustaining 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 fi rst time. It is not a lack of engineering skill thatprevents 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 fi eld 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 colonies; it could yield enormous benefits back on Earth.>

### Helium-3 Good – Even if He-3 is in small quantities on the lunar surface, mining costs would not be high by any measureable standard. A $6 billion investment in capital can develop some of the first He-3 fusion power plants.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<LUNAR MINING Samples collected in 1969 by Neil Armstrong during the fi rst 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 diffi cult. 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 fi nal 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 fi elds 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 effi ciencies of 70 percent may be possible, as there is no need to convert proton energy to heat in order to drive turbinepowered 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 effi ciency, 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 fi ve 1000-megawatt plants were on line, replacing old conventional plants or meeting new demand.>

### Helium-3 Good – One challenge to lunar mining is designing launch spacecraft. Newly developed Saturn V’s could carry 100-ton payloads for less than $1,500 per year. Private enterprise will be willing to invest in lunar commercialization with an original investment of $15 billion.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<NEW SPACECRAFT Perhaps the most daunting challenge to mining the moon is designing the spacecraft to carry the hardware and crew to the lunar surface. The Apollo Saturn V spacecraft remains the benchmark for a reliable, heavy-lift moon rocket. Capable of lifting 50 tons to the moon, Saturn V’s remain the largest spacecraft ever used. In the 40 years since the spacecraft’s development, vast improvements in spacecraft technology have occurred. For an investment of about $5 billion it should be possible to develop a modernized Saturn capable of delivering 100-ton payloads to the lunar surface for less than $1500 per pound. Returning to the moon would be a worthwhile pursuit even if obtaining helium-3 were the only goal. But over time the pioneering venture would pay more valuable dividends. Settlements established for helium-3 mining would branch out into other activities that support space exploration. Even with the next generation of Saturns, it will not be economical to lift the massive quantities of oxygen, water and structural materials needed to create permanent human settlements in space. We must acquire the technical skills to extract these vital materials from locally available resources. Mining the moon for helium-3 would offer a unique opportunity to acquire those resources as byproducts. Other opportunities might be possible through the sale of low-cost access to space. These additional, launch-related businesses will include providing services for government-funded lunar and planetary exploration, astronomical observatories, national defense, and long-term, on-call protection from the impacts of asteroids and comets. Spaceand lunartourism also will be enabled by the existence of low-cost, highly reliable rockets. With such tremendous business potential, the entrepreneurial private sector should support a return to the moon, this time to stay. For an investment of less than $15 billion—about the same as was required for the 1970s Trans Alaska Pipeline—private enterprise could make permanent habitation on the moon the next chapter in human history.>

## He3 Advantage---Solvency---Tech Feasibility

### General Solvency – He-3 mining can be commercially viable because of existing nuclear fusion research and equipment and the potential for cost-efficiency in comparison to conventional fossil fuels.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 255-257

<Whether the production of lunar He-3-based fusion power will prove commercially viable remains a complex and disputed question. The commercial success of such a development will clearly depend, among other" things, on the parallel and integrated achievement of both economically efficient He-3-fueled fusion power reactors and a sustainable lunar mining enterprise capable of economically extracting and returning to Earth an assured supply of He-3 10 fuel such reactors; neither is worth pursuing without the other. However, the development of He-3-based fusion need not start from scratch, but instead will likely build on the substantial research and investment already committed to the development of fusion power more generally in ITER and other already ongoing projects. Moreover, the development of lunar He-3 mining can similarly build on—and indeed form an additional rationale for—the already existingcommitment of various space powers to establish lunar bases. As indicated earlier, lunar mining activities may be worth developing not only to extract He-3 from the regolith, but also to obtain a variety of other byproducts highly useful for die support of lunar bases."

Finally, the economic viability of He-3-based fusion power will, of course, depend on its eventual production cost relative to alternative sources of energy such as fossil fuel or other conventional sources of energy, energy produced by nuclear fission reactors, or other forms of fusion energy—all figures difficult to accurately predict at this time. Proponents of He-3-based fusion energy argue that, notwithstanding the substantial costs involved in developing He-3 fusion reactors, establishing a lunar mining operation, and transporting He-3 back to Earth, He-3-based fusion power will eventually be more than competitive with the cost of other types of energy resources and provide more than sufficient incentive for the participation of both government and private enterprise.>

## He3 Advantage---Solvency---Now Key

### US Must Act Now – Multiple actors including China, Russia, and India have been pushed into the “cosmic middle class” with unprecedented world growth expanding fears of energy crises. Specifically, China and Russia have designs to conduct lunar mining for He-3.

Guterl 7 – Fred Guterl, US Newsweek Correspondent, February 5, 2007, “Race To The Moon,” Newsweek International Edition, Lexis

<Russia is not the only nation with renewed ambitions for manned spaceflight. China, a relative newcomer, has developed a booster capable of propelling a capsule to the moon and has now sent three astronauts into orbit. China plans to launch its first moon probe on April 17, NEWSWEEK has learned, and hopes eventually to follow up with a manned trip. Japan is moving ahead with a moon program. And last week an Indian flight successfully deployed four satellites, giving Prime Minister Atal Bihari Vajpayee's audacious promise in 2003 to send a spacecraft to the moon by 2008 at least a patina of realism.

Why, after so many decades, is everybody now interested in sending people to the moon? Prestige and the desire simply to explore seem to be what's motivating NASA. President George W. Bush set a goal three years ago to establish a permanent base on the moon and eventually send a manned mission to Mars (though many critics argue for heading straight to the Red Planet). Unprecedented worldwide growth has pushed formerly impoverished nations like China, Russia and India into the cosmic middle class. And although technological spinoffs have always been a weak justification for ridiculously expensive manned missions, Russia and China have designs to mine the moon for its resources--particularly helium-3, a rare isotope that some scientists think could fuel nuclear fusion reactors and provide a source of clean energy.>

## He3 Advantage---Solvency---General

### Helium 3 Good – Helium-3 is nontoxic and absorbs neutrons efficiently which has allowed Helium-3 to be used in national and homeland security, industry, and science.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<What Is Helium-3 Used For?Helium-3 has properties that currently make it in high demand. Like all helium, helium-3 isnontoxic. Helium-3 also absorbs neutrons. This property has resulted in its widespread use forneutron detection. Neutron detection is a key component of applications in national and homelandsecurity, industry, and science. For example, the federal government uses radiation portalmonitors and other neutron detectors at the U.S. border to prevent smuggling of nuclear andradiological material, and the oil and gas industry uses neutron detectors for well logging.3Another property that has increased demand for helium-3 in recent years is the ability to polarizeits nucleus. For example, magnetic resonance imaging (MRI) can take advantage of this propertyto enable real-time visualization of a patient’s lung capacity and capability.4Finally, helium-3 has unique cryogenic properties. Low-temperature physicists use a mixture ofhelium-3 and helium-4 to achieve temperatures just a few thousandths of a degree above absolutezero (millikelvins). At temperatures below 2.5 millikelvin, helium-3 becomes a superfluid.5>

### Helium-3 Good – He-3 forms a major component of our defensive and offensive capabilities. He-3 is used in radiation detection machines, navigation systems for munitions, missiles, aircraft, and surface vehicles.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<National and Homeland SecurityThe demand for helium-3 for national and homeland security purposes falls into two main categories: the detection of smuggled radiological and special nuclear material and the monitoring of known special nuclear material to ensure its security.53The Department of Defense, Department of State, NNSA, and DHS all have deployed radiation detection equipment to detect smuggled radiological and nuclear material.54 Through programssuch as Cooperative Threat Reduction, the Second Line of Defense, and the Radiation PortalMonitor program, these agencies have deployed thousands of radiation portal monitors both domestically and overseas. Each portal uses approximately 50 liters of helium-3 as the basis for its neutron detection capability. Some of the programs have been in place since before 2001.Others, such as those operated through DHS, were established later. The broad expansion of thesedeployments has provided the greatest demand for helium-3 and been the largest drain on thehelium-3 stockpile.The Department of Defense and NNSA also use helium-3 in neutron detectors to ensure thatstores of special nuclear material are fully accounted for. Accurate neutron counting over longtime periods is one way to monitor the continued presence of materials such as plutonium. Inaddition, the United States contributes helium-3 to meet the nuclear security and monitoring needs of the International Atomic Energy Agency (IAEA).Department of Defense guidance and navigation systems for munitions, missiles, aircraft, and surface vehicles include ring laser gyroscopes that use helium-3. Testing and qualification are under way on an alternative gas for this purpose.55>

## He3 Advantage---Nuclear Forensics---1AC

### 1. No Helium-3 Now – Helium-3 supplies used for radiation detection are dropping – Helium-3 is unique in detection accuracy and reliability.

Wald 9 – Matthew L. Wald, International Herald Tribune Correspondent, November 24, 2009, “Shortage Of Ingredient Mires Bomb Detection,” The International Herald Tribune, News Section, Pg. 4, Lexis

<The U.S. Department of Homeland Security has spent $230 million to develop better technology for detecting smuggled nuclear bombs but has had to stop deploying the new machines because the United States has run out of a crucial raw material, experts say. The ingredient is helium 3, an unusual form of the element that is formed when tritium, an ingredient of hydrogen bombs, decays. But the government mostly stopped making tritium in 1989. ''I have not heard any explanation of why this was not entirely foreseeable,'' said Representative Brad Miller, Democrat of North Carolina, who is the chairman of a House subcommittee that is investigating the problem. An official from the Homeland Security Department testified last week before Mr. Miller's panel, the Investigations and Oversight Subcommittee of the House Science Committee, that demand for helium 3 appeared to be 10 times the supply. Some government agencies, Mr. Miller said, did anticipate a crisis, but the Homeland Security Department appears not to have gotten the message. The department had planned a worldwide network using the new detectors, which were supposed to detect plutonium or uranium in shipping containers. The government wanted 1,300 to 1,400 machines, which cost $800,000 each, for use in ports around the world to thwart terrorists who might try to deliver a nuclear bomb to a big American city by stashing it in one of the millions of containers that enter the United States every year. At the White House, Steve Fetter, an assistant director of the Office of Science and Technology Policy, said the helium 3 problem was short-term because other technologies would be developed. But, he said, while the government had a large surplus of helium 3 at the end of the Cold War, ''people should have been aware that this was a one-time windfall and was not sustainable.'' Helium 3 is not hazardous or even chemically reactive, and it is not the only material that can be used for neutron detection. The Homeland Security Department has older equipment that can look for radioactivity, but it does not differentiate well between bomb fuel and innocuous materials that naturally emit radiation - like cat litter, ceramic tiles and bananas - and sounds false alarms more often. Earlier this year, the Pacific Northwest National Laboratory, part of the U.S. Energy Department, said in a report, ''No other currently available detection technology offers the stability, sensitivity and gamma/neutron discrimination'' of detectors using helium 3. Helium 3 is used to detect neutrons, the subatomic particles that sustain the chain reaction in a bomb or a reactor. Plutonium, the favorite bomb-making material of most governments with nuclear weapons, intermittently gives off neutrons, which are harder for a smuggler to hide than other forms of radiation. The declining supply is also needed for physics research and medical diagnostics. Mr. Miller estimated that demand for helium 3 was about 65,000 liters per year through 2013 and that total production by the only two countries that produce it in usable form, the United States and Russia, was only about 20,000 liters. >

### 2. Lunar Helium-3 Unique – 1,000,000 metric tons of helium-3 are embedded in the Moon’s regolith – Helium-3 is very rare on Earth.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 250-251

<He-3 is a component of "solar wind" comprised of gas and charged particles continuously emitted by the sun into the solar system in the course of its thermonuclear fusion processes.12 During more than four billion year's in which die solar wind has impacted the Moon, significant amounts of He-3, in addition to particles of other ionized components of the solar wind, have become embedded in the Moon's regolith—the loose and dusty upper layer of rocks and soil comprising much of the Moon's surface.19 While He-3 constitutes only a minute proportion of the lunar regolith," it is estimated that, altogether, there may be as much as one million metric tons of He-3 potentially recoverable

from the Moon's surface.181 This amount of He-3 is theoretically equivalent to ten times the energy content of all of the coal, oil, and natural gas economically recoverable on Earth.16 Since the Earth, unlike the Moon, possesses a magnetic field and atmosphere that deflect the solar wind, He-3 is rarely found naturally on Earth.17 The small amounts of He-3 available for research and experiment on Earth are derived principally from the decay of tritium used in thermonuclear weapons.1">

### Scenario 1: Proliferation

### 1. Helium-3 Radiation Technology K2 IAEA – The helium-3 crisis will impede the nuclear monitoring capabilities of the International Atomic Energy Agency.

Shea And Morgan 10 – Dana A. Shea, Specialist In Space And Technology Policy, Daniel Morgan, Specialist In Space And Technology Policy, December 22, 2010, “The Helium-3 Shortage: Supply, Demand, And Options For Congress,” Congressional Research Service, Online: http://assets.opencrs.com/rpts/R41419\_20101222.pdf

<National and Homeland SecurityThe demand for helium-3 for national and homeland security purposes falls into two main categories: the detection of smuggled radiological and special nuclear material and the monitoring of known special nuclear material to ensure its security.53The Department of Defense, Department of State, NNSA, and DHS all have deployed radiation detection equipment to detect smuggled radiological and nuclear material.54 Through programssuch as Cooperative Threat Reduction, the Second Line of Defense, and the Radiation PortalMonitor program, these agencies have deployed thousands of radiation portal monitors both domestically and overseas. Each portal uses approximately 50 liters of helium-3 as the basis for its neutron detection capability. Some of the programs have been in place since before 2001.Others, such as those operated through DHS, were established later. The broad expansion of thesedeployments has provided the greatest demand for helium-3 and been the largest drain on thehelium-3 stockpile.The Department of Defense and NNSA also use helium-3 in neutron detectors to ensure thatstores of special nuclear material are fully accounted for. Accurate neutron counting over longtime periods is one way to monitor the continued presence of materials such as plutonium. Inaddition, the United States contributes helium-3 to meet the nuclear security and monitoring needs of the International Atomic Energy Agency (IAEA).Department of Defense guidance and navigation systems for munitions, missiles, aircraft, and surface vehicles include ring laser gyroscopes that use helium-3. Testing and qualification are under way on an alternative gas for this purpose.55>

### 2. IAEA K2 Non-Proliferation – The IAEA continues to form the cornerstone of nuclear arms control.

IAEA 1 – International Atomic Energy Agency, 2001, “IAEA Safeguards: Stemming The Spread Of Nuclear Weapons,” IAEA 2001 Annual Report “Nuclear Security And Safeguards,” IAEA Bulletin, Vol. 43, No. 4, <http://www.iaea.org/Publications/Factsheets/English/S1_Safeguards.pdf>

<As the world’s nuclear inspectorate, the IAEA performs an indispensable role in furthering nuclear non-proliferation. IAEA Safeguards: Stemming the Spread of Nuclear Weapons International Atomic Energy Agency “Inspections by an impartial, credible third party have beena cornerstone of international nuclear arms control agreementsfor decades. Where the intent exists to develop aclandestine nuclear weapons program, inspections serveeffectively as a means of both detection and deterrence.” IAEA Director General, Mohamed ElBaradei Washington Post, October 2002 Most countries around the world use nuclear technologies for a wide variety of peaceful purposes — for generating electricity, diagnosing disease and treating cancer, for numerous industrial applications and for food and medical sterilization. At least 30 countries have nuclear power reactors. There are scores of other major facilities containing nuclear material in over 70 countries that are “safeguarded” under IAEA agreements with governments. Safeguards are a set of activities by which the IAEA seeksto verify that a State is living up to its international undertakings not to use nuclear programm for nuclearweapons purposes. The safeguards system is based on assessment of the correctness and completeness of the State’s declarations to the IAEA concerning nuclear material and nuclear-related activities. To date, 145 States have entered into such agreements with the IAEA, submitting nuclear materials, facilities and activities to the scrutiny of IAEA’s safeguards inspectors. IAEA verification helps to provide assurance that suchitems are not diverted or misused in order to assemblenuclear weapons and that no items required to be declared under safeguards are undeclared. This, in turn, helps to allay security concerns among States with respect to the development of nuclear weapons. Through its role as the world’s nuclear inspectorate, theIAEA performs an indispensable role in global efforts to furthernuclear non-proliferation. The strengthened safeguardssystem, based on “comprehensive” safeguards agreements and “additional protocols” to those agreements, has establisheda new and higher standard for effective, co-operativeverification of States’ nuclear undertakings.>

### 3. Proliferation Bad – Extinction.

Krieger ‘9  - David Krieger, President of Nuclear Age Peace Foundation and Council and World Future Council, 2009, “Still Loving the Bomb After All These Years”, Online: <https://www.wagingpeace.org/articles/2009/09/04_krieger_newsweek_response.php?krieger>

<Jonathan Tepperman’s article in the September 7, 2009 issue of Newsweek, “Why Obama Should Learn to Love the Bomb,” provides a novel but frivolous argument that nuclear weapons “may not, in fact, make the world more dangerous….”  Rather, in Tepperman’s world, “The bomb may actually make us safer.” Tepperman shares this world with Kenneth Waltz, a University of California professor emeritus of political science, who Tepperman describes as “the leading ‘nuclear optimist.’”   Waltz expresses his optimism in this way: “We’ve now had 64 years of experience since Hiroshima.  It’s striking and against all historical precedent that for that substantial period, there has not been any war among nuclear states.”  Actually, there were a number of proxy wars between nuclear weapons states, such as those in Korea, Vietnam and Afghanistan, and some near disasters**,** the most notable being the 1962 Cuban Missile Crisis.  Waltz’s logic is akin to observing a man falling from a high rise building, and noting that he had already fallen for 64 floors without anything bad happening to him, and concluding that so far it looked so good that others should try it.  Dangerous logic!  Tepperman builds upon Waltz’s logic, and concludes “that all states are rational,” even though their leaders may have a lot of bad qualities, including being “stupid, petty, venal, even evil….”  He asks us to trust that rationality will always prevail when there is a risk of nuclear retaliation, because these weapons make “the costs of war obvious, inevitable, and unacceptable.”  Actually, he is asking us to do more than trust in the rationality of leaders; he is asking us to gamble the future on this proposition.  “The iron logic of deterrence and mutually assured destruction is so compelling,” Tepperman argues, “it’s led to what’s known as the nuclear peace….”  But if this is a peace worthy of the name, which it isn’t, it certainly is not one on which to risk the future of civilization. One irrational leader with control over a nuclear arsenal could start a nuclear conflagration, resulting in a global Hiroshima**.**  Tepperman celebrates “the iron logic of deterrence,” but deterrence is a theory that is far from rooted in “iron logic.”  It is a theory based upon threats that must be effectively communicated and believed.  Leaders of Country A with nuclear weapons must communicate to other countries (B, C, etc.) the conditions under which A will retaliate with nuclear weapons.  The leaders of the other countries must understand and believe the threat from Country A will, in fact, be carried out.  The longer that nuclear weapons are not used, the more other countries may come to believe that they can challenge Country A with impunity from nuclear retaliation.  The more that Country A bullies other countries, the greater the incentive for these countries to develop their own nuclear arsenals.  Deterrence is unstable and therefore precarious.  Most of the countries in the world reject the argument, made most prominently by Kenneth Waltz, that the spread of nuclear weapons makes the world safer. These countries joined together in the Nuclear Non-Proliferation Treaty (NPT) to prevent the spread of nuclear weapons, but they never agreed to maintain indefinitely a system of nuclear apartheid in which some states possess nuclear weapons and others are prohibited from doing so.  The principal bargain of the NPT requires the five NPT nuclear weapons states (US, Russia, UK, France and China) to engage in good faith negotiations for nuclear disarmament, and the International Court of Justice interpreted this to mean complete nuclear disarmament in all its aspects.   Tepperman seems to be arguing that seeking to prevent the proliferation of nuclear weapons is bad policy, and that nuclear weapons, because of their threat, make efforts at non-proliferation unnecessary and even unwise.  If some additional states, including Iran, developed nuclear arsenals, he concludes that wouldn’t be so bad “given the way that bombs tend to mellow behavior.”  Those who oppose Tepperman’s favorable disposition toward the bomb, he refers to as “nuclear pessimists.”  These would be the people, and I would certainly be one of them, who see nuclear weapons as presenting an urgent danger to our security, our species and our future.   Tepperman finds that when viewed from his “nuclear optimist” perspective, “nuclear weapons start to seem a lot less frightening.”  “Nuclear peace,” he tells us, “rests on a scary bargain: you accept a small chance that something extremely bad will happen in exchange for a much bigger chance that something very bad – conventional war – won’t happen.”  But the “extremely bad” thing he asks us to accept is the end of the human species.  Yes, that would be serious.  He also doesn’t make the case that in a world without nuclear weapons, the prospects of conventional war would increase dramatically.  After all,it is only an unproven supposition that nuclear weapons have prevented wars, or would do so in the future.  We have certainly come far too close to the precipice of catastrophic nuclear war.  As an ultimate celebration of the faulty logic of deterrence, Tepperman calls for providing any nuclear weapons state with a “survivable second strike option.”  Thus, he not only favors nuclear weapons, but finds the security of these weapons to trump human security.   Presumably he would have President Obama providing new and secure nuclear weapons to North Korea, Pakistan and any other nuclear weapons states that come along so that they will feel secure enough not to use their weapons in a first-strike attack**.**Do we really want to bet the human future that Kim Jong-Il and his successors are more rational than Mr. Tepperman?>

### Scenario 2: Nuclear Terrorism

### 1. Helium-3 Radiation Technology K2 Prevent Dirty Bomb – Many materials empirically detected by in-place radiation systems are perfect for an Al-Qaeda built dirty bomb.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<The world, it turns out, is awash in uncontrolled radioactive materials. Most are harmless, but a few are dangerous, and many detectors are still too crude to distinguish among different types of radiation; they ring just as loudly if they locate nuclear-bomb material or contaminated steel or, for that matter, bananas, which emit radiation from the isotope potassium-40. So far, the result has been a cacophony of false alarms, which, in most cases, are caused by naturally occurring radiation that has found its way from soil or rock into manufactured products such as ceramic tiles. In addition, people who have recently received medical treatments with radioactive isotopes such as thorium can set off the detectors. At baseball's All-Star Game in Detroit in 2005, unobserved NEST scientists screened tens of thousands of fans entering the stadium, and their sensors rang just once-reacting to the former Secretary of Energy Spencer Abraham, who was radioactive from a recent doctor's visit. Detritus from nuclear commerce that has slipped through American and international regulatory systems is another periodic source of alarms, and one that has proved to be a greater cause of concern. Virtually none of the loose material detected so far would be useful to a terrorist seeking to build a fission weapon-a bomb of the sort that was dropped on Hiroshima. A disquieting fraction of it, however, might be useful for what the American defense bureaucracy calls a "radioactive dispersal device," more commonly known as a dirty bomb. There is recent evidence, too, that Al Qaeda-inspired radicals are pursuing such a weapon.>

### 2. Dirty Bombs Bad – Dirty bombs can produce significant economic and human devastation easily.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<The term "dirty bomb" can refer to a wide variety of devices, but generally it describes one that would use a conventional explosive such as dynamite to release radioactive material into the air. The initial explosion and its subsequent plume might kill or sicken a dozen or perhaps as many as a few hundred people, depending on such factors as wind and the bomb-maker's skill. If the weapon was particularly well made, employing one of the most potent and long-lived types of radioactive materials that are used in medicine and in the food industry, it might also cause considerable economic damage-perhaps rendering a number of city blocks uninhabitable. Radioactive ground contamination cannot easily be scrubbed away, so it might be necessary to tear down scores of buildings and cart the rubble to disposal sites. It's easy to imagine what the impact of such an attack would be if the contaminated area was, say, a quarter of the East Village, or the Seventh Arrondissement of Paris.>

## He3 Advantage---Nuclear Forensics---Uniqueness

### Radiation Detection Bad – As of now, America’s radiation detection capabilities are inefficient and have resulted in heavy expenditures with not much yield involving hundreds of false alarms which must be investigated by NEST teams.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<In October, 2005, a radiation sensor at the Port of Colombo, in Sri Lanka, signaled that the contents of an outbound shipping container included radioactive material. The port's surveillance system, installed with funds from the National Nuclear Security Administration, an agency within the Department of Energy, wasn't yet in place, so the container was loaded and sent to sea before it could be identified. After American and Sri Lankan inspectors hurriedly checked camera images at the port, they concluded that the suspect crate might be on any one of five ships-two of which were steaming toward New York. Sri Lanka is a locus of guerrilla war and arms smuggling. It is not far from Pakistan, which possesses nuclear arms, is a haven for Al Qaeda, and has a poor record of nuclear security. The radiation-emitting container presented at least the theoretical danger of a "pariah ship," Vayl Oxford, the director of the Domestic Nuclear Detection Office, which is part of the Department of Homeland Security, said. It seemed plausible, if unlikely, that Al Qaeda or rogue Pakistani generals might load a bomb onto a cargo vessel. Within days, American satellites located the five suspect ships and intelligence analysts scrutinized their manifests; a team at the National Security Council took charge. One ship, it learned, was bound for Canada, and another for Hamburg, Germany. The White House decided to call in its atomic-bomb squad, known as NEST, the Nuclear Emergency Support Team-scientists who are trained to search for nuclear weapons. One team flew to Canada and a second to Europe, where it intercepted one of the ships at sea before it could reach Hamburg. They found nothing.The United States Coast Guard stopped the two New York-bound ships in territorial waters, about ten miles offshore; from that distance, if there was a nuclear weapon on board a detonation would cause relatively little harm. Scientists boarded the vessels, shouldering diagnostic equipment, but these ships, too, turned out to be clean; as it happened, the offending vessel was on an Asian route, and its cargo was scrap metal mixed with radioactive materials that had been dumped improperly. The entire episode, which was not disclosed to the public, lasted about two weeks. This sometimes nerve-racking exercise resulted in no more than the disposal of some radioactive waste. It was also the first major defensive maneuver triggered by a shield that the United States is trying to build as a defense against a clandestine nuclear attack. The idea, in essence, is to envelop the country in rings of radiation detectors and connect these sensors to military and police command centers, which would then respond to unexplained movements of nuclear material. The project, comparable in ambition to ballistic-missile defense, is the first of its kind in the atomic age. The plan has already attracted criticism from some scientists and defense strategists, primarily because, as with missile defense, the project promises to be expensive and would require leaps of ingenuity to overcome technical problems presented by the laws of physics. Still, with little public discussion this "layered defense," as it is described by its proponents, is being deployed. The federal government has distributed more than fifteen hundred radiation detectors to overseas ports and border crossings, as well as to America's northern and southern borders, domestic seaports, Coast Guard ships, airports, railways, mail facilities, and even some highway truck stops. More detectors are being distributed each month. NEST and the Federal Bureau of Investigation maintain a permanent team to respond to events in Washington and along the Northeast Corridor; a second team trained to dismantle nuclear weapons is based in Albuquerque, and eight other teams able to diagnose radioactive materials operate on continuous alert elsewhere in the country. Since the terrorist attacks of September 11, 2001, NEST teams have been deployed about twice a year because of specific threats reported by intelligence agencies, including at least two instances, apart from the Sri Lankan episode, where they boarded a ship approaching the United States. NEST units also discreetly screen vehicles, buildings, and people at designated events such as political conventions and the recent N.B.A. All-Star Game, in Las Vegas. In the United States alone, the sensors generate more than a thousand radiation alarms on an average day, all of which must be investigated.>

## He3 Advantage---Nuclear Forensics---Solvency

### Helium-3 Good – He-3 is comparatively the best chemical used for radioactivity detection because it is significantly more accurate and gives less false readings as explained by the Homeland Security Department and Northwest National Laboratory of the US Energy Department.

Wald 9 – Matthew L. Wald, International Herald Tribune Correspondent, November 24, 2009, “Shortage Of Ingredient Mires Bomb Detection,” The International Herald Tribune, News Section, Pg. 4, Lexis

<The U.S. Department of Homeland Security has spent $230 million to develop better technology for detecting smuggled nuclear bombs but has had to stop deploying the new machines because the United States has run out of a crucial raw material, experts say. The ingredient is helium 3, an unusual form of the element that is formed when tritium, an ingredient of hydrogen bombs, decays. But the government mostly stopped making tritium in 1989. ''I have not heard any explanation of why this was not entirely foreseeable,'' said Representative Brad Miller, Democrat of North Carolina, who is the chairman of a House subcommittee that is investigating the problem. An official from the Homeland Security Department testified last week before Mr. Miller's panel, the Investigations and Oversight Subcommittee of the House Science Committee, that demand for helium 3 appeared to be 10 times the supply. Some government agencies, Mr. Miller said, did anticipate a crisis, but the Homeland Security Department appears not to have gotten the message. The department had planned a worldwide network using the new detectors, which were supposed to detect plutonium or uranium in shipping containers. The government wanted 1,300 to 1,400 machines, which cost $800,000 each, for use in ports around the world to thwart terrorists who might try to deliver a nuclear bomb to a big American city by stashing it in one of the millions of containers that enter the United States every year. At the White House, Steve Fetter, an assistant director of the Office of Science and Technology Policy, said the helium 3 problem was short-term because other technologies would be developed. But, he said, while the government had a large surplus of helium 3 at the end of the Cold War, ''people should have been aware that this was a one-time windfall and was not sustainable.'' Helium 3 is not hazardous or even chemically reactive, and it is not the only material that can be used for neutron detection. The Homeland Security Department has older equipment that can look for radioactivity, but it does not differentiate well between bomb fuel and innocuous materials that naturally emit radiation - like cat litter, ceramic tiles and bananas - and sounds false alarms more often. Earlier this year, the Pacific Northwest National Laboratory, part of the U.S. Energy Department, said in a report, ''No other currently available detection technology offers the stability, sensitivity and gamma/neutron discrimination'' of detectors using helium 3. Helium 3 is used to detect neutrons, the subatomic particles that sustain the chain reaction in a bomb or a reactor. Plutonium, the favorite bomb-making material of most governments with nuclear weapons, intermittently gives off neutrons, which are harder for a smuggler to hide than other forms of radiation. The declining supply is also needed for physics research and medical diagnostics. Mr. Miller estimated that demand for helium 3 was about 65,000 liters per year through 2013 and that total production by the only two countries that produce it in usable form, the United States and Russia, was only about 20,000 liters.>

### Helium-3 Good – Homeland Security – He-3 is used significantly throughout the Department of Homeland Security to search for radioactive material trafficking and which require significant amounts of He-3.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Homeland Security

The demand for Helium-3 neutron detectors has increased significantly since 9/11. Helium-3 is used as a neutron detector technology throughout the full spectrum of homeland security instruments, ranging from small 3/8” diameter detectors installed in pager-sized systems to six-foot long detectors installed in large area Radiation Portal Monitors (RPM). GE’s Helium-3 detectors are widely used in radiation pagers, handheld instruments, fission meters, backpacks, mobile systems and RPMs that are deployed to search for and detect the illicit trafficking of fissile radioactive materials. Homeland security systems, particularly the RPMs, require a significant amount of Helium-3.

### IAEA K2 Non-Proliferation – IAEA forms the backbone of the NPT, by far the most widely adhered to legal agreement in the field of disarmament and non-proliferation, and holds cooperating states accountable for nuclear policy declarations.

IAEA 1 – International Atomic Energy Agency, 2001, “IAEA Safeguards: Stemming The Spread Of Nuclear Weapons,” IAEA 2001 Annual Report “Nuclear Security And Safeguards,” IAEA Bulletin, Vol. 43, No. 4, <http://www.iaea.org/Publications/Factsheets/English/S1_Safeguards.pdf>

<The International Atomic Energy Agency (IAEA) was originally intended to be a kind of broker for controlled nuclear assistance and trade. Since 1957 the IAEA has — according to its mandate — ensured “that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.”1 1 Article II of the Statute of the IAEA. Verifying the Peaceful Uses of Nuclear Energy State Commitments to Non-Proliferation The IAEA in Action / Verification IAEA Analytical Laboratory at Seibersdorf / D. Calma, IAEA. Following the completion of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1968, the IAEAhas become the instrument with which to verify that the“peaceful use” commitments made under the NPT or similaragreements are kept through performing what is known as its “safeguards” role. Under the NPT, governments around the world have committed to three common objectives: preventing the proliferation of nuclear weapons; pursuing nuclear disarmament; and promoting the peaceful uses of nuclear energy. The NPT has made it obligatory for all its non-nuclearweapon State parties to submit all nuclear material in nuclear activities to IAEA safeguards, and to conclude a comprehensive safeguards agreement with the Agency. With all but a handful of the world community as Stateparties, the NPT is by far the most widely adhered to legalagreement in the field of disarmament and non-proliferation. The five nuclear-weapon States as identified by the NPT are China, France, the Russian Federation, the United Kingdom and the United States. The more than 180 non-nuclearweapon States that are party to the NPT have pledged not to develop or otherwise acquire nuclear weapons. When comprehensive safeguards agreements first became a requirement under the Treaty for the Prohibition of Nuclear Weapons in Latin America (1967) and subsequently under the NPT (1968), the IAEA established a safeguards standard (reproduced as INFCIRC/153 (Corrected)) suitable for application to both simple nuclear activities and to complex nuclear fuel cycles, i.e. a system applicable to reactors and to conversion, enrichment, fabrication and reprocessing plants which produce and process reactor fuel. The State has an obligation to declare to the IAEA,when the agreement enters into force, all nuclear materialand facilities subject to safeguards under the agreement. The State also has an obligation to update this information and to declare all new nuclear materials and facilities which subsequently become subject to the terms of the agreement. The IAEA uses nuclear material accountancy as its basic measure for safeguarding declared material. The system monitors the quantities of nuclear material present in a nuclear facility and the changes in these quantities that take place over time. In addition, the IAEA analyses all relevant information obtained through verification and from other sources to ensure consistency with State declarations.>

## He3 Advantage---Nuclear Forensics---Impacts

### Radiation Detection Good – While much of the articles which have been detected by the radiation-sensing system would be suited for the development of a refined bomb, much of the material confiscated would be perfect for a dirty bomb which evidence shows Al Qaeda may be building.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<The world, it turns out, is awash in uncontrolled radioactive materials. Most are harmless, but a few are dangerous, and many detectors are still too crude to distinguish among different types of radiation; they ring just as loudly if they locate nuclear-bomb material or contaminated steel or, for that matter, bananas, which emit radiation from the isotope potassium-40. So far, the result has been a cacophony of false alarms, which, in most cases, are caused by naturally occurring radiation that has found its way from soil or rock into manufactured products such as ceramic tiles. In addition, people who have recently received medical treatments with radioactive isotopes such as thorium can set off the detectors. At baseball's All-Star Game in Detroit in 2005, unobserved NEST scientists screened tens of thousands of fans entering the stadium, and their sensors rang just once-reacting to the former Secretary of Energy Spencer Abraham, who was radioactive from a recent doctor's visit. Detritus from nuclear commerce that has slipped through American and international regulatory systems is another periodic source of alarms, and one that has proved to be a greater cause of concern. Virtually none of the loose material detected so far would be useful to a terrorist seeking to build a fission weapon-a bomb of the sort that was dropped on Hiroshima. A disquieting fraction of it, however, might be useful for what the American defense bureaucracy calls a "radioactive dispersal device," more commonly known as a dirty bomb. There is recent evidence, too, that Al Qaeda-inspired radicals are pursuing such a weapon.>

### Dirty Bombs Bad – Dirty bombs deliver radioactive material to a wide region and cause millions of dollars of economic devastation while producing hundreds of deaths in busy city centers.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<The term "dirty bomb" can refer to a wide variety of devices, but generally it describes one that would use a conventional explosive such as dynamite to release radioactive material into the air. The initial explosion and its subsequent plume might kill or sicken a dozen or perhaps as many as a few hundred people, depending on such factors as wind and the bomb-maker's skill. If the weapon was particularly well made, employing one of the most potent and long-lived types of radioactive materials that are used in medicine and in the food industry, it might also cause considerable economic damage-perhaps rendering a number of city blocks uninhabitable. Radioactive ground contamination cannot easily be scrubbed away, so it might be necessary to tear down scores of buildings and cart the rubble to disposal sites. It's easy to imagine what the impact of such an attack would be if the contaminated area was, say, a quarter of the East Village, or the Seventh Arrondissement of Paris.>

### Dirty Bombs Bad – Al Qaeda may very well be developing a dirty bomb as evidenced by Osama bin Laden’s research into uranium, Al Qaeda’s pleas for scientists, and smuggling practices which emphasize transport of dirty bomb components.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

It is common, in defense studies, to evaluate an adversary on the basis of capability and intent. Pakistan has a nuclear-weapons capability, but its government, however fragile it may be, is presumed to have no hostile intentions toward the United States. Al Qaeda, on the other hand, has demonstrated hostile intentions but has little known nuclear capability. Osama bin Laden has declared that the acquisition of nuclear weapons is a religious duty, and it is well documented that he tried to buy uranium during the mid-nineteen-nineties while he was living in Sudan. (Like many other would-be purchasers of black-market nuclear material, he apparently fell victim to a scam.) After September 11th, bin Laden met with Pakistani nuclear scientists to discuss weapons issues. More recently, Al Qaeda-inspired radicals have sought nuclear materials. "We know they have a significant appetite and they have been searching for different materials, in different venues, for the past several years," Vahid Majidi, an assistant director of the F.B.I., who is in charge of the bureau's newly formed weapons-of-mass-destruction directorate, told me. "The question becomes our vigilance and their ability to execute." Last September, the Nuclear Threat Initiative posted a translation of a message that appeared on the Web and was attributed to Abu Ayyub al-Masri, the leader of Al Qaeda in Iraq. The speaker called for experts in "chemistry, physics, electronics, media and all other sciences, especially nuclear scientists and explosives experts." He continued, "We are in dire need of you. . . . The field of jihad can satisfy your scientific ambitions, and the large American bases are good places to test your unconventional weapons, whether biological or dirty, as they call them." The available evidence, then, suggests that while jihadi leaders might like to acquire a proper fission weapon, their pragmatic plans seem to run to dirty bombs-a more plausible ambition. Among other things, the international nuclear black market holds more promise for dirty-bomb builders than for those who are interested in fission weapons. In all the cases of nuclear smuggling reported to the International Atomic Energy Agency since the collapse of the Soviet Union, none have involved significant amounts of fissionable materials. (There have been at least two cases in which a seller possessing small amounts of highly enriched uranium promised that he could get much more but was arrested before the claim could be tested; the most recent of these occurred in the former Soviet republic of Georgia, in 2006.) By comparison, the I.A.E.A. has recorded about three dozen black-market smuggling incidents through 2004 involving radiological isotopes in quantities that would be useful for a destructive dirty bomb, according to European diplomats who have analyzed the records. It would not be simple to build a damaging device with these materials. Still, Peter Zimmerman, who served as the chief scientist of the Senate Foreign Relations Committee from 2001 to 2003, said, "I think there are Al Qaeda people who, given finely divided material, could think of very creative and malicious ways to use it. Why hasn't it happened? The answer is we've been lucky."

### Nuclear Terrorism Bad – According to an article in Foreign Policy, organizations can overcome the constraints of making nuclear weapons with a small group of scientists and an adequate budget with parts which can be ordered over the internet.

Coll 7 – Steve Coll, Pulitzer-Prize Winning President Of New America, March 12, 2007, “The Unthinkable: Can The United States Be Made Safe From Nuclear Terrorism?” The New Yorker, Fact Section, A Reporter At Large, Vol. VV No. 000issue, Lexis: pg. 48

<Building a fission weapon, or even detonating a stolen one, would be a challenging task for conspirators who didn't have a government's budget and infrastructure behind them, but people who are knowledgeable about nuclear weapons believe that it can be done. The most difficult aspect of such a project is acquiring a sufficient amount of highly enriched uranium or plutonium; the engineering work required to make a crude bomb could likely be mastered by a group of scientists-perhaps as few as a dozen. To prove the point, in a recent article in Foreign Policy Jeffrey Lewis and Peter Zimmerman described a hypothetical terrorist plan to build a basic fission weapon on a hundred-and-fifty-acre ranch in a remote area of the United States. Their imaginary budget was ten million dollars, their team would consist of nineteen people, and they found that they could buy many of the parts required over the Internet. Their scheme was inspired by the more ambitious plans of the Japanese terrorist cult Aum Shinrikyo, which explored uranium mining in Australia during the nineteen-nineties before mounting a sarin-gas attack on the Tokyo subway. Any of these cases, however, would require a successful plan to move contraband nuclear materials across international borders; as with the movement of terrorists themselves, borders offer a relatively uncomplicated chance of detection. This ancient principle of defense, more than faith in the technology of radiation sensing, may explain the support that the Bush Administration's detector program has attracted so far.>

Nuclear terrorism by Al-Queda is very likely in the next few years under Zawahiri.

Kanani 11 - Rahim Kanani, Founder And Editor In Chief Of World Affairs Commentary, July 29, 2011, “New al-Qaeda Chief Zawahiri Has Strong Nuclear Intent,” Online: http://blogs.forbes.com/rahimkanani/2011/06/29/new-al-qaeda-chief-zawahiri-has-strong-nuclear-intent/

Rigid, arrogant, unpopular and lacking the necessary charisma to reenergize a battered global terrorist organization, Dr. Ayman al-Zawahri has been continually regarded by U.S. officials and veteran terrorism analysts as incapable of following in the footsteps of Osama bin Laden. Perhaps, but underestimating his ability to orchestrate widespread terror is a dangerous consequence of marginalizing his learned skillset, for we must not discount his former position as al-Qaeda’s deputy chief and operational commander for years. We should be especially worried about the threat of nuclear terrorism under Zawahiri’s leadership. In a recent report titled “Islam and the Bomb: Religious Justification For and Against Nuclear Weapons”, which I researched for and contributed to, lead author Rolf Mowatt-Larssen, former director of intelligence and counterintelligence at the U.S. Department of Energy, argues that al-Qaeda’s WMD ambitions are more powerful than ever. And that “this intent no longer feels theoretical, but operational.” “I believe al-Qaeda is laying the groundwork for a large scale attack on the United States, possibly in the next year or two,” continues Mowatt-Larssen in the opening of the report issued earlier this year by the Belfer Center for Science and International Affairs at Harvard Kennedy School. “The attack may or may not involve the use of WMD, but there are signs that al-Qaeda is working on an event on a larger scale than the 9/11 attack.” Most will readily dismiss such claims as implausible and unlikely, and we hope they are right, but after spending months with Mowatt-Larssen, who also served as the former head of the Central Intelligence Agency’s WMD and terrorism efforts, scrutinizing and cross-referencing Zawahiri’s 268-page treatise published in 2008 titled “Exoneration”, the analytics steered us towards something far more remarkable than expected. “As I read the text closely, in the broader context of al-Qaeda’s past, my concerns grew that Zawahiri has written this treatise to play a part in the ritualistic process of preparing for an impending attack,” states Mowatt-Larssen. “As Osama bin Laden’s fatwa in 1998 foreshadowed the 9/11 attack, Ayman Zawahiri’s fatwa in 2008 may have started the clock ticking for al-Qaeda’s next large scale strike on America. If the pattern of al-Qaeda’s modus operandi holds true, we are in the middle of an attack cycle.” Among several important findings, Zawahiri sophisticatedly weaves identical passages, sources and religious justifications for a nuclear terrorist attack against the United States previously penned by radical Saudi cleric Nasir al Fahd. Indeed, the language used, research cited, and arguments put forth are nothing short of detailed and deliberate. Reading as both a religious duty to kill millions of Americans and a lengthy suicide note together, this piece of literature is something we must take seriously with Zawahiri now at the helm of al-Qaeda. The time may have come for al-Qaeda’s new CEO to leave a legacy of his own. Concluding the author’s note, Mowatt-Larssen states, “Even if this theory proves to be wrong, it is better to overestimate the enemy than to under­estimate him. Conventional wisdom holds that al-Qaeda is spent—that they are incapable of carrying out another 9/11. Leaving aside whether this view is correct, for which I harbor grave doubts, we will surely miss the signs of the next attack if we continue to overestimate our own successes, and dismiss what terrorists remain capable of accomplishing when they put their minds to it.” We must remember that Zawahiri’s arrogance and rigidness are not substitutes for determination and will.

## He3 Advantage---Shale Fields---1AC

### 1. No Helium-3 Now/Helium-3 K2 Shale Fields – Helium-3 supply failures have resulted in a national crisis in US natural gas resources.

Lobsenz 10 – George Lobsenz, Executive Editor of Energy Daily, April 23, 2010, “DoE Helium Shortage Hits Nuke Security, Oil, And Gas Industry,” Defense Daily, Vol. 246 No. 16, Lexis

<The Energy Department's failure to recognize an impending supply squeeze for helium-3--a nonradioactive gas produced in the agency's nuclear weapons complex--has created a national crisis requiring White House intervention and threatening key U.S. nuclear and homeland security programs, a wide range of medical and scientific research activities and development of U.S. oil and natural gas resources, a House subcommittee was told yesterday. The testimony before the House Science and Technology Committee's investigations and oversight subcommittee revealed that DoE and other federal officials only fully grasped the situation in 2008, and that fast-dwindling helium-3 supplies forced the government last year to begin rationing the gas, which has unique neutron detection and refrigerant capabilities that cannot be provided by other substances in some research and industrial applications. And in a growing snowball of real-world impacts, the sudden helium shortage already has: --Disrupted international nonproliferation efforts led by the International Atomic Energy Agency that use helium-based devices to track and safeguard sensitive nuclear materials; --Slowed Department of Homeland Security (DHS) and DoE programs to deploy radiation detection machines at airports, seaports and border crossings --Delayed a huge swath of cutting-edge scientific research, ranging from superconductivity to nanotechnology to quantum computing; --Curtailed operations at some neutron-scattering facilities overseas, although similar DoE facilities such as the Spallation Neutron Source at Oak Ridge, Tenn., have sufficient helium for planned operations through fiscal year 2014. --Jeopardized progress on new lung imaging techniques that promise better treatment methods for respiratory disease; and --Forced oil well services companies to scramble for helium-3 devices that are critical to assessing and developing underground oil and gas reservoirs, including the nation's fast-growing shale gas fields.Officials from all those industrial and research sectors, as well as a General Electric [GE] official in charge of that company's radiation detector production unit, said they only learned of the helium-3 shortage last year and now were scrambling to develop alternative technologies and, where possible, recycling methods for helium-3.>

2AC Extension – Helium-3 K2 Shale Fields

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Oil and Gas

Helium-3 neutron detectors are also widely used in oil and gas exploration. These detectors are used in conjunction with a neutron source to locate hydrogenous materials such as oil, natural gas, and water. Neutron measurements in conjunction with inputs from other drill string instruments are used to locate hydrocarbon reservoirs during drilling, and to further delineate the reservoirs during logging operations. The overwhelming majority of nuclear porosity tools used in the oil and gas industry today depend on the unique properties of Helium-3 neutron detectors.

Helium-3 neutron detectors have high neutron sensitivity, which enables them to be packaged to fit inside the tool string. The excellent gamma discrimination characteristic of Helium-3 means that background gamma radiation levels do not interfere with the accuracy of the neutron measurements. These detectors must also operate reliably and survive at temperatures up to 200oC under severe vibration and shock levels up to 1,000 times the force of gravity. It is likely that without Helium-3, exploration for new reserves, development drilling of existing fields, and logging of both new and existing wells will be severely curtailed until an alternative technology is developed.>

### 2. Shale Mining Good – Shale gas will prevent the development of energy cartels by reducing reliance on foreign energy supplies.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

<In short, the skeptics are missing the bigger picture—the picture I think is the much more likely one. Here's a closer look at what I'm talking about, and how I believe the boom in shale gas will shake up the world. One of the biggest effects of the shale boom will be to give Western and Chinese consumersfuel supplies close to home—thus avoiding a potential natural-gas cartel. Remember: Prior tothe discovery of shale gas, huge declines were expected in domestic production in U.S.,Canada and the North Sea. That meant an increasing reliance on foreign supplies—at a timewhen natural gas was becoming more important as a source of energy. Even more troubling, most of those gas supplies were located in unstable regions. Two countries in particular had a stranglehold over supply: Russia and Iran. Before the shalediscoveries, these nations were expected to account for more than half the world's known gasresources.Russia made no secret about its desire to leverage its position and create a cartel of gasproducers—a kind of latter-day OPEC. That seemed to set the stage for a repeat of the oil issues that have worried the world over the past 40 years. As far as I'm concerned, you can now forget all that. Shale gas will breed competition amongenergy companies and exporting countries—which in turn will help economic stability inindustrial countries, and thwart petro-suppliers that try to empower themselves at our expense.Market competition is the best kryptonite for cartel power. For one measure of the coming change, consider the prospects for liquefied natural gas, which has been converted to a liquid so it can be carried in a supertanker like oil. It's the easiest wayto move natural gas very long distances, so it gives a good picture of how much countries arerelying on foreign supplies. Before the shale discoveries, experts expected liquefiednatural gas, or LNG, to account for half of the internationalgas trade by 2025, up from 5% in the 1990s. With theshale boom, that share will be more like one-third. In the U.S., the impact of shale gas and deep-water drillingis already apparent. Import terminals for LNG sit virtuallyempty, and the prospects that the U.S. will become evenmore dependent on foreign imports are receding. Also, soaring shale-gas production in the U.S. has meant thatcargoes of LNG from Qatar and elsewhere are going toEuropean buyers, easing their dependence on Russia. So,Russia has had to accept far lower prices from formerlycaptive customers, slashing prices to Ukraine by 30%, forinstance.>

### Scenario 1: Red Spread

### 1. Shale Mining Good – Denying Russia the use of energy exports as a political lever leads to a smaller Russian sphere of influence.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

<But the political fallout from shale gas will do a lot more than stifle natural-gas cartels. It will throw world politics fora loop—placing some longtime troublemakers in their placeand possibly bringing some rivals into the Western fold. Again, remember that as their energy-producing influence grew, nations like Russia, Venezuela and Iran becamemore successful in resisting Western interference in their affairs—and exporting their ideologies and strategicagendas through energy-linked deal-making and threats ofcutoffs.In 2006 and 2007, disputes with Ukraine led Russia to cutoff supplies, leaving customers in Kiev and Western Europebriefly without fuel in the dead of winter. That cutoffeffectively shifted Ukraine's internal politics: The countryturned away from the pro-NATO, anti-Moscow candidateand toward a coalition more to Moscow's liking. It looked like the U.S. and Europe would see their globalpower eclipse as they kowtowed to their energy suppliers. But shale gas is going to defang the energy diplomacy ofpetro-nations. Consuming nations throughout Europe andAsia will be able to turn to major U.S. oil companies andtheir own shale rock for cheap natural gas, and tell theChavezes and Putins of the world where to stick theirsupplies—back in the ground.

Europe, for instance, receives 25% of itsnatural-gas supply via pipelines from Russia,with some consumers almost completelydependent on the big supplier. In the wake of Russia's strong-arming of Ukraine, Europehas been actively diversifying its supply, andshale gas will make that task cheaper andeasier.Shale-gas resources are believed to extend into countries such as Poland, Romania, Sweden, Austria, Germany—and Ukraine. Once European shale gas comes, theKremlin will be hard-pressed to use its energy exports as a political lever.>

### 2. Red Spread Bad – Generic Card

### Scenario 2: Iran Proliferation

### 1. Shale Mining Good – Once Europe is free from Iran’s nuclear hold, Tehran may rethink nuclear policy.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

<I would also argue that greater shale-gas production in Europe will make it harder for Iran toprofit from exporting natural gas. Iran is currently hampered by Western sanctions againstinvestment in its energy sector, so by the time it can get its natural gas ready for export, themarketing window to Europe will likely be closed by the availability of inexpensive shale gas. And that may lead Tehran to tone down its nuclear efforts. Look at it this way: If Iran can't sellits gas in Europe, what options does it have? Piping to the Indian subcontinent is impractical,and LNG markets will be crowded with lower-cost, competing supplies. It's admittedly a long shot, but if the regime acts rationally, it will realize it has a chance to winsome global goodwill by shifting away from nuclear-power efforts—and using its cheap naturalgassupplies to generate electricity at home. Overall, the Middle East might get a bit poorer as gas eats into the market for oil. If the drop in revenue is severe enough, it could bring instability.>

### 2. Iran Proliferation Bad – Generic Card

### Scenario 3: US-China Relations

### 1. Shale Mining Good – US-China relations are increased when China is freed from problematic energy partners.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

<Shale-gas development could also mean big changes for China. The need for energy importshas taken China to problematic nations such as Iran, Sudan and Burma, making it harder for theWest to forge global policies to address the problems those countries create. But with newlyaccessible natural gas available at home, China could well turn away from imports—and the hotspots that produce them. The less vulnerable China is to imported oil and gas, the more likely it would be to supportsanctions or other measures against petro-states with human-rights problems or aggressiveagendas. Moreover, the less Beijing worries about U.S. control of sea lanes, the easier it will befor the U.S. and China to build trust. So, domestic shale gas for China may help integrateBeijing into a Pax Americana global system.>

### 2. US-China Relations Good – Generic Card

## He3 Advantage---Shale Fields---Impacts

### Shale Mining Good – While many people are unconvinced of shale-gas exploration, fears of high costs are discounted by existing new technology and fears of environmental pollution are overplayed fears.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

<To be sure, plenty of people (including Russian Prime Minister Vladimir Putin and many Wall Street energy analysts) aren't convinced that shale gas has the potential to be such a game changer. Their arguments revolve around two main points: that shale-gas exploration is tooexpensive and that it carries environmental risks. I'd argue they are wrong on both counts. Take costs first. Over the past decade, new techniques have been developed that drastically cut the price tag of production. The Haynesville shale, which extends from Texas into Louisiana, is seeing costs as low as $3 per million British thermal units, down from $5 or more in the Barnett shale in the 1990s. And more cost-cutting developments are likely on the way as major oilcompanies get into the game. If they need to do shale for $2, I am willing to bet they can, in thenext five years.When it comes to environmental risks, critics do have a point: They say drilling for shale gasruns a risk to ground water, even though shale is generally found thousands of feet below the water table. If a well casing fails, they argue, drilling fluids can seep into aquifers. They're overplaying the danger of such a failure. For drilling on land, where most shale-gasdeposits are, the casings have been around for decades with a good track record. But waterpollution can occur if drilling fluids are disposed of improperly. So, regulations and enforcementmust be tightened to ensure safety. More rules will raise costs—but, given the abundance ofsupply, producers can likely absorb the hit. Already, some are moving to nontoxic drilling fluids, even without imposed bans. But the skeptics aren't just overstating theobstacles. They're missing two much bigger points. For one thing, they're ignoring history: The reserves and production of new energyresources tend to increase over time, notdecrease. They're also not taking into account how quickly public opinion canchange. The country can turn on a dime andembrace a cheaper energy source, castingaside political or environmental reservations. This has happened before, with the rapidspread of liquefied-natural-gas terminals overthe past few years.>

### Shale Mining Good – Shale gas will free Western and Chinese consumers from fuel controlling nations by developing competition among energy companies and developing domestic sources of energy which will prevent the development of powerful energy cartels.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

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### Shale Mining Good – Shale gas exploration will drive down liquefied gas imports significantly easing American and European dependence on Russia who will be forced to slash prices as is already happening now.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

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### Shale Mining Good – The political fallout from shale gas will help bring rivaling nations into the Western fold just as when Russia used energy to leverage nations catalyzing cooperation with the US.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

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### Shale Mining Good – Freeing Europe from Iran’s energy clutches will help develop credibility to US-led sanctions and may convince Iran to shift away from nuclear building efforts.

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### Shale Mining Good – With newly accessible domestic natural gas, China could turn away from imports and become integrated into the Pax Americana global system with renewed relations between Beijing and Washington.

Jaffe 10 – Amy Meyers Jaffe, Wallace S. Wilson Fellow for Energy Studies at the James A. Baker III Institute for Public Policy at Rice University And Co-Author of "Oil, Dollars, Debt and Crises: The Global Curse of Black Gold,” May 10, 2010, “Shale Gas Will Rock The World,” Wall Street Journal, <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html>

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### Shale Mining Good – Even if shale mining reduces subsidies going towards renewable energy, shale energy will allow us in the long run by investing in R&D which will help us implement efficient renewable energy sources down the road.

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<With natural gas cheap and abundant, the prospects for renewable energy will change just as drastically. I have been a big believer that renewable energy was about to see its time. Prior to the shale-gas revolution, I thought rising hydrocarbon prices would propel renewables and nuclear power into the marketplace easily—albeit with a little shove from a carbon tax or a capand- trade system. But the shale discoveries complicate the issue, making it harder for wind, solar and biomass energy, as well as nuclear, to compete on economic grounds. Subsidies that made renewables competitive with shale gas would get more expensive, as would loan guarantees and incentives for new nuclear plants. Shale gas also hurts the energy-independence argument for renewables: Shale gas is domestic, just like wind and solar, so we won't be shipping those dollars to the Middle East. But that doesn't mean we should stop investing in renewables. As large as our shale-gas resources are, they're still exhaustible, and eventually we will still need to transition to energy that is cleaner and more plentiful. So, what should we do? First, avoid the urge to protect coal states and let cheaper natural gas displace coal, which accounts for about half of all power generated in the U.S. Ample natural gas for electricity generation could also make it easier to shift to electric vehicles—once again helping the environment and lessening our dependence on the Middle East. Then, I think we still need to invest in renewables—but smartly. States with renewable-energy potential, such as windy Texas or sunny California, should keep their mandates that a fixed percentage of electricity must be generated by alternative sources. That will give companies incentives and opportunities to bring renewables to market and lower costs over time through experience and innovation. Yes, renewables may seem relatively more expensive in those states as shale gas hits the market. And, yes, that may mean seeking more help from government subsidies. But I don't think the cost would be prohibitive, and the long-term benefits are worth it. Still, I don't believe we should set national mandates—which would get prohibitively expensive in states without abundant renewable resources. Instead of pouring money into subsidies to make such a plan work, the federal government should invest in R&D to make renewables competitive down the road without big subsidies. \*\*\* In the end, what's important to understand is that shale gas may be the key to solving some of our most pressing short-term crises, a way to bridge the gap to a more-secure energy and economic future. The trade deficit has crippled our economy and shows no signs of abating as long as we remain tethered to imported energy. Why ship dollars abroad where they can destabilize global financial markets—and then hit us back in lost jobs and savings—when we can develop the resources we have here in our own country? Shall we pay Vladimir Putin and Mahmoud Ahmadinejad>

## He3 Advantage---Shale Fields---2AC Extensions

### 2AC 1 – Helium-3 key to national gas industry activity.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Oil and Gas

Helium-3 neutron detectors are also widely used in oil and gas exploration. These detectors are used in conjunction with a neutron source to locate hydrogenous materials such as oil, natural gas, and water. Neutron measurements in conjunction with inputs from other drill string instruments are used to locate hydrocarbon reservoirs during drilling, and to further delineate the reservoirs during logging operations. The overwhelming majority of nuclear porosity tools used in the oil and gas industry today depend on the unique properties of Helium-3 neutron detectors.

Helium-3 neutron detectors have high neutron sensitivity, which enables them to be packaged to fit inside the tool string. The excellent gamma discrimination characteristic of Helium-3 means that background gamma radiation levels do not interfere with the accuracy of the neutron measurements. These detectors must also operate reliably and survive at temperatures up to 200oC under severe vibration and shock levels up to 1,000 times the force of gravity. It is likely that without Helium-3, exploration for new reserves, development drilling of existing fields, and logging of both new and existing wells will be severely curtailed until an alternative technology is developed.>

### 2AC 2 – Expanding shale gas production will allow nations to reduce dependence on the Middle East, North Africa, and Russia.

Medlock 11 – Kenneth B. Medlock III, Ph.D., is the James A. Baker, III, and Susan G. Baker Fellow in Energy and Resource Economics at the Baker Institute, 2011, “Impact of Shale Gas Development on Global Gas Markets,” Wiley Periodicals, Online: <http://www.rice.edu/energy/publications/docs/EF-pub-MedlockWileyShaleGas-042011.pdf>

Geopolitically, the repercussions of expanding production potential of shale gas are equally pro­found. To begin, LNG exports originate from a di­versity of sources (see Exhibit 4), with Qatar being the largest LNG exporter and Australia a dose sec­ond. Nigeria, Iran, and Venezuela each grow to po­sitions of prominence, collectively accounting for about 28 percent of global LNG exports by 2035-Notabry, however, this occurs about 15 years later than in Rice World Gas Trade Model cases we have examined in which the revelations about shale are assumed to have never come to pass. Thus, shale gas, by displacement, not only has spatial impacts on the global gas market, but also temporal im­pacts. More specifically, shale gas delays the world's reliance on regions that have historically been vola­tile, and, in the case of the United States, growth in LNG import reliance is shifted by over two de­cades.3 Thus, shale production yields security ben­efits more broadly than just to the United States. The emergence of shale gas also limits the near-term possibility of a successful natural gas cartel being formed by the countries involved in the Gas Exporting Countries Forum (GECF) by increasing the elasticity of supply of natural gas in countries outside the GECF, thereby reduc­ing the monopoly power that could be exerted by a cartel on the market. Moreover, to the extent that shale gas resources are made more available globally, consuming nations throughout Europe and Asia will be able to reduce dependence on more geopolitically risky sources of supply from the Middle East, North Africa, and Russia. The emergence of shale gas also limits the near-term possibility of a successful natural gas cartel being formed by countries involved in the Gas Ex-porting Countries Forum.

### 2AC 2 – Gas accessibility will prevent the formation of any potential natural gas cartel.

Katz 10 - Diane Katz, July/August 2010, “Shale Gas: A Reliable And Affordable Alternative To Costly “Green” Schemes,” The Economist, Fraser Institute, Online: [http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/articles/shale-gas-reliable-affordable-alternative(1).pdf](http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/articles/shale-gas-reliable-affordable-alternative%281%29.pdf)

The new accessibility to shale gas will also moderate the influence of OPEC and any potential natural gas cartel by providing affordable and reliable alternative sources of energy. Indeed, US production of natural gas in March hit an historical monthly high of 2.31 trillion cubic feet, topping Russia to become the largest producer in the world (Energy Information Administration, 2009). Consequently, natural gas exports once headed to North America are instead heading to Europe, thereby forcing Russia to lower prices for its once-captive customers (Fine, 2010).

### Red Spread 1 – Gas will prevent Russia from monopolizing Eastern Europe.

Fine 10 – Dr. Daniel Fine, Ph.D Mining And Minerals Resources Institute At MIT, 2010, “The Impact Of Shale Gas Technology On Geopolitics,” Fletcher Institute, Online: http://fletcher.tufts.edu/news/2010/04/features/fine.shtml

Substitution away from imported gas by the United States will impact Russia, the world’s largest exporter of natural gas, where gas production is controlled almost exclusively by government-run Gazprom. Moreover, Chevron has signed an agreement with Poland to search for and extract natural gas there, and similar arrangements have apparently been made in Romania. “When Chevron announces that they have gas [in Poland],” Dr. Fine said, “then Russia is shut out,” and will no longer be able to act as a near-monopoly supplier of gas in Eastern Europe.

## He3 Advantage---Shale Fields---2AC Add-Ons

### 3 Internal Links:

### 1. Energy subsidies.

Katz 10 - Diane Katz, July/August 2010, “Shale Gas: A Reliable And Affordable Alternative To Costly “Green” Schemes,” The Economist, Fraser Institute, Online: [http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/articles/shale-gas-reliable-affordable-alternative(1).pdf](http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/articles/shale-gas-reliable-affordable-alternative%281%29.pdf)

Governments at every level across North America are collectively showering billions of tax dollars on “green energy” schemes in an effort to avert global warming and end our “dependence on foreign oil.” But in the political arena, there is precious little attention being paid to a far more affordable alternative energy source with great potential to reduce both fossil fuel emissions and imports of Middle Eastern oil. In contrast to government tax breaks, preferential loans, grants, and other forms of subsidies to wind and solar projects, private investors are moving capital into the production of “shale gas.” 1 Trapped within dense sedimentary rock, this “unconventional” 2 natural gas was for decades considered too costly to retrieve. But advances in drilling technologies, along with the rising cost of conventional natural gas, have transformed the economics of shale gas extraction. Consequently, the vast stores of shale gas buried a thousand metres or more below the surface of North America (and beyond) have the potential to dramatically alter both environmental politics and geopolitics.

### 2. Oil-independent economic growth.

Medlock 11 – Kenneth B. Medlock III, Ph.D., is the James A. Baker, III, and Susan G. Baker Fellow in Energy and Resource Economics at the Baker Institute, 2011, “Impact of Shale Gas Development on Global Gas Markets,” Wiley Periodicals, Online: <http://www.rice.edu/energy/publications/docs/EF-pub-MedlockWileyShaleGas-042011.pdf>

POTENTIAL FOR SHALE AND ITS GEOPOLITICAL IMPLICATIONS In general, natural gas stands to play a very im­portant role in the primary energy mix for decades to come. Moreover, as long as access is not greatly restricted, domestic natural gas resources should keep the United States relatively free of any sig­nificant LNG imports for the next couple of de­cades, a result that is borne out in modeling done at BIPP using the Rice World Gas Trade Model (RWGTM). In fact, our work indicates that LNG import terminals will realize load factors below 25 percent into the 2030s. This is a direct result of shale production growth, indicated in Exhibit 2, which by 2030 accounts for just under 50 percent of US Lower 48 production.2 In fact, recent analysis at BIPP indicates that shale gas production could push annual US pro­duction to about 28 trillion cubic feet in the mid-20305, with the strongest growth coming in two basins—the Marcellus and Haynesville shales. In Canada, broad declines in the Western Canadian Sedimentary Basin are offset by strong growth in the Montney shale and Horn River shale. Overall, this is a much more robust oudook for domestic production than most held just five to ten years ago. The implications of a large domestic resources base are both diverse and potentially profound. To begn, domestic gas prices should be relatively stable, particularly if the long-run supply curve is indeed highly elastic (i.e., long and relatively flat). This does not rule out periodic volatility, but the central tendency of price should be toward the long-run marginal cost of supply, meaning do­mestic gas prices should remain relatively stable. This underlies the result seen in Exhibit 3> where the price at Henry Hub increases from its current levels but remains, on an average annual basis, in the mid-$5 to mid-$6 range. These relatively low and stable prices also encourage demand growth, particularly as utilities and industrial consumers increasingly invest in gas-using equipment and technologies. Notably, this opens avenues for eco­nomic activity that are not tied to oil, a prospect that could be welcome in the coming years.

### 3. Job growth.

Fine 10 – Dr. Daniel Fine, Ph.D Mining And Minerals Resources Institute At MIT, 2010, “The Impact Of Shale Gas Technology On Geopolitics,” Fletcher Institute, Online: http://fletcher.tufts.edu/news/2010/04/features/fine.shtml

Dr. Daniel Fine of the Mining and Minerals Resources Institute at MIT addressed Fletcher students at a talk sponsored by the International Security Studies Program and offered his insights into how the development of new technology will allow the United States to tap vast, previously inaccessible, resources of natural gas that will impact everything from the price of gasoline to the ability of Chinese companies to buy equity in Russian natural gas fields. The United States has a monopoly on “hydro-fracing” technology. The technology, short for hydraulic fracturing, releases natural gas trapped in shale deposits by injecting the deposits with high-pressure water mixed with sand and small amounts of chemical additives. According to Dr. Fine, the “cloud over gas” used to be “do we have enough gas?” In 2003, Federal Reserve Chairman Alan Greenspan declared that the United States did not have enough natural gas, and that it would be necessary to import liquid natural gas (LNG). This, said Dr. Fine, was clearly a mistake in the light of the new hydro-facing technology, not only because importing LNG poses a security risk to the United States, but because tapping natural gas from shale represents an economic “bonanza” in “the most [economically] repressed parts of the country:” western New York, western Pennsylvania and West Virginia, areas which suffer from high rates of unemployment, and are estimated to host 490 trillion cubic feet of natural gas. The thousands of jobs that could be created in these areas could stand in the way of President Obama’s pursuit of subsidies for renewable energy.

### 4. Economy Good – Generic Impact Card

## He3 Advantage---Nuclear Energy---1AC

### 1. Helium-3 K2 Nuclear Fusion - Fusion development is dependent upon a vast supply of helium-3.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 22

<The possibility of a Helium-3 fueled lunar economy was mentioned previously. In order for this to be a possibility fusion technology must be advanced beyond the current very small scale reactions being achieved (Schmitt). One problem with this plan of waiting for fusion technology to develop before establishing a lunar base is that fusion without Helium-3 is very much less desireable. Using common deuterium fusion plans, power plants would actually produce more nuclear waste per kilowatt hour than a nuclear fission plant of comparable size would (Schmitt 41). Thus fusion technology is somewhat dependent on having a large supply of He-3 while at the same time, getting He-3 from the Moon is depending on having large scale fusion plants operational. Only time will tell which occurs first, but with additional funding, and a He-3 source its likely fusion power could be figured out.>

### 2. Nuclear Fusion K2 Energy – Pure helium-3-based nuclear energy can power Earth for 500 years.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg.

<2. Outer Space's Potential to Create Innovative Energy Solutions

Many nations in the international community have begun to strongly emphasize the need to develop energy solutions that reduce the world's reliance on fossil fuels.n162 Many theories have been advanced, n163 and it is possible that the most workable theories have yet to be conceived. However, the proposed helium-3 fusion reactor is an intriguing thought which deserves some attention.

Helium-3 is a helium isotope that is rare on Earth but is believed to be abundant on the Moon.n164 The Apollo program's research [\*506] on the lunar surface indicated that microwaves could be used to draw helium-3 out of the Moon's surface. n165Once removed, the isotope can be used in a fusion reaction that is cheap to produce, long lasting, and produces nominal amounts of radioactive waste. n166 One group of physicists theorizes that the total amount of helium-3 on the Moon could meet the totality of Earth's energy needs for 500 years. n167>

2AC Extension

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<A REASON TO RETURN Throughout history, the search for precious resources—from food to minerals to energy—inspired humanity to explore and settle ever-more-remote regions of our planet. I believe that helium-3 could be the resource that makes the exploration of our moon both feasible and desirable. Although quantities suffi cient for research exist, no commercial supplies of helium-3 are present on Earth. If they were, we probably would be using them to produce electricity today. The more we learn about building fusion reactors, the more desirable a helium- 3-fueled reactor becomes. Researchers have tried several approaches to harnessing the awesome power of hydrogen fusion to generate electricity. The stumbling block is finding a way to achieve the temperatures required to maintain a fusion reaction. All materials known to exist melt at these surface-of-thesun temperatures. For this reason, the reaction can take place only within a magnetic containment field, a sort of electromagnetic Thermos bottle. Initially, scientists believed they could achieve fusion using deuterium, an isotope of hydrogen found in seawater. They soon discovered thatsustaining 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 fi rst time. It is not a lack of engineering skill thatprevents 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 fi eld 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 colonies; it could yield enormous benefits back on Earth.>

### 3. No Energy Now/Energy Good – Multiple Impacts

Rhodes And Beller 2K – Richards Rhodes, Author And Editor of 23 Nuclear Weapons Books, Denis Beller, UNLV M.S. In Materials And Nuclear Engineering Program, January-February 2000, “The Need For Nuclear Power,” Foreign Affairs, Vol. 79, No. 1, pg. 30-44, JSTOR

<A CLEAN BREAK The world needs more energy. Energy multiplies human labor, increasing productivity. It builds and lights schools, purifies water, powers farm machinery, drives sewing machines and robot assemblers, stores and moves information. World population is steadily increasing, having passed six billion in 1999. Yet one-third ofthat number?two billion people?lack access to electricity. Development depends on energy, and the alternative to development is suffering: poverty, disease, and death. Such conditions create instability and the potential for widespread violence. National security therefore requires developed nations to help increase energy production in their more populous developing counterparts. For the sake of safety as well as security, that increased energy supply should come from diverse sources. "At a global level," the British Royal Society and Royal Academy of Engineering estimate in a 1999 report on nuclear energy and climate change, "we can expect our consumption of energy at least to double in the next 50 years and to grow by a factor of up to five in the next 100 years as the world population increases and as people seek to improve their standards of living." Even with vigorous conservation, world energy production would have to TRIPLE by 2050 to support consumption at a mere one-third of today's U.S. percapita rate. The International Energy Agency (iea) of the Organization for Economic Richard Rhodes is the author of The Making ofthe Atomic Bomb, Dark Sun, and other books. Denis Beller is a nuclear engineer and Techni cal Staff Member at the Los Alamos National Laboratory. [30] The Need for Nuclear Power Cooperation and Development (oecd) projects 65 percent growth in world energy demand by 2020, two-thirds ofthat coming from devel oping countries. "Given the levels of consumption likely in the future/' the Royal Society and Royal Academy caution, "it will be an immense challenge to meet the global demand for energy without unsustainable long-term damage to the environment." That damage includes surface and air pollution and global warming.>

### 4. Climate Change Outweighs

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<Arguably, the problem of climate change is dramatically more important than that of energy security, although that may not be the case for politicians who must face voters with an increasingly acute concern about energy prices and availability. The worst possible outcome for states that fail to secure energy supplies concurrent with their domestic needs is a contraction in the quantity of energy-intensive work that can be done. By contrast, the worst possible outcome from climate change is a situation in which natural carbon sinks become self-amplifying net sources of carbon, producing a runaway climate change effect ultimately leading to a world very hostile to human life. The prior existence of such inhospitable climates, as documented in paleoclimatic records, demonstrates that climatic forcings of a certain type and magnitude can be amplified into massive shifts in the climate system.2 Even non-runaway climate change outcomes could prove devastating for the global economy as well as international peace and security, particularly if large-scale reductions in water availability or major agricultural impacts emerge on regional or continental scales.>

2AC Extension – Climate Change Outweighs

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<The Seriousness of Climate Change The need to massively reduce global greenhouse gas emissions is clear and urgent. According to the Fourth Assessment Report of the IPCC, stabilizing the atmospheric concentration of greenhouse gasses at a level consistent with the European Union’s target of less than 2˚c of global temperature change requires massive reductions. Even at 2˚c of change, the IPCC predicts wide-ranging and serious impacts.12 Stabilizing concentrations means cutting emissions of all greenhouse gasses to a level where net absorption by sinks equals net global production. The level at which stabilization occurs determines what level of warming will occur. Two different stabilization scenarios offer a glimpse of the relationship between stabilization concentration, temperature change, and difficulty of implementation: Stabilization at 450 Parts Per Million (PPM) of Carbon Dioxide Equivalent: According to the IPCC, stabilization between 445 and 490 ppm would likely produce temperature increases of between 2.0˚c and 2.4˚c by 2100. Stabilizing at 450 ppm would require that global emissions peak by 2010 and fall by seven per cent per year thereafter, falling to seventy per cent below 2005 va--lues by 2050. A study by Malte Meinshausen uses ipcc estimates about the relationship between stabilization and temperature change to estimate that there is a risk of between twenty-six per cent and seventy-eight per cent (mean forty-eight per cent) that mean global temperature change will exceed two degrees under this scenario.13 Stabilization at 550 PPM: According to the IPCC, stabilization between 535 and 590 ppm would likely produce temperature increases of between 2.8˚c and 3.2˚c by 2100. This would require emissions to peak between 2016 and 2026, then fall at a rate of one to three per cent per year, reaching levels twenty-five per cent below 2006 levels by 2050. The Meinshausen study 98 projects a risk of between sixty-eight per cent and ninety-nine per cent that the two degree target will be exceeded, with a mean estimate of eighty-five per cent.Another way to consider the problem is to decide upon a maximum level of acceptable temperature rise. By using that figure and estimates of the sensitivity of the climate to carbon dioxide, it is possible to determine how many carbon emissions humanity can produce while not exceeding the temperature threshold. Taking the 2.0˚c target for temperature change adopted by the European Union, and using the climatic sensitivities at the upper and lower bound of the probable range determined by the ipcc, the total quantity of carbon dioxide that humanity can emit between the present day and the point where global society is carbon neutral is estimated between 484 and 661 billion tonnes of carbon – a figure that includes all emissions from both developed and developing states.14 Annual emissions of carbon are already ten billion tonnes per year (thirty-six billion tonnes of carbon dioxide) and increasing at around 3.5 per cent per year, despite the significant increase in fossil fuel prices. Given the definition of probability used by the ipcc, the 661 billion tonne figure only corresponds to a sixty-six per cent chance of avoiding a temperature increase of over 2.0˚c, and it must be recalled that the emergence of strong positive feedback loops could boost climatic sensitivity well outside this range. Indeed, scientists including James Hansen have argued that stabilization below 350ppm is necessary to avoid dangerous anthropogenic climate change. According to the The Economics of Climate Change: The Stern Review, a business-as-usual scenario in which emissions continue to increase at the present rate would likely result in 2.0˚c to 3.0˚c degrees of warming by 2050 and concentrations well over 1000 ppm by 2100, with probable temperature increases of more than 5.0˚c.15 To put this in context, the temperature difference between the world at present and that prevailing during prior ice ages was between 3.5°c and 5.0°c.16>

### 5. Helium-3 Nuclear Fusion Solvency – He-3 is comparatively best fuel source for nuclear fusion for 5 reasons.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 252-254

<For a number of reasons, including the limited terrestrial availability of He-3 and the very high temperatures required to achieve He-3-based fusion, most current research, and any first generation fusion power reactors, will likely be based on a fuel cycle involving the fusion of deuterium ("D") and tritium ("T"), two isotopes of hydrogen available on Earth and capable of fusing at considerably lower temperatures.25 However, an He-3-D fuel cycle, if and when technically achievable, theoretically offers significant advantages as compared with the D-T fuel cycle. Unlike a D-T fusion reaction, which results in considerable neutron radiation, and He-S-D fusion reaction would produce little radioactivity and a substantially higher proportion of directly usable energy.26 More specifically, the comparativeadvantages of an He-3-D fuel cycle over a D-T fuel cycle would include: (1) increased electrical conversion efficiency; (2) reduced radiation damage to containment vessels, obviating the need for frequent expensive replacement; (3) reduced radioactive waste, with consequent reduced costs of protection and disposal; (4) increased levels of safely in the event of accident; and (5) potentially lower costs of electricity production.27 In particular, an Hc-3-D fuel cycle would significantly reduce the risk of nuclear proliferation because an He-3-D reaction, unlike a D-T reaction would produce few neutrons and could not be readily employed to produce plutonium or other weapons-grade fissile materials.28 Consequently, interest in developing He-3-fucled thermonuclear energy is likely to continue.>

## He3 Advantage---Nuclear Energy---Uniqueness

### 1. Nuclear Power Inevitable Now – Many nations are looking towards nuclear fission power as fossil fuel prices climb.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<IV. CLIMATE CHANGE HAS NEVERTHELESS REVIVED THE CIVILIAN NUCLEAR ENERGY OPTION. Climate change concerns have reversed nuclear energy use trends in OECD nations, boosted expansion plans in OECD Pacific, and rejuvenated commercial, civilian nuclear energy use in non-OECD nations such as India. Climate change has revived the nearly dormant nuclear industry for at least two important and obvious reasons. First, nuclear power plants do not spew large amounts of harmful emissions, among them greenhouse gas emissions that cause global warming. According to one IAEA estimate, nuclear technology could potentially reduce the proportionate emissions share of power plants by about forty percent. (46) The MIT study predicts that based on current projections, nuclear energy could reduce up to a 25% increment in coal use by 2050. (47) OECD's Nuclear Energy Agency (OECD-NEA) estimates that continuous nuclear energy development could eliminate nearly 200 Gigatonnes (Gt) of C[O.sub.2] by 2050, as opposed to 100Gt or 55Gt if nuclear plants were phased out or even phased out and revived later, respectively. (48) Ina Parliamentary publication, Australia implicitly emphasized the inevitability of nuclear energy reliance by nations that had accepted emissions reduction obligations. (49) Consequently, even nations decommissioning or phasing out nuclear power plants are seriously reviewing their policy. For example, the United Kingdom is considering the expansion of its nuclear facilities.(50) More significantly, the Nuclear Suppliers Group (NSG) waived sanctions on the supply of nuclear materials and technology to India, primarily to enable the sub-continent to develop with lower climate impact. (51) The promise of emissions reduction has obviously revived commercial nuclear energy. A second reason for the resurgence of nuclear power is climate change regulation. Climate regulation can improve competitiveness of nuclear energy with coal. Generally, in addition to environmental, safety, and security concerns, the high cost of nuclear power plant construction and maintenance relative to the cost of fossil fuels such as coal deters civilian nuclear energy development. (52) The 1998 WEO predicted that with the exception of OECD Europe, high costs would drive down nuclear power generation and encourage coal and oil use. (53) The study attributed the decline in nuclear energy in OECD North America to an increase in coal-based electricity generation. (54) Similarly, it noted that in China the higher cost of nuclear energy--three times that of coal per kilowatt--made a weak case for development of nuclear power plants. (55) Climate regulation can change this cost dynamic by placing a price on carbon emissions. Such regulation will increase costs of coal-based power and make alternative sources of electricity that are capital-intensive, such as nuclear energy, cost effective. (56) Presently, because of checkered global carbon regulation combined with other factors such as long-term waste disposal, fuel cycle, and risk of proliferation, nuclear energy remains an expensive source of electricity. (57) Nations are therefore considering measures to increase the cost effectiveness of nuclear energy in the context of climate regulation. For example, the U.S. Department of Energy (DOE) has been studying gaps in and strategies for increasing the competitiveness and rapid deployment of nuclear energy in the United States. (58) A detailed DOE report recommended several measures, including: 1) taking into account low natural gas prices and potential carbon non-regulation at the R&Dstage so as to eliminate non-competitiveness of nuclear technology; and 2) implementing a 1989 NRC regulation (10 CFR [section] 50) that would expedite "Early. Site Permit (ESP), Design Certification (DC), and Combined License (COL)." (59) The DOE correctly reports that these measures can create the requisite incentives for the nuclear industry to take advantage of potential regulation of carbon emissions through tax or sequestration requirements. (60) The MIT study also recommends the inclusion of nuclear energy in anational carbon-free or renewable energy portfolio. (61) The Obama administration, its views on Yucca Mountain notwithstanding, (62) supports investment in nuclear technology. In his February 2011 State of the Union address, President Obama pledged support for new, safe nuclear technology development and has proposed to increase government loan guarantees to the industry to $54 million in his 2011 budget. (63) The regulatory situation in more advanced Europe is different, because European states are signatories to the Kyoto Protocol and have accepted binding emissions reduction obligations. (64) The costs of nuclear energy can already be measured against the cost of carbon emissions. For example, in 2007 the World Energy Council (WEC) reported that notwithstanding uncertainty regarding the exact costs of nuclear power generation, nuclear energy in Europe was not subject to the financial risks associated with regulation of C[O.sub.2] emissions, unlike carbon- and coal-fired and CCGT power plants that would be affected if carb6n prices reached 20\_/tCO2. (65) WEC therefore concluded thatnuclear energy costs in Europe would decrease subject to environmental regulations. (66) European nations that planned to phase out nuclear power plants are already witnessing a nuclear renaissance. Some European nations are reconsidering their nuclear energy policies in light of climate regulation. (67) For instance, in a report tothe Parliament the United Kingdom government noted that the nation could not reduce emissions and at the same time meet its energy needs without including nuclear power in its energy mix. The report recommended the preservation of the nuclear option either by replacing powerplants slated for closure by 2023 with new nuclear facilities or by renewing operation of plants slated for shutdown. The report also noted that carbon price increases would enhance the cost effectiveness of nuclear energy. The report appears to have used increased competitiveness of nuclear energy as reason for recommending that the government support companies to invest in capital-intensive nuclear power plant construction projects. (68) The U.K. government is apparently acting on these recommendations; in 2008, the Cabinet sought to attract investors by offering a series of incremental incentives, including fast track planning and assurances on carbon pricing. (69) The German government has suspended its deal with the nuclear industry to phase out nuclear power plants over a 32-year period, pendingfinancial negotiations for lengthening the life of nuclear power plants. (70) The Swedish government has also recommenced nuclear power plant construction, following a vote to remove a ban on nuclear energyimposed by a 1980 referendum. (71) In other countries, including Japan, China, and some in South America and Asia, governments remain undeterred by cost considerations. (72) As mentioned earlier, these nations view nuclear energy as a central strategy for managing their greenhouse gas emissions withoutcompromising their energy use. Nations such as China may even receive theadditional benefit of reduced air pollution from sulfur dioxide and other emissions. (73) Clearly, excluding nuclear technology from Joint Implementation (JI) or Clean Development Mechanism (CDM) provisions has not stalled a nuclear energy renaissance. On the contrary, anticipated climate regulation is turning the tide in favor of nuclear energy. Further, whilenuclear energy is explicitly excluded under JI and CDM, there are noconstraints on Annex I nations generating and trading in emissions credits by substituting domestic fossil fuel use with nuclear energy. (74) Thus, global nuclear energy expansion may be inevitable in view ofclimate change. Moreover, such expansion warrants international cooperation, even if nuclear energy is excluded from Kyoto Protocol mechanisms. In a presentation at COP 12 in Nairobi, a U.S. senior climate negotiator included nuclear energy in the United States' international technology cooperation portfolio. (75) The United States has already been pivotal in promoting nuclear cooperation with several nations,including the United Arab Emirates (76) and India, (77) effectively establishing the foundation for building a nuclear energy future.>

### Nuclear Fission Now – Many nations, both developed and undeveloped, are refocusing on nuclear fission for electrical generation behind the scenes of more publically recognized “green” energy sources.

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg. 230-231

<I. The Moon's Significance

The Moon is at the forefront of long-term global energy and security strategies. This section will explore the reasons that the Moon will be increasingly relevant in the next century. First, it will describe potential resource and energy opportunities that the Moon may yield, paying special attention to Helium-3. Helium-3 is a molecule projected by the solar wind, which some scientists have speculated is the key to harnessing fusion power on the Earth. This Part will briefly comment on the possibility of mineral ores that could be extracted from the Moon. Second, it will describe the current lunar policies of the Earth's most powerful countries.

A. The Moon as a Mineral and Energy Source

The Moon, at first blush, may not appear to be particularly relevant in any assessment of the current energy problems facing the world. However, the Moon may provide the key to make nuclear fusion power a viable provider of electricity on Earth.

While green energy sources receive considerable publicity, several developed states have begun refocusing on nuclear power as a source for [\*231] electrical generation. n6 China is currently in the midst of planning the construction of dozens of nuclear power generators and is on pace to build over 300 in the next fifty years. n7 Over three-quarters of French electricity is generated by nuclear power. n8 England, n9 Italy, n10 Finland, n11 and Russia n12 are also building nuclear plants. Even lesser developed states like Thailand, n13 Egypt, n14 and Vietnam n15 are beginning to investigate the feasibility of nuclear power. Of states relying extensively on nuclear power, only Germany is seriously considering alterations to its energy strategy. n16>

### Nuclear Power Inevitable – (Reasons for why He-3 Nuclear Fusion is preferable over D-T Nuclear Fusion or Nuclear Fission) Environmental concerns have convinced many nations to reconsider the nuclear energy option. Environmental concerns will eventually make expensive nuclear energy be on par with inexpensive fossil fuel energy and reduced emissions are desirable.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<IV. CLIMATE CHANGE HAS NEVERTHELESS REVIVED THE CIVILIAN NUCLEAR ENERGY OPTION. Climate change concerns have reversed nuclear energy use trends inOECD nations, boosted expansion plans in OECD Pacific, and rejuvenated commercial, civilian nuclear energy use in non-OECD nations such as India. Climate change has revived the nearly dormant nuclear industry for at least two important and obvious reasons. First, nuclear power plants do not spew large amounts of harmful emissions, among them greenhouse gas emissions that cause global warming. According to one IAEA estimate, nuclear technology could potentially reduce the proportionate emissions share of power plants by about forty percent. (46) The MIT study predicts that based on current projections, nuclear energy could reduce up to a 25% increment in coal use by 2050. (47) OECD's Nuclear Energy Agency (OECD-NEA) estimates that continuous nuclear energy development could eliminate nearly 200 Gigatonnes (Gt) of C[O.sub.2] by 2050, as opposed to 100Gt or 55Gt if nuclear plants were phased out or even phased out and revived later, respectively. (48) Ina Parliamentary publication, Australia implicitly emphasized the inevitability of nuclear energy reliance by nations that had accepted emissions reduction obligations. (49) Consequently, even nations decommissioning or phasing out nuclear power plants are seriously reviewing their policy. For example, the United Kingdom is considering the expansion of its nuclear facilities.(50) More significantly, the Nuclear Suppliers Group (NSG) waived sanctions on the supply of nuclear materials and technology to India, primarily to enable the sub-continent to develop with lower climate impact. (51) The promise of emissions reduction has obviously revived commercial nuclear energy. A second reason for the resurgence of nuclear power is climate change regulation. Climate regulation can improve competitiveness of nuclear energy with coal. Generally, in addition to environmental, safety, and security concerns, the high cost of nuclear power plant construction and maintenance relative to the cost of fossil fuels such as coal deters civilian nuclear energy development. (52) The 1998 WEO predicted that with the exception of OECD Europe, high costs would drivedown nuclear power generation and encourage coal and oil use. (53) The study attributed the decline in nuclear energy in OECD North America to an increase in coal-based electricity generation. (54) Similarly, it noted that in China the higher cost of nuclear energy--three times that of coal per kilowatt--made a weak case for development of nuclear power plants. (55) Climate regulation can change this cost dynamic by placing a price on carbon emissions. Such regulation will increase costs of coal-based power and make alternative sources of electricity that are capital-intensive, such as nuclear energy, cost effective. (56) Presently, because of checkered global carbon regulation combined with other factors such as long-term waste disposal, fuel cycle, and risk of proliferation, nuclear energy remains an expensive source of electricity. (57) Nations are therefore considering measures to increase the cost effectiveness of nuclear energy in the context of climate regulation. For example, the U.S. Department of Energy (DOE) has been studying gaps in and strategies for increasing the competitiveness and rapid deployment of nuclear energy in the United States. (58) A detailed DOE report recommended several measures, including: 1) taking into account low natural gas prices and potential carbon non-regulation at the R&Dstage so as to eliminate non-competitiveness of nuclear technology; and 2) implementing a 1989 NRC regulation (10 CFR [section] 50) that would expedite "Early. Site Permit (ESP), Design Certification (DC), and Combined License (COL)." (59) The DOE correctly reports that these measures can create the requisite incentives for the nuclear industry to take advantage of potential regulation of carbon emissions through tax or sequestration requirements. (60) The MIT study also recommends the inclusion of nuclear energy in anational carbon-free or renewable energy portfolio. (61) The Obama administration, its views on Yucca Mountain notwithstanding, (62) supports investment in nuclear technology. In his February 2011 State of the Union address, President Obama pledged support for new, safe nuclear technology development and has proposed to increase government loan guarantees to the industry to $54 million in his 2011 budget. (63) The regulatory situation in more advanced Europe is different, because European states are signatories to the Kyoto Protocol and have accepted binding emissions reduction obligations. (64) The costs of nuclear energy can already be measured against the cost of carbon emissions. For example, in 2007 the World Energy Council (WEC) reported that notwithstanding uncertainty regarding the exact costs of nuclear power generation, nuclear energy in Europe was not subject to the financial risks associated with regulation of C[O.sub.2] emissions, unlike carbon- and coal-fired and CCGT power plants that would be affectedif carb6n prices reached 20\_/tCO2. (65) WEC therefore concluded thatnuclear energy costs in Europe would decrease subject to environmental regulations. (66) European nations that planned to phase out nuclear power plants are already witnessing a nuclear renaissance. Some European nations are reconsidering their nuclear energy policies in light of climate regulation. (67) For instance, in a report tothe Parliament the United Kingdom government noted that the nation could not reduce emissions and at the same time meet its energy needs without including nuclear power in its energy mix. The report recommended the preservation of the nuclear option either by replacing powerplants slated for closure by 2023 with new nuclear facilities or by renewing operation of plants slated for shutdown. The report also noted that carbon price increases would enhance the cost effectiveness of nuclear energy. The report appears to have used increased competitiveness of nuclear energy as reason for recommending that the government support companies to invest in capital-intensive nuclear power plant construction projects. (68) The U.K. government is apparently acting on these recommendations; in 2008, the Cabinet sought to attract investors by offering a series of incremental incentives, including fast track planning and assurances on carbon pricing. (69) The German government has suspended its deal with the nuclear industry to phase out nuclear power plants over a 32-year period, pendingfinancial negotiations for lengthening the life of nuclear power plants. (70) The Swedish government has also recommenced nuclear power plant construction, following a vote to remove a ban on nuclear energyimposed by a 1980 referendum. (71) In other countries, including Japan, China, and some in South America and Asia, governments remain undeterred by cost considerations. (72) As mentioned earlier, these nations view nuclear energy as a central strategy for managing their greenhouse gas emissions withoutcompromising their energy use. Nations such as China may even receive theadditional benefit of reduced air pollution from sulfur dioxide and other emissions. (73) Clearly, excluding nuclear technology from Joint Implementation (JI) or Clean Development Mechanism (CDM) provisions has not stalled a nuclear energy renaissance. On the contrary, anticipated climate regulation is turning the tide in favor of nuclear energy. Further, whilenuclear energy is explicitly excluded under JI and CDM, there are noconstraints on Annex I nations generating and trading in emissions credits by substituting domestic fossil fuel use with nuclear energy. (74) Thus, global nuclear energy expansion may be inevitable in view ofclimate change. Moreover, such expansion warrants international cooperation, even if nuclear energy is excluded from Kyoto Protocol mechanisms. In a presentation at COP 12 in Nairobi, a U.S. senior climate negotiator included nuclear energy in the United States' international technology cooperation portfolio. (75) The United States has already been pivotal in promoting nuclear cooperation with several nations,including the United Arab Emirates (76) and India, (77) effectively establishing the foundation for building a nuclear energy future.>

## He3 Advantage---Nuclear Energy---Solvency

### 4. Helium-3 Solves – Helium-3-based nuclear fusion is a clean, safe, economical, and abundant nuclear energy source and comparatively more desirable than nuclear fission.

Kulcinski & Schmitt, with the Fusion Technology Institute in the Department of Engineering Physics at the University of Wisconsin-Madison 2000 (July 2000, G.L. Kulcinski and H.H. Schmitt, 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, JMP)

<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 TRITUM. 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 third generation 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.>

### Helium-3 Good – Helium-3 solves a slew of problems by replacing fossil fuels and nuclear fission reactors even with uncertain technological and economic feasibility.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 246-247

<While the technological and economic feasibility of fusion based nuclear energy, particularly fusion reactors utilizing He-3 as fuel, is still uncertain and contested, and its commercial realization at best decades away,5 the implications of such a development could be far-reaching and profound. Fusion energy could significantly reduce the world's heavy dependence on fossil fuels, which are associated with environmental pollution, greenhouse gas emissions, and global warming-not to mention their rising price and role in recurrent geopolitical and economic tensions. Fusion energy could also provide a safer alternative to many countries' growing reliance on energy generated from nuclear fission reactors, which hold the potential dangers of nuclear accidents, terrorism, weapons proliferation, and radioactive waste disposal. Moreover, in contrast to the prospect of depletion of terrestrial fossil fuels, it is estimated that there is sufficient He-3 present on the Moon to meet humanity's rapidly growing energy needs for many centuries to come.6 Thus, despite the problematic future of He-3-based fusion energy, it is not surprising that the United States and other major powers are beginning to position themselves to ensure their future access to lunar He-3 resources.>

### Helium-3 Good – He-3 is comparatively more economical than D-F as a fuel source for nuclear fusion for 5 reasons: increased efficiency, reduced radiation damage, reduced radioactive waste, increased safety, and cheaper energy production.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 252-254

<For a number of reasons, including the limited terrestrial availability of He-3 and the very high temperatures required to achieve He-3-based fusion, most current research, and any first generation fusion power reactors, will likely be based on a fuel cycle involving the fusion of deuterium ("D") and tritium ("T"),

two isotopes of hydrogen available on Earth and capable of fusing at considerably lower temperatures.25 However, an He-3-D fuel cycle, if and when technically achievable, theoretically offers significant advantages as compared with the D-T fuel cycle. Unlike a D-T fusion reaction, which results in considerable neutron radiation, and He-S-D fusion reaction would produce little radioactivity and a substantially higher proportion of directly usable energy.26 More specifically, the comparative

advantages of an He-3-D fuel cycle over a D-T fuel cycle would include: (1) increased electrical conversion efficiency; (2) reduced radiation damage to containment vessels, obviating the need for frequent expensive replacement; (3) reduced radioactive waste, with consequent reduced costs of protection and disposal; (4) increased levels of safely in the event of accident; and (5) potentially lower costs of electricity production.27 In particular, an Hc-3-D fuel cycle would significantly reduce the risk of nuclear proliferation because an He-3-D reaction, unlike a D-T reaction would produce few neutrons and could not be readily employed to produce plutonium or other weapons-grade fissile materials.28 Consequently, interest in developing He-3-fucled thermonuclear energy is likely to continue.>

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 255-257

<Whether the production of lunar He-3-based fusion power will prove commercially viable remains a complex and disputed question. The commercial success of such a development will clearly depend, among other" things, on the parallel and integrated achievement of both economically efficient He-3-fueled fusion power reactors and a sustainable lunar mining enterprise capable of economically extracting and returning to Earth an assured supply of He-3 10 fuel such reactors; neither is worth pursuing without the other. However, the development of He-3-based fusion need not start from scratch, but instead will likely build on the substantial research and investment already committed to the development of fusion power more generally in ITER and other already ongoing projects. Moreover, the development of lunar He-3 mining can similarly build on—and indeed form an additional rationale for—the already existingcommitment of various space powers to establish lunar bases. As indicated earlier, lunar mining activities may be worth developing not only to extract He-3 from the regolith, but also to obtain a variety of other byproducts highly useful for die support of lunar bases."

Finally, the economic viability of He-3-based fusion power will, of course, depend on its eventual production cost relative to alternative sources of energy such as fossil fuel or other conventional sources of energy, energy produced by nuclear fission reactors, or other forms of fusion energy—all figures difficult to accurately predict at this time. Proponents of He-3-based fusion energy argue that, notwithstanding the substantial costs involved in developing He-3 fusion reactors, establishing a lunar mining operation, and transporting He-3 back to Earth, He-3-based fusion power will eventually be more than competitive with the cost of other types of energy resources and provide more than sufficient incentive for the participation of both government and private enterprise.>

### Helium-3 Good – He-3 is a prerequisite to the advancement of fusion technology because conducting conventional D-T fusion without He-3 is not very economically profitable.

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 22

<Although there are many difficulties in making lunar development feasible, the benefits of engaging in such an endeavor are well worth the risks. Lunar development is beyond merely establishing a lunar industry—such development would be establishing a lunar economy. Due to the aforementioned benefits, both space exploration and Earth development will benefit as a result of the lunar economy. This lunar economy has the potential to radically change the economic aspect of our everyday lives, freeing us from our current „zero-sum game‟ of resources(Lewis 11). From Helium-3 to Solar Power Satellites, there is no limit to the potential for investment and development in the new lunar economy.>

Cheetham And Pastuf 8 – Brad Cheetham, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, Dan Pastuf, Professor University of Buffalo Department of Mechanical and Aerospace Engineering, 2008, “Lunar Resources And Development,” Topics In Space Exploration And Development EE441, Online: <http://www.eng.buffalo.edu/~cheetham/index_files/Moon%20Paper%20441.pdf>, pg. 22

<The possibility of a Helium-3 fueled lunar economy was mentioned previously. In order for this to be a possibility fusion technology must be advanced beyond the current very small scale reactions being achieved (Schmitt). One problem with this plan of waiting for fusion technology to develop before establishing a lunar base is that fusion without Helium-3 is very much less desireable. Using common deuterium fusion plans, power plants would actually produce more nuclear waste per kilowatt hour than a nuclear fission plant of comparable size would (Schmitt 41). Thus fusion technology is somewhat dependent on having a large supply of He-3 while at the same time, getting He-3 from the Moon is depending on having large scale fusion plants operational. Only time will tell which occurs first, but with additional funding, and a He-3 source its likely fusion power could be figured out.>

### Helium-3 Good – Even with practical nuclear fusion predicted to be five decades off, current predictions are based only on conventional D-T fuel sources. He-3 would eliminate many of the obstacles facing researchers including radioactive containment catalyzing future efforts.

Williams 7 – Matt Williams, Contributing Author MIT Technology Review, August 23, 2007, “Mining The Moon,” MIT Technology Review, <http://www.technologyreview.com/energy/19296/page1/>

<Could He-3 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.>

### Helium-3 Good – Answers to Frank Close’s objection to He-3 nuclear fusion which are based on the assumption that He-3 nuclear fusion would depend on Tokamak-based reactors. Kulcinski’s special fusion reactor is proof of the potential of He-3 but a lack of He-3 and financial support hinder such technology from breaking even.

Williams 7 – Matt Williams, Contributing Author MIT Technology Review, August 23, 2007, “Mining The Moon,” MIT Technology Review, <http://www.technologyreview.com/energy/19296/page1/>

<Close's objection, however, assumes that deuterium-helium-3 fusion and pure helium-3 fusion would take place in tokamak-based reactors. There might be alternatives: for example, Gerald Kulcinski, a professor of nuclear engineering at the University of Wisconsin-Madison, has maintained the only helium-3 fusion reactor in the world on an annual budget that's barely into six figures.

Kulcinski's He3-based fusion reactor, located in the Fusion Technology Institute at the University of Wisconsin, is very small. When running, it contains a spherical plasma roughly 10 centimeters in diameter that can produce sustained fusion with 200 million reactions per second. To produce a milliwatt of power, unfortunately, the reactor consumes a kilowatt. Close's response is, therefore, valid enough: "When practical fusion occurs with a demonstrated net power output, I--and the world's fusion community--can take note."

Still, that critique applies equally to ITER and the tokamak-based reactor effort, which also haven't yet achieved breakeven (the point at which a fusion reactor produces as much energy as it consumes). What's significant about the reactor in Wisconsin is that, as Kulcinski says, "We are doing both deuterium-He3 and He3-He3 reactions. We run deuterium-He3 fusion reactions daily, so we are very familiar with that reaction. We are also doing He3-He3 because if we can control that, it will have immense potential."

The reactor at the Fusion Technology Institute uses a technology called inertial electrostatic confinement (IEC). Kulcinski explains: "If we used a tokamak to do deuterium-helium-3, it would need to be bigger than the ITER device, which already is stretching the bounds of credibility. Our IEC devices, on the other hand, are tabletop-sized, and during our deuterium-He3 runs, we do get some neutrons produced by side reaction with deuterium." Nevertheless, Kulcinski continues, when side reactions occur that involve two deuterium nuclei fusing to produce a tritium nucleus and proton, the tritium produced is at such a higher energy level than the confinement system that it immediately escapes. "Consequently, the radioactivity in our deuterium-He3 system is only 2 percent of the radioactivity in a deuterium-tritium system."

More significant is the He3-He3 fusion reaction that Kulcinski and his assistants produce with their IEC-based reactor. In Kulcinski's reactor, two helium-3 nuclei, each with two protons and one neutron, instead fuse to produce one helium-4 nucleus, consisting of two protons and two neutrons, and two highly energetic protons.

"He3-He3 is not an easy reaction to promote," Kulcinski says. "But He3-He3 fusion has the greatest potential." That's because helium-3, unlike tritium, is nonradioactive, which, first, means that Kulcinski's reactor doesn't need the massive containment vessel that deuterium-tritium fusion requires. Second, the protons it produces--unlike the neutrons produced by deuterium-tritium reactions--possess charges and can be contained using electric and magnetic fields, which in turn results in direct electricity generation. Kulcinski says that one of his graduate assistants at the Fusion Technology Institute is working on a solid-state device to capture the protons and convert their energy directly into electricity.

Still, Kulcinski's reactor proves only the theoretical feasibility and advantages of He3-He3 fusion, with commercial viability lying decades in the future. "Currently," he says, "the Department of Energy will tell us, 'We'll make fusion work. But you're never going to go back to the moon, and that's the only way you'll get massive amounts of helium-3. So forget it.' Meanwhile, the NASA folks tell us, 'We can get the helium-3. But you'll never get fusion to work.' So DOE doesn't think NASA can do its job, NASA doesn't think that DOE can do its job, and we're in between trying to get the two to work together." Right now, Kulcinski's funding comes from two wealthy individuals who are, he says, only interested in the research and without expectation of financial profit.

Overall, then, helium-3 is not the low-hanging fruit among potential fuels to create practical fusion power, and it's one that we will have to reach the moon to pluck. That said, if pure He3-based fusion power is realizable, it would have immense advantages.>

### Helium-3 Good – Nuclear Safeguards – Helium-3 allows detectors to maintain a high neutron sensitivity and excellent gamma discrimination for accurate measurements while allowing for extremely quick responses in accounting for nuclear materials.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Nuclear Safeguards

The purpose of nuclear safeguards programs is to prevent diversion of nuclear materials for non-peaceful purposes. Nuclear safeguards systems are installed at facilities that process, handle, use and store plutonium, uranium, nuclear fuel, spent fuel or nuclear waste. Safeguards systems quantify and monitor nuclear material to enable facilities to precisely account for plutonium and uranium during all aspects of processing, storage and clean up. The International Atomic Energy Agency (IAEA) and the National Nuclear Security Administration (NNSA) via the National Laboratories sponsor a number of international safeguards programs such as the new reprocessing facility that is under construction at the Rokkasho Reprocessing Complex in Japan.

Nuclear safeguards systems are typically compact. The detectors must have high neutron sensitivity and excellent gamma discrimination to enable accurate neutron measurements. The extremely fast response of Helium-3 detectors makes certain measurements possible. Helium-3 detector performance can be further tailored to permit highly precise nuclear material assay. This is a key element in accurately accounting for nuclear materials.>

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### Helium-3 Good – Nuclear fusion may be the solution to our nuclear fission woes by producing energy with significantly

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg. 234

< [\*234] Fission reactions are not the sole focus of nuclear-power research. A great amount of expense and research has been dedicated to try and make a different type of nuclear power, fusion power, viable. n36 Fusion is the energy-producing cycle that powers the sun. n37 Instead of relying on the splitting of heavy elements to generate power, fusion generates energy from combining the nuclei of the lightest elements, like Hydrogen. n38The purportedly simplest n39 form of the fusion reaction is the fusing of Deuterium and Tritium, isotopes of Hydrogen. n40The problem is that the fusion of these two isotopes releases approximately 80% of its energy in the form of highly-volatile radioactive neutrons. n41

Nevertheless, fusion has advantages over fission. First, the half-lives of the fusion products generated are significantly shorter than those generated in fission. n42Accordingly, fusion produces no significant radioactive waste, and any waste products created would naturally, and rapidly, decay into harmless materials. n43Additionally, Deuterium and Tritium are naturally-occurring, abundant isotopes, and so there would be no difficulty in procuring ample supplies of these fuel sources for thousands of years. n44>

### Helium-3 Good – Nuclear fusion may be the solution to our nuclear fission woes with the use of clean and reliable He-3 which has the potential to make nuclear fusion economical. While the prospect of risking much on a single mineral is imperfect, we need all the options we can get.

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg. 234-237

<While fusion, in theory, is the solution to the world's energy crisis, a problem exists. Humans have not been able to harness the fusion reaction for any purpose other than to create the explosion caused by a hydrogen bomb. n45 [\*235] Because nuclei are positively charged and repel each other by nature, a large energy expenditure is necessary to fuse nuclei together. n46The amount of energy generated by the fusion, however, is sufficient to cause other fusions of surrounding nuclei, and as a result, the process can quickly become uncontrollable and dangerous. n47 Additionally, attempts at generating the fusion reaction using the Deuterium-Tritium model has never produced a net increase in energy, i.e., more energy is consumed trying to generate the necessary reaction than is expended by the few reactions that actually occur. n48

While this might suggest that fusion should be relegated to the trash bin of failed physics experiments, some researchers have proposed that Helium-3 could be the answer to the fusion question. n49Helium-3 is a single neutron isotope of Helium that is not radioactive and, when bombarded with neutrons, could interact with electromagnetic forces applied in the fusion process. This interaction could create electricity directly, without producing radioactive neutrons as a byproduct of the reaction. n50Additionally, its proponents theorize that Helium-3 would generate almost no radioactive waste or byproducts, given its non-radioactive nature. n51

Although this sounds promising, these theories are confined to academic debate because Helium-3 exists in very small quantities on the Earth. n52Rocks taken from the Moon, however, show that Helium-3 exists in much higher abundance there n53 because the sun, which produces Helium-3 as part of its fusion process, projects Helium-3 via the solar wind to the Moon. n54 The Earth is relatively shielded from the solar wind by its magnetosphere, and as a result, [\*236] the Earth receives very little Helium-3. n55 Accordingly, the accumulations on the Moon over several-billion years greatly outnumber terrestrial Helium-3 accumulations. n56

While the notion of traveling to the Moon to secure a rare isotope, which may help an experimental, untested, and dangerous energy source, may sound not only impractical but insane, states are currently discussing and planning for exploratory trips to the Moon to investigate mining Helium-3. n57 The status of these programs will be briefly sketched below. n58 Suffice it to say that the pursuit of Helium-3 is no pipe dream. While going to the Moon to power the Earth may seem like a desperate measure, we certainly live in increasingly desperate times.

Regardless of whether the Moon is able to aid humanity in solving the impending energy crisis, the satellite will have further importance as states begin evaluating the feasibility of space colonization. While space colonization may seem like the stuff of pulp science fiction, states are actually considering attempting to build Moon bases and, in turn, populating Mars. n59 The International Space Station is a preliminary venture to determine the long-term effects of living outside the confines of the Earth. n60 Additionally, the Moon may be able to furnish valuable mineral ores not commonly found on the Earth. n61 As a result, a number of states are in the initial stages of planning on [\*237] visiting the Moon to reap its potential benefits. n62 For these reasons, a new space race is about to commence, which will lead not only to competition on the Earth but to a jockeying for power in space and on the Moon itself. As a result, the law of outer space, and particularly of the Moon, is more relevant now than at any time since the end of the Cold War.>

### Lunar Exploration Good – Helium-3 is a much more suited choice to nuclear fusion and can significantly improve production and safety costs. Helium-3 technology is being developed now as shown by Kulcinski’s He-3-He-3 nuclear fusion reactor.

Wakefield 00 – Julie Wakefield, SPACE Author Of “One Small Step for Space Tourists,” June 30, 2000, “Researchers And Space Enthusiasts See Helium-3 As The Perfect Fuel Source,” SPACE, Online: http://www.space.com/scienceastronomy/helium3\_000630.html.

<Fusion research began in 1951 in the United States under military auspices. After its declassification in 1957scientists began looking for a candidate fuel source that wouldn't produce neutrons. Although Louie Alvarez and Robert Cornog discovered helium 3in 1939, only a few hundred pounds (kilograms) were known to exist on Earth,most the by-product of nuclear-weapon production.Apollo astronauts found helium 3 on the moon in 1969, but the link between the isotope and lunar resources was not made until 1986. "It took 15 years for us [lunar geologists and fusion pioneers] to stumble across each other," said Schmitt, the last astronaut to leave footprints on the moon.For solving long-term energy needs,proponents contend helium 3 is a greater choice than first generation nuclear fuels like deuterium and tritium (isotopes of hydrogen), which are now being tested on a large scale worldwide in tokamak thermonuclear reactors.Such approaches, which generally use strong magnetic fields to contain the tremendously hot, electrically charged gas or plasma in which fusion occurs, have cost billions and yielded little. The International Thermonuclear Experimental Reactor or ITER tokamak, for example, won't produce a single watt of electricity for several years yet.Increases production and safety costs"I don't doubt it will eventually work,"Kulcinski said. "But I have serious doubts it will ever provide an economic power source on Earth or in space." That's because reactors that exploit the fusion of deuterium and tritium release 80 percent of their energy in the form of radioactive neutrons, which exponentially increase production and safety costs.In contrast, helium 3 fusion would produce small residual radioactivity. Helium 3, an isotope of the familiar helium used to inflate balloons and blimps, has a nucleus with two proton sand one neutron. A nuclear reactor based on the fusion of helium 3 and deuterium, which has a single nuclear proton and neutron, would produce very few neutrons -- about 1 percent of the number generated by the deuterium-tritium reaction. "You could safely build a helium 3 plant in the middle of a big city," Kulcinski said.Helium 3 fusion is also ideal for powering spacecraft and interstellar travel. While offering the high performance power of fusion -- "a classic Buck Rogers propulsion system" -- helium3 rockets would require less radioactive shielding, lightening the load,said Robert Frisbee, an advanced propulsion engineer at NASA's Jet Propulsion Laboratory in Pasadena California.Recently Kulcinski's team reports progress toward making helium 3 fusion possible. Inside a lab chamber, the Wisconsin researchers have produced protons from a steady-state deuterium-helium3 plasma at a rate of 2.6 million reactions per second. That's fast enough to produce fusion power but not churn out electricity. "It's proof of principle, but a long way from producing electricity or making a power source out of it," Kulcinski said. He will present the results in Amsterdam in mid July at the Fourth International Conference on Exploration and Utilization of the Moon.>

### Nuclear Fusion Good – Fusion energy has immense potential with widespread and abundant materials and the capacity to power the world for centuries to come.

Letcher 8 - Trevor M. Letcher, Energy And Thermodynamics Author, 2008, “Future Energy: Improved, Sustainable, And Clean Options For Our Planet,” Print

<2. Desirable Characteristics of Fusion Power

Fusion energy has been pursued for roughly six decades by many nations, with a degree and scale of collaboration perhaps unique in human experience. The reasons for this unparalleled cooperation across so many decades, even among nations that were otherwise enemies during much of this time, are twofold: fusion energy has immense potential if it becomes practical, and practical fusion power is hard to achieve. First we discuss some desirable characteristics.

The materials that would be used to fuel D-T and eventually D-D reactors are abundant, widespread and easily extracted at modest cost. The cost of deu¬terium extracted from water is only about $0.02-0.03 per gigajoule (278 kWh) of electricity when used in a D-D fusion reactor [1,2], assuming a net plant electri¬cal efficiency of 33%. For a D-T reactor, which produces more energy per reac¬tion, the cost of deuterium per GJ of electricity would be about $0,003-0.005, and the cost of lithium to produce tritium would be about $0,001-0.002 per gigajoule. The fuel costs are thus negligible, and would not be expected to increase due to depletion for a very long time. The amount of deuterium in the earth's water would allow the production of about 1022GJ of electricity if used in D-T reactors, an amount which is more than 1011 times the entire world annual electricity production, or, in D-D reactors, more than 1020 times the present annual world electricity production. For D-T reactors, the more relevant fuel constraints are set by the availability of lithium to breed tritium. Lithium is most cheaply avail¬able from dry salt lakes and saline lakes, of which there are many in such areas as the western USA, where cheap surface salt reserves are estimated to contain enough lithium [4] to produce about 3 x 1014 GJ of electricity, an amount equiv-alent to roughly 500-600 times the primary annual energy consumption of the world. Since the USA comprises only 6% of the world's surface, and there are other arid regions with surface salt deposits, the sum of such surface deposits is…>

### Nuclear Fusion Good – The cost of fusion energy can be estimated using current nuclear fission data. The fuel costs will be neglibible in comparison with the value of the electricity produced and a facility for waste disposal will be uneeded.

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<5. Economics of Fusion Energy

As discussed in Section 2, the fuel costs for fusion reactors will be negligible in comparison with the value of the electricity produced. This does not mean, how¬ever, that the electricity will be free; it simply means that fuel costs will be an

insignificant component of the cost of power. It is difficult to precisely assess the cost of fusion-genera ted electricity until there is experience with an operating power plant, since the cost will be dependent upon the reliability and the fre¬quency and expense of maintenance, both of which are likely to improve with the hindsight of experience. However, much of a fusion power plant will be sim¬ilar to that of a present-day nuclear fission plant. Only the nuclear island will be different. A fusion plant will not need a spent fuel storage facility, although it will probably need at least a short-term repository to allow the short-to-medium lifetime activation products to decay in components replaced in the course of maintenance. Unlike fission plants, fusion plants should not need a long-term repository for high-level radioactive waste. The fuel reprocessing, which for fusion requires extracting tritium from the breeding blanket and unfused deu¬terium and tritium from the chamber, will take place on the power plant site in a relatively simple facility, while a long-term fission economy will require reprocessing spent fuel to maintain a supply of fissionable plutonium and ura-nium. While the present direct cost of coal is cheap compared with other energy sources, this will rise in the future as more deposits are exhausted and as the cost of transportation fuels increase. If coal is burned in power plants which lessen its environmental impact by sequestering the C02, then the costs will rise further.

Thus, if fusion power production can be made to work with reasonable reli¬ability and tolerable downtime for maintenance, then it is likely that the cost of energy from fusion will be relatively similar to that from sustainable fission with fuel recycling and heavy actinide storage, or to that of coal plants in another 50 years with C02 sequestration. In any event, coal, even with sequestration, could not be the long-term power source of fusion or fission with fuel breeding and recycling, simply because of the limited reserves of coal.>

### Solvency-nuclear fusion power plants, efficient, economic value

Barnatt 09,Christopher Barnatt, [A lecturer and futurist, and Associate Professor of Computing and Future Studies in Nottingham University Business School.](http://www.explainingthefuture.com/helium3.html) Author of six traditional books on computing and future studies, 2009, https://mail.google.com/mail/?shva=1#inbox

Helium-3 Power Generation

Helium-3 (He3) is gas that has the potential to be used as a fuel in future nuclear fusion power plants. There is very little helium-3 available on the Earth. However, there are thought to be significant supplies on the Moon. Several governments have subsequently signalled their intention to go to the Moon to mine helium-3 as a fuel supply. Such plans may come to fruition within the next two to three decades and trigger a new Space Race.

In addition to the information below, you can also find out more about this topic from the Mining Helium-3 On the Moon video or in my interview on "the new space race and mining the moon for helium 3" available from my BBC Nottingham Profile Page. There is also some great information on this topic over at Helium-3.us. Oh, and you can even read the website and play the game at Helium3Game.com from Discovery Channel, and on which I worked as a consultant.

Helium-3 and Nuclear Fusion

To provide a little background -- and without getting deeply into the science -- all nuclear power plants use a nuclear reaction to produce heat. This is used to turn water into steam that then drives a turbine to produce electricity. Current nuclear power plants have nuclear fission reactors in which uranium nuclei are split part. This releases energy, but also radioactivity and spent nuclear fuel that is reprocessed into uranium, plutonium and radioactive waste which has to be safety stored, effectively indefinitely. An overview of this nuclear fuel cycle can be found here.

For over 40 years scientists have been working to create nuclear power from nuclear fusion rather than nuclear fission. In current nuclear fusion reactors, the hydrogen isotopes tritium and deuterium are used as the fuel, with atomic energy released when their nuclei fuse to create helium and a neutron. Nuclear fusion effectively makes use of the same energy source that fuels the Sun and other stars, and does not produce the radioactivity and nuclear waste that is the by-product of current nuclear fission power generation. However, the so-termed "fast" neutrons released by nuclear fusion reactors fuelled by tritium and deuterium lead to significant energy loss and are extremely difficult to contain. One potential solution may be to use helium-3 and deuterium as the fuels in "aneutronic" (power without neutrons) fusion reactors. The involved nuclear reaction here when helium-3 and deuterium fuse creates normal helium and a proton, which wastes less energy and is easier to contain. Nuclear fusion reactors using helium-3 could therefore provide a highly efficient form of nuclear power with virtually no waste and no radiation. A short wall chart explaining this in more detail can be found here. The aforementioned fission, fusion and aneutronic fusion nuclear reactions are also illustrated in animations in my Mining Helium-3 On the Moon video.

Mining Helium-3 on the Moon

One of many problems associated with using helium-3 to create energy via nuclear fusion is that, at least on the Earth, helium-3 is very, very rare indeed. Helium-3 is produced as a by-product of the maintenance of nuclear weapons, which could net a supply of around 15Kg a year. Helium-3 is, however, emitted by the Sun within its solar winds. Our atmosphere prevents any of this helium-3 arriving on the Earth. However, as it does not have an atmosphere, there is nothing to stop helium-3 arriving on the surface of the Moon and being absorbed by the lunar soil. As a result, it has been estimated that there are around 1,100,000 metric tonnes of helium-3 on the surface of the Moon down to a depth of a few metres. This helium-3 could potentially be extracted by heating the lunar dust to around 600 degrees C, before bringing it back to the Earth to fuel a new generation of nuclear fusion power plants.

As reported in an Artemis Project paper, about 25 tonnes of helium-3 -- or a fully-loaded Space Shuttle cargo bay's worth -- could power the United States for a year. This means that helium-3 has a potential economic value in the order of $3bn a tonne -- making it the only thing remotely economically viable to consider mining from the Moon given current and likely-near-future space travel technologies and capabilities.

### Nuclear Fusion Solvency – The cost of fusion energy can be estimated using current nuclear fission data. The fuel costs will be negligible in comparison with the value of the electricity produced and a facility for waste disposal will be unneeded.

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## He3 Advantage---Nuclear Energy---Climate Change Solvency

### Nuclear Energy Good – Nuclear energy is a low-carbon mechanism to produce electricity which is a relatively reliable source of renewable energy and requires less land, more abundant fuels, and can gap the bridge between fossil fuels and completely renewable resources.

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<The Case for Nuclear

Some of the most outspoken advocates for rapid and comprehensive action on climate change arealso big supporters of nuclear power. They see it as a low-carbon way to provide large amounts of electricity to national grids, as well as an important ‘wedge’ in the drive towards stabilizing global concentrations of greenhouse gasses. Examples of such supporters include climatic scientist James Hanson and biologist James Lovelock. Political support for nuclear energy exists for several reasons: among them, concerns about maintaining secure access to energy and with low-carbon energy production. Views on nuclear energy as a long-term option differ among supporters. Whereas some see nuclear power

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as a desirable option indefinitely, others see it as a temporary bridge serving as a deeply flawed stop-gap until superior energy options are more fully developed and deployed. Given the long timelines associated with power plant planning, construction, and deployment, errors made in the choice of generating options will have an impact for many decades.

Nuclear energy is a low-carbon way to produce electricity. Even when lifecycle emissions are considered – including energy use in locating, mining, milling, enriching, and disposing of spent uranium – nuclear energy has strong potential as a climate-friendly option. The Canadian experience provides a good example. The Pembina Institute estimates that the total emissions for Canada’s nuclear sector (including twenty-three reactors at seven power stations) are between 468,000 and 594,000 tonnes of carbon dioxide per year.5 That is about 0.07 per cent of Canada’s total emissions for the year in which the estimate was made (2006). In 2005, Canada’s nuclear industry produced eighty-five terawatt hours of electricity, approximately eleven per cent of Canada’s total energy use.6 By comparison, one five-hundred megawatt coal-fired power plant produces about three million tonnes of carbon dioxide. That is equivalent to about 0.4 per cent of Canada’s installed electrical capacity, and about 0.4 per cent of Canada’s 2006 emissions. The Pembina Institute estimates consider the greenhouse gas emissions associated with the construction and decommissioning of nuclear power stations, as well as those associated with fuel production and disposal. The Intergovernmental Panel on Climate Change (ipcc) estimates that if all the world’s existing nuclear generating stations were coal plants, 2.2 billion tons of additional CO2 per year would be entering the atmosphere. When lifetime emissions are taken into account, arguments that nuclear energy is nearly as bad as energy from fossil fuel are thus not credible. Nuclear energy has a genuine capability to produce low-carbon electricity.

The power output from nuclear plants is large and relatively consistent. Barring maintenance shutdowns, they are capable of maintaining large and steady flows into the electrical grid.7 This stands in particular contrast to individual renewable generating sites, where power output varies with wind intensity, incoming solar radiation, and so forth. A relatively predictable output means that nuclear stations do not require as much ‘peak’ generation capacity on standby. That being said, inevitable shutdowns for refuelling and maintenance mean that nuclear energy cannot claim to be entirely consistent, or wholly without the need for backup capacity that can serve the grid during times of disruption. These disruptions are, however, more rare and often more predictable than those associated with intermittent renewable technologies, such as wind

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power. Nuclear power also has an advantage in terms of the amount of land required to produce a certain amount of electricity. Compared to renewable options like solar, a nuclear plant can produce more than one hundred times as much power on the same plot of land.

The economically viable supply of nuclear fuel in the medium-term seems adequate for present purposes. Furthermore, the most significant uranium producers globally are Canada and Australia: states likely to be stable suppliers, in contrast with some of the volatile regimes exporting hydrocarbon fuels. Certainly, states such as the us, France, and Japan would prefer to be able to secure long-term contracts for access to fuel from rich and stable democracies, as opposed to facing the need to buy fuel at volatile prices from states facing both significant internal and regional security challenges. Theoretically, it may become commercially viable in the future to use thorium for fuel in fission reactors,8 or to extract uranium from novel sources such as phosphates or seawater. Another possibility is that fuel reprocessing or so-called ‘breeder’ reactors will be developed to the point of commercial viability. If so, fuel availability for nuclear reactors might be extended quite considerably.9 While it would still not be accurate to refer to nuclear fission as a renewable source of energy, the provision of additional fuel and extension of its viability would generate a greater span of time in which technological progress could occur on other fronts. In so doing, nuclear energy could act as a significant bridge between an economy largely powered on carbon-intensive, increasingly costly and depleted fossil fuels, and one that relies upon energy extracted from inexhaustible sources.>

### Nuclear Energy Good – In comparison to coal-produced electricity, nuclear power may actually reduce the emission of toxic and radioactive substances into the environment even when small and medium scale accidents are taken into account.

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<Part of the case for nuclear also lies in the rebuttals of some of the charges against it. For instance, when it comes to the emission of toxic and radioactive substances into the environment, coal-fired electrical generation seems to be worse than nuclear power.10 Additionally, while nuclear accidents are far more sensational than those associated with other forms of electrical generation, they have been arguably less severe in reality than in the popular imagination. Even Chernobyl, a name that has become synonymous with all the dangers of nuclear energy, is estimated by the World Health Organization to have killed fifty-six people directly with four thousand expected extra cancer deaths among the six-hundred thousand most exposed people. Three-hundred thousand people were also permanently relocated.11 By comparison, the WHO estimates that 2.4 million people per year die as the result of air pollution. By reducing deaths associated with toxic smokestack emissions (not to mention those associated with climate change), nuclear power might actually save lives, even when inevitable small and medium-scale accidents are taken into account. While challenging methodological and ethical

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questions accompany any such comparisons, it must be acknowledged that there are serious risks and health consequences associated with the conventional alternatives to nuclear energy, as well as with nuclear power itself.>

### Climate Change Outweighs – The need to reduce emissions is urgent with much work needed to reach less than 2 degrees of global temperature change in the coming years. On our current course, global temperature increases would be more than 5 degrees, an amount equivalent to the difference between the world at present and the world of past ice ages.

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<The Seriousness of Climate Change The need to massively reduce global greenhouse gas emissions is clear and urgent. According to the Fourth Assessment Report of the IPCC, stabilizing the atmospheric concentration of greenhouse gasses at a level consistent with the European Union’s target of less than 2˚c of global temperature change requires massive reductions. Even at 2˚c of change, the IPCC predicts wide-ranging and serious impacts.12 Stabilizing concentrations means cutting emissions of all greenhouse gasses to a level where net absorption by sinks equals net global production. The level at which stabilization occurs determines what level of warming will occur. Two different stabilization scenarios offer a glimpse of the relationship between stabilization concentration, temperature change, and difficulty of implementation: Stabilization at 450 Parts Per Million (PPM) of Carbon Dioxide Equivalent: According to the IPCC, stabilization between 445 and 490 ppm would likely produce temperature increases of between 2.0˚c and 2.4˚c by 2100. Stabilizing at 450 ppm would require that global emissions peak by 2010 and fall by seven per cent per year thereafter, falling to seventy per cent below 2005 va--lues by 2050. A study by Malte Meinshausen uses ipcc estimates about the relationship between stabilization and temperature change to estimate that there is a risk of between twenty-six per cent and seventy-eight per cent (mean forty-eight per cent) that mean global temperature change will exceed two degrees under this scenario.13 Stabilization at 550 PPM: According to the IPCC, stabilization between 535 and 590 ppm would likely produce temperature increases of between 2.8˚c and 3.2˚c by 2100. This would require emissions to peak between 2016 and 2026, then fall at a rate of one to three per cent per year, reaching levels twenty-five per cent below 2006 levels by 2050. The Meinshausen study 98 projects a risk of between sixty-eight per cent and ninety-nine per cent that the two degree target will be exceeded, with a mean estimate of eighty-five per cent.Another way to consider the problem is to decide upon a maximum level of acceptable temperature rise. By using that figure and estimates of the sensitivity of the climate to carbon dioxide, it is possible to determine how many carbon emissions humanity can produce while not exceeding the temperature threshold. Taking the 2.0˚c target for temperature change adopted by the European Union, and using the climatic sensitivities at the upper and lower bound of the probable range determined by the ipcc, the total quantity of carbon dioxide that humanity can emit between the present day and the point where global society is carbon neutral is estimated between 484 and 661 billion tonnes of carbon – a figure that includes all emissions from both developed and developing states.14 Annual emissions of carbon are already ten billion tonnes per year (thirty-six billion tonnes of carbon dioxide) and increasing at around 3.5 per cent per year, despite the significant increase in fossil fuel prices. Given the definition of probability used by the ipcc, the 661 billion tonne figure only corresponds to a sixty-six per cent chance of avoiding a temperature increase of over 2.0˚c, and it must be recalled that the emergence of strong positive feedback loops could boost climatic sensitivity well outside this range. Indeed, scientists including James Hansen have argued that stabilization below 350ppm is necessary to avoid dangerous anthropogenic climate change. According to the The Economics of Climate Change: The Stern Review, a business-as-usual scenario in which emissions continue to increase at the present rate would likely result in 2.0˚c to 3.0˚c degrees of warming by 2050 and concentrations well over 1000 ppm by 2100, with probable temperature increases of more than 5.0˚c.15 To put this in context, the temperature difference between the world at present and that prevailing during prior ice ages was between 3.5°c and 5.0°c.16>

## He3 Advantage---Nuclear Energy---Laundry List Impacts

### Nuclear Power Bad – Many of the problems associated with nuclear energy such as accidents, nuclear terrorism, radioactive waste, nuclear proliferation, questionable renewability, and financial risk, which have been etched into the public mind, will continue to haunt the nuclear industry making nuclear energy economically undesireable.

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<The Problems with Nuclear

Most of the major problems of nuclear energy are well known. They include the danger of accidents or the intentional targeting of nuclear stations by malicious actors. There are also issues of uranium mining and enrichment and the disposal of waste. Other arguments against nuclear energy include expense, the disputed need for major public subsidies, water usage, and deployment timelines. Geopolitical concerns include the dangers of nuclear proliferation. Finally, there is the reality that nuclear power plants do use a non-renewable resource as fuel, raising questions about how long reliance upon them can successfully delay the need for truly renewable options. Not all the problems associated with nuclear power differentiate it from all other options – for instance, fossil fuel power plants also require water for cooling. That said, each of these issues needs to be considered when assessing the costs and benefits of nuclear power.

One concerning aspect of using nuclear power is the possibility of catastrophic accidents. As etched into the public consciousness by the accidents at Chernobyl and Three Mile Island, it is possible for nuclear generating stations to go from billion dollar assets to major liabilities in minutes. The reality of this danger is underscored by the liability guarantees extended to nuclear firms in Canada and the United States. In Canada, the Nuclear Liability Act requires that nuclear generators purchase

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insurance for damages up to seventy-five million dollars. The responsibility to pay claims exceeding seventy-five million dollars then rests with the federal government. There is no legal limit on the size of such claims. Suppliers of equipment for nuclear power generation are exempt from liability in the event of an accident. Given the possibility that a nuclear accident could cause far more than seventy-five million dollars in damages, significant financial risk is being transferred from private operators to taxpayers. In the United States, the Price-Anderson Nuclear Industries Indemnity Act limits the liability of private operators to ten billion, beyond which responsibility transfers to the federal government. Private firms are apparently unwilling to tolerate the full potential costs involved in an accident at their facilities, and the willingness of national governments to accept the transfer of risk must be seen as a significant implicit subsidy to the industry. The political risks associated with an accident are also substantial. A major shift towards new nuclear construction could be derailed in response to a major accident somewhere in the world. Wherever the probable rate of failure is non-zero and wherever some possible failure outcomes are catastrophic, the danger of such an outcome will continue to haunt the nuclear industry.>

### Nuclear Power Bad – The front end of nuclear energy will come with a load of significant environmental impacts most important of which is radioactive contamination which will last for generations and for which no geological repositories currently exist.

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<As with the extraction and processing of fossil fuels, the front end of the nuclear fuel cycle involves significant environmental impacts, including the toxic products of mining and the greenhouse gas emissions associated with exploration, mining, milling, enrichment, and transport. Many sites around the world have become seriously contaminated as the result of nuclear materials being handled there. The Hanford Site, used in the early period of nuclear technology in the United States, is probably the most contaminated site in the entire country, with millions of gallons of high-level waste present and large but uncertain associated future cleanup costs. While higher standards now exist in developed states, radioactive contamination of land and water must continue be borne in mind as costs associated with the use of nuclear energy. So too must the energy costs associated with fuel processing be counted against the total energy output of the nuclear industry. That is particularly important in circumstances where high-carbon power sources are used to power extraction and enrichment equipment. While the enrichment of fuel certainly generates net energy, energy use associated with producing uranium fuel can diminish the low-carbon qualifications of nuclear power.17 At present, the great majority of nuclear waste from commercial reactors is stored in either cooling ponds or dry storage casks. From both an environmental and a public support standpoint, the generation of nuclear waste is one of the largest drawbacks of nuclear fission as a

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power source. Just as the emission of greenhouse gasses threatens future generations with harmful ecological outcomes, the production of nuclear wastes at all stages in the fuel cycle presents risks to those alive in the present and to those who will be alive in the future, across a span of time not generally considered by human beings. Wastes like Plutonium-239 remain highly dangerous for tens of millennia: a span roughly equivalent to the total historical record of human civilizations.18 Furthermore, while most states using nuclear power have declared an intention of creating geological repositories for wastes, no state has such a facility in operation.19 The decades-long story of the planned Yucca Mountain repository in the United States demonstrates some of the practical, political, and legal challenges to establishing such facilities in democratic societies. Dry cask storage is not an acceptable long-term option, as suggested by its Canada Nuclear Safety Commission categorization as ‘a short-term management technique.’20 When dealing with wastes dangerous for millennia, it cannot be assumed that regular maintenance and inspection will continue. Storage systems must be ‘passively safe’: able to contain the wastes they store for the full duration of their dangerous lives, without the need for active intervention from human beings. To date, no such facilities exist. Their successful development and commercial operation is a pre-requisite of the responsible expanded use of nuclear power. In an ideal world, passively safe storage facilities for waste would be established before, not after, the reactors that will eventually fill them.>

## He3 Advantage---Nuclear Energy---Uranium Security Impact

### Nuclear Energy Bad – Multiple Impacts

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<The Problems with Nuclear Most of the major problems of nuclear energy are well known. They include the danger of accidents or the intentional targeting of nuclear stations by malicious actors. There are also issues of uranium mining and enrichment and the disposal of waste. Other arguments against nuclear energy include expense, the disputed need for major public subsidies, water usage, and deployment timelines. Geopolitical concerns include the dangers of nuclear proliferation. Finally, there is the reality that nuclear power plants do use a non-renewable resource as fuel, raising questions about how long reliance upon them can successfully delay the need for truly renewable options. Not all the problems associated with nuclear power differentiate it from all other options – for instance, fossil fuel power plants also require water for cooling. That said, each of these issues needs to be considered when assessing the costs and benefits of nuclear power. One concerning aspect of using nuclear power is the possibility of catastrophic accidents. As etched into the public consciousness by the accidents at Chernobyl and Three Mile Island, it is possible for nuclear generating stations to go from billion dollar assets to major liabilities in minutes. The reality of this danger is underscored by the liability guarantees extended to nuclear firms in Canada and the United States. In Canada, the Nuclear Liability Act requires that nuclear generators purchase 100 insurance for damages up to seventy-five million dollars. The responsibility to pay claims exceeding seventy-five million dollars then rests with the federal government. There is no legal limit on the size of such claims. Suppliers of equipment for nuclear power generation are exempt from liability in the event of an accident. Given the possibility that a nuclear accident could cause far more than seventy-five million dollars in damages, significant financial risk is being transferred from private operators to taxpayers. In the United States, the Price-Anderson Nuclear Industries Indemnity Act limits the liability of private operators to ten billion, beyond which responsibility transfers to the federal government. Private firms are apparently unwilling to tolerate the full potential costs involved in an accident at their facilities, and the willingness of national governments to accept the transfer of risk must be seen as a significant implicit subsidy to the industry. The political risks associated with an accident are also substantial. A major shift towards new nuclear construction could be derailed in response to a major accident somewhere in the world. Wherever the probable rate of failure is non-zero and wherever some possible failure outcomes are catastrophic, the danger of such an outcome will continue to haunt the nuclear industry.>

### Nuclear Energy Bad – Unreliability/Uranium Scarcity

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<Nuclear power is exorbitantly expensive, and notoriously unreliable. Wall Street is deeply reluctant to re-involve itself in any nuclear investment, despite the fact that in the 2005 Energy Bill the U.S. Congress allocated $13 billion in subsidies to revive a moribund nuclear power industry. To compound this problem, the global supplies of usable uranium fuel are finite. If the entire world’s electricity production were replaced today by nuclear energy, there would be less than nine more years of accessible uranium. But even if certain corporate interests are convinced that nuclear power at the moment might be a beneficial investment, one major accident at a nuclear reactor that induces a meltdown would destroy all such investments and signal the end of nuclear power forever.>

2AC Extension - Nuclear Energy Bad – Unreliability/Uranium Scarcity

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<At any point in time, the world’s economically accessible supply of uranium depends upon several factors: the extent and quality of known reserves; available extraction and processing technologies; and the market price of uranium. In the medium-term, the last of these is arguably the most important, since higher costs should spur exploration and technological development. That said, it is possible that future supplies of uranium will prove insufficient to maintain low prices in the absence of commercial breeding of nuclear fuel; this is particularly true in the event that large amounts of new nuclear capacity is constructed. While nuclear supporters argue that future fuel constraints will be eliminated through technological advances, it is not currently clear whether such technologies will ever be viable and, if they are viable, when they will be available, at what cost, and with what level of government support. However, fuel costs are a comparatively small fraction of the total expense of building and operating nuclear plants. As such, the economics of doing so successfully is less dependent on fuel prices than for fossil-fuel fired thermal plants.>

## He3 Advantage---Nuclear Energy---Radiation Impact

### Nuclear Energy Bad – Radiation/Disease.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<Contrary to the nuclear industry claims, smoothly running nuclear power plants are also not emission free. Government regulations allow nuclear plants “routinely” to emit hundreds of thousands of curies of radioactive gases and other radioactive elements into the environment every year. Thousands of tons of solid radioactive waste are presently accumulating in the cooling pools beside the 103 operating nuclear plants in the United States and hundreds of others throughout the world. This waste contains extremely toxic elements that will inevitably pollute the environment and human food chains, a legacy that will lead to epidemics of cancer, leukemia, and genetic disease in populations living near nuclear power plants or radioactive waste facilities for many generations to come.>

2AC Extension - Nuclear Power Bad – Radiation

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<As with the extraction and processing of fossil fuels, the front end of the nuclear fuel cycle involves significant environmental impacts, including the toxic products of mining and the greenhouse gas emissions associated with exploration, mining, milling, enrichment, and transport. Many sites around the world have become seriously contaminated as the result of nuclear materials being handled there. The Hanford Site, used in the early period of nuclear technology in the United States, is probably the most contaminated site in the entire country, with millions of gallons of high-level waste present and large but uncertain associated future cleanup costs. While higher standards now exist in developed states, radioactive contamination of land and water must continue be borne in mind as costs associated with the use of nuclear energy. So too must the energy costs associated with fuel processing be counted against the total energy output of the nuclear industry. That is particularly important in circumstances where high-carbon power sources are used to power extraction and enrichment equipment. While the enrichment of fuel certainly generates net energy, energy use associated with producing uranium fuel can diminish the low-carbon qualifications of nuclear power.17 At present, the great majority of nuclear waste from commercial reactors is stored in either cooling ponds or dry storage casks. From both an environmental and a public support standpoint, the generation of nuclear waste is one of the largest drawbacks of nuclear fission as a 101 power source. Just as the emission of greenhouse gasses threatens future generations with harmful ecological outcomes, the production of nuclear wastes at all stages in the fuel cycle presents risks to those alive in the present and to those who will be alive in the future, across a span of time not generally considered by human beings. Wastes like Plutonium-239 remain highly dangerous for tens of millennia: a span roughly equivalent to the total historical record of human civilizations.18 Furthermore, while most states using nuclear power have declared an intention of creating geological repositories for wastes, no state has such a facility in operation.19 The decades-long story of the planned Yucca Mountain repository in the United States demonstrates some of the practical, political, and legal challenges to establishing such facilities in democratic societies. Dry cask storage is not an acceptable long-term option, as suggested by its Canada Nuclear Safety Commission categorization as ‘a short-term management technique.’20 When dealing with wastes dangerous for millennia, it cannot be assumed that regular maintenance and inspection will continue. Storage systems must be ‘passively safe’: able to contain the wastes they store for the full duration of their dangerous lives, without the need for active intervention from human beings. To date, no such facilities exist. Their successful development and commercial operation is a pre-requisite of the responsible expanded use of nuclear power. In an ideal world, passively safe storage facilities for waste would be established before, not after, the reactors that will eventually fill them.>

### Nuclear Energy Bad – Enironment

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<The current administration clearly believes that if it lies frequently and with conviction, the general public will be lulled into believing their oft-repeated dictums. As this book will show, no part of “efficiently, safely, and with no discharge of greenhouse gases or emissions” is true. Nuclear energy creates significant greenhouse gases and pollution today, and is on a trajectory to produce as much as conventional sources of energy within the next one or two decades. It requires massive infusions of government (read taxpayer) subsidies, relying on universities and the weapons industry for its research and development, and being considered far too risky for private investors. It is also doubtful that the 8,358 individuals diagnosed between 1986 and 2001 with thyroid cancer in Belarus, downwind of Chernobyl, would choose the adjective “safe” to describe nuclear power. Nuclear power is not “clean and green,” as the industry claims, because large amounts of traditional fossil fuels are required to mine and refine the uranium needed to run nuclear power reactors, to construct the massive concrete reactor buildings, and to transport and store the toxic radioactive waste created by the nuclear process. Burning of this fossil fuel emits significant quantities of carbon dioxide (CO2)—the primary “greenhouse gas”—into the atmosphere. In addition, large amounts of the now-banned chlorofluorocarbon gas (CFC) are emitted during the enrichment of uranium. CFC gas is not only 10,000 to 20,000 times more efficient as an atmospheric heat trapper (“greenhouse gas”) than CO2, but it is a classic “pollutant” and a potent destroyer of the ozone layer. While currently the creation of nuclear electricity produces only one-third the amount of CO2 emitted from a similar-sized, conventional gas generator, this is a transitory statistic. Over several decades, as the concentration of available uranium ore declines, more fossil fuels will be required to extract the ore from less concentrated ore veins.Within ten to twenty years, nuclear reactors will produce no net energy because of the massive amounts of fossil fuel that will be necessary to mine and to enrich the remaining poor grades of uranium. (The nuclear power industry contends that large quantities of uranium can be obtained by reprocessing radioactive spent fuel. However, this process is extremely expensive, medically dangerous for nuclear workers, and releases large amounts of radioactive material into the air and water; it is therefore not a pragmatic consideration.) By extension, the operation of nuclear power plants will then produce exactly the same amounts of greenhouse gases and air pollution as standard power plants.>

### Nuclear Fission Bad – Even with new fission-powered technology producing more energy than fossil fuels, a variety of safety concerns including disposal of radioactive waste and another Chernobyl are a concern as well as the fact that nuclear fission supplies are running low now.

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg. 231-232

<The type of nuclear power that these plants would produce is fission power. n17 Fission generates energy by inundating heavy elements n18 with [\*232] neutrons. n19 As these free neutrons are integrated into heavy-element atoms, there is a possibility that the nucleus of the atom will split. n20 Well-known isotopes that are given to a high probability of undergoing a fission reaction include Uranium-235 and Plutonium-239. n21 As each atomic nucleus splits, a large amount of energy is produced. n22 Once an atomic nucleus splits in a fission reaction, it produces other isotopes with smaller atomic weights and free neutrons. In turn, these free neutrons collide with other heavy-element atoms, inducing the latter to likewise fissure and generate energy. n23

Among other reasons, nuclear power plants have become more desirable because the fuel costs necessary to keep nuclear reactors operating is lower per kilowatt-hour than the corresponding costs for fossil fuels. n24Additionally, current technology has made it possible for fission-powered electrical generation to be less expensive than comparable electrical generation from fossil fuels. n25 For example, in Finland, France, Germany, the Czech Republic, Slovakia, Romania, Japan, and Canada, fission-powered electricity is cheaper per kilowatt-hour than electrical generation from coal. n26

There are, however, concerns about the safety and long-term viability of fission reactors. After fission reactions split heavy-element atoms, the fission products remain (atomic nuclei created through the fission process, along with other metals), as well as the non-fissured Uranium and Plutonium. n27These products are now nuclear waste and remain highly radioactive. Unfortunately, there is no safe way to dispose of nuclear waste, which has resulted in steel-lined underground repositories, where the waste elements can undergo [\*233] radioactive decay away from populations and water supplies. n28Governments are also concerned about the possibility of another nuclear disaster like that which occurred at Ukraine's Chernobyl Nuclear Power Plant in 1986. n29 Although the Chernobyl accident occurred during a special test of one reactor rather than in the course of its normal operation, n30 and regardless of the fact that the accident's direct causes were archaic technology and human error n31 rather than any inherent defect in fission reactions, Chernobyl became a symbol of the risks of nuclear power plants. n32 As a result, nuclear power has become a political bugaboo, and many states have been relatively leery of nuclear power ever since. n33

While fission reactors may be curative of many of the world's energy problems over the short term, one serious problem may deny fission a place as a permanent solution to electrical generation. Just as any other mineral source, over-consumption will eventually exhaust the nuclear fuel supplies necessary to the fission reaction. While estimates vary as to how long the current reserves will last, n34 some states, such as India, are already having difficulty maintaining fuel sources for their nuclear reactors. n35 For these reasons, while fission-nuclear power has advantages, it seems to be an incomplete answer to the world's energy problems.>

### Nuclear Power Bad – The environmental shortcomings of developing nuclear programs are 1) legal uncertainty undermines the environmental potential and 2) without a consideration of environmental issues new programs may obfuscate environmental challenges.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<VI. ENGAGING INDIA IN NUCLEAR ENERGY SHOWS LOCAL AND GLOBAL ENVIRONMENTAL PROBLEMS While security or proliferation concerns regarding India's nuclearprogram have received significant attention, (108) the environmentalrisks are less explored, even though at least two environmental shortcomings are apparent: 1) domestic and international legal uncertainties undermine the environmental promise of civilian nuclear energy asa climate mitigation tool; (109) and 2) transferring nuclear technology to India without considering environmental issues, such as a waste management or liability regime, create future environmental governance challenges, both domestic and international, which will be heightened by poor international regulatory mechanisms. These environmental concerns indicate that ignoring nuclear energy within the climate regime is a poor environmental governance strategy.>

### Nuclear Power Bad – Nuclear energy development brings with it a slew of environmental and safety risks which are not covered by current protection measures. In India, a single individual with “competent authority” is able to develop radioactive waste disposal sites wherever they so please.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<B. Transferring Nuclear Technology to India Sets the Stage for Future Environmental Issues Nuclear energy development also increases non-climate related environmental and safety risks, but key nuclear agreements pay lip service to these risks. For instance, a recent agreement between the UnitedStates and India on reprocessing spent fuel merely requires the government of India "to follow best practices, as established in its national regulations, for minimizing the impact of the environment which may arise from the operation of the Facility." (148) However, India's national regulation is nascent, and the government has not yet established any best practices in this regard. Waste management rules best illustrate the problem. A 1987 Atomic Energy (Safe Disposal of Radioactive Wastes) Rule (149) that governs waste management does not designate any particular area for use as a waste storage site, unlike the U.S. Nuclear Waste Policy Act of 1982. (150) Itonly requires prior authorization from a "competent authority," who can decide what constitutes an appropriate site. (151) While such basic legislation may have been sufficient to deal withthe small quantities of waste that India's fledgling nuclear plants probably produced, it would be dangerous to provide such discretionary authority to dispose of large quantities of waste, including highlytoxic plutonium from spent fuel reprocessing that will be produced when India implements its new nuclear energy program.>

### Nuclear Power Bad – India’s case study demonstrates that with the current legal uncertainty surrounding nuclear power, the expansion of nuclear energy programs will not reduce emissions and may even aggravate environmental proglems.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<India's case study demonstrates that India and other nations' expansion of nuclear energy programs will neither produce the positive result of reducing greenhouse gas emissions nor mitigate potential related environmental problems. Nuclear energy within the current legal structure is a lose-lose proposition that deserves much more legal scrutiny than it has received. To be sure, the consequences of climate change unraveling amidst several nuclear facilities governed by ill thought-out environmental and safety rules are unthinkable. There is anurgent need to design international and domestic rules on nuclear energy and also to reconsider current approaches to emissions reductionthat may lead nations to pursue environmentally catastrophic alternatives without much forethought.>

### Nuclear Power Bad – Nations are simply “piggybacking” on climate change to achieve energy security goals. There are no existent legal mechanisms for the task of reducing emissions and managing nuclear energy which can lead to, as shown in India, detrimental environmental effects. We should not adopt alternatives which will worsen environmental problems.

Deepa 11 – Badrinarayana Deepa, Assistant Professor of Law, Chapman University School of Law, June 14, 2011, “Environmental Challenges of Climate-Nuclear Fusion: A Case Study of India,” Power Engineering, http://www.power-eng.com/news/2011/06/1437206685/environmental-challenges-of-climate-nuclear-fusion-a-case-study-of-india.html

<VII. CONCLUSION: ACKNOWLEDGING AND ADDRESSING THE CLIMATE-NUCLEAR LINK Excluding nuclear energy from the international climate change regime for environmental reasons has not slowed the expansion of nuclearpower. On the contrary, India and other nations are piggybacking on climate change to achieve their long-term energy security goals. This is a troubling development, because the absence of proper international and domestic legal infrastructure and strategies for reducing emissions and managing environmental and safety impacts of nuclear energy demonstrates the inadequacies of both global climate and environmental governance. A better approach is necessary to address the issue of nuclear energy in a more meaningful manner, including establishing a coherent environmental governance mechanism, proper assessment of the risks involved, and prioritization of environmental protection goals. To the extent that nations continue to expand their nuclear energy, nuclear energy should be included within an international climate regime; indeed, current approaches to climate change under the Kyoto Protocol may require reconsideration. Reducing greenhouse gas emissions has not only become an important environmental issue, it has become the environmental issue. The problem with this situation is that nations have not figured out a way toeffectively reduce emissions, primarily because climate change is also an economic issue and reductions would call for either new sourcesof energy in our current growth model or an entirely new economic growth model. Absent any new ideas regarding the latter, nations are focusing on maintaining the current model of economic growth, while at the same time promoting new sources of energy and seeking emissions reduction. However, balancing all three concerns--emissions, economics, and energy--is difficult, if not downright improbable when nationalobjectives on all three issues are not aligned. India's case shows that its energy, security, and economic growth law and policy do not correspond to its position on emissions reduction. The fairness of such policy is beside the point; what matters is dealing with the realities of the emission-energy-economics dilemma by taking new approaches to climate change mitigation. The current approach is fixated on reducing emissions within a targeted time period. Instead, nations should establish a climate assessment system, underwhich nations make efforts to phase out sources of energy that are found to contribute to climate change, while at the same time establishing transparent mechanisms to assess the efficacy of alternative energy sources. Under such an approach, nations will have to demonstratewith reasonable certainty that the proposed technology will mitigate climate change within a particular time. Nations should also grant international incentives such as tariff exemptions under the General Agreement on Tariffs and Trade (GATT) to such technologies or establish special investment regimes to promote their development. (182) At the same time, technologies such as nuclear energy that do not timely contribute to climate mitigation and that may present environmental problems must be discouraged through a system of disincentives, or their use must be promoted under a legal framework that maximizes their contribution to emissions reduction and minimizes their environmentalimpact. Without a fresh approach, the continuing stalemate on climate change presents a bleak picture. Even worse, it may cause nations to adopt alternatives that will lead to further environmental deterioration.>

## He3 Advantage---Nuclear Energy---Prolif Imapct

### Nuclear Energy Bad – Proliferation

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<Adding to the danger, nuclear power plants are essentially atomic bomb factories. A 1,000 megawatt nuclear reactor manufactures 500 pounds of plutonium a year; normally ten pounds of plutonium is fuel for an atomic bomb. A crude atomic bomb sufficient to devastate a city could certainly be crafted from reactor grade plutonium. Therefore any non-nuclear weapons country that acquires a nuclear power plant will be provided with the ability to make atomic bombs (precisely the issue the world confronts with Iran today). As the global nuclear industry pushes its nefarious wares upon developing countries with the patent lie about “preventing global warming,” collateral consequences will include the proliferation of nuclear weapons, a situation that will further destabilize an already unstable world.>

2AC Extension Nuclear Power Bad – Proliferation

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<Nuclear proliferation is a major geopolitical concern in several regions. States with hostile neighbors watch nervously whenever nuclear facilities of any kind are constructed. Furthermore, there can never be a complete separation between equipment, personnel, materials, and knowledge used for civilian nuclear power generation and the same things used for weapons development. All else being equal, a state in possession of reactors, fuel, and scientists will be able to produce an atomic bomb significantly more easily than one lacking these ingredients; this is especially true given the consensus that the most difficult aspect of acquiring a crude but functional fission device is the acquisition of bomb-grade uranium or plutonium. States that have either developed or sought to develop nuclear weapons using expertise (and possibly materials or equipment) diverted from civilian programs include Israel, South Africa, Pakistan, North Korea, Iraq, and possibly Iran. While the construction of new nuclear reactors in states that already have nuclear weapons probably does not contribute to proliferation risks, their more widespread dissemination in states with few or no bombs may well encourage regional rivals to consider moving towards nuclearization. The more volatile a particular region becomes – and the more acute the security concerns different states develop about one another become – the more likely various actors will seek to convert civilian into military nuclear capability.>

## He3 Advantage---Nuclear Energy---Misc Impacts

### Nuclear Power Bad – Water Wars

Ilnyckyj 9 – Milan Ilnyckyj, UBC And Oxford Graduate In International Relations And Political Science, 2009, “Climate Change, Energy Security, And Nuclear Power,” Online: http://www.sindark.com/NonBlog/Articles/CCNuclear.pdf

<One of the most probable and worrisome consequences of climate change is changes in regional water availability. Decreased water quantity and increased temperature both pose challenges for nuclear facilities, since they use very large quantities of water for cooling.23 The ipcc projects that future precipitation is likely to be more sporadic, increasing in total quantity in high-latitude regions while subtropical zones dry out. Loss of winter snowpack leads to diminished summer river flow, while changes in precipitation patterns and evaporation will likewise alter the quantity and timing of water availability in different regions. Areas that have not faced significant water stress in the past may find themselves doing so, while areas that had previously faced moderate stress might find themselves in extreme conditions. Already, there are precedents of nuclear power plants that needed to be shut down due to high ambient water temperatures or low water flow. For example, in summer 2007, the generating station at Browns Ferry, Alabama had to be shut down because cooling water from the Tennessee River was too hot to use.24 Particularly in areas like the Southern United States and Australia, uncertainty about future water availability could constrain the additional deployment of nuclear stations. Deployment in spite of such concerns could lead to additional shutdowns of the kind already seen, depriving the grid of power and the plants of usefulness.>

### Nuclear Energy Bad – Nuclear Terrorism

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<In this day and age, nuclear power plants are also obvious targets for terrorists, inviting assault by plane, truck bombs, armed attack, or covert intrusion into the reactor’s control room. The subsequent meltdown could induce the death of hundreds of thousands of people in heavily populated areas, and they would expire slowly and painfully, some over days and others over years from acute radiation illness, cancer, leukemia, congenital deformities, or genetic disease. Such an attack at the Indian Point reactors, thirty-five miles from Manhattan, for instance, would effectively incapacitate the world’s main financial center for the rest of time. An attack on one of the thirteen reactors surrounding Chicago would wreak similar catastrophic medical consequences. Amazingly, security at U.S. nuclear power plants remains at virtually the same lax levels as prior to the 9/11 attacks.>

## He3 Advantage---Nuclear Energy---Caldicott

### Nuclear Energy Bad – Nuclear energy creates significant pollution and requires massive infusions of government subsidies. Large amounts of fossil fuels and extremely harmful fossil fuels are required to refine uranium while.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<The current administration clearly believes that if it lies frequently and with conviction, the general public will be lulled into believing their oft-repeated dictums. As this book will show, no part of “efficiently, safely, and with no discharge of greenhouse gases or emissions” is true. Nuclear energy creates significant greenhouse gases and pollution today, and is on a trajectory to produce as much as conventional sources of energy within the next one or two decades. It requires massive infusions of government (read taxpayer) subsidies, relying on universities and the weapons industry for its research and development, and being considered far too risky for private investors. It is also doubtful that the 8,358 individuals diagnosed between 1986 and 2001 with thyroid cancer in Belarus, downwind of Chernobyl, would choose the adjective “safe” to describe nuclear power. Nuclear power is not “clean and green,” as the industry claims, because large amounts of traditional fossil fuels are required to mine and refine the uranium needed to run nuclear power reactors, to construct the massive concrete reactor buildings, and to transport and store the toxic radioactive waste created by the nuclear process. Burning of this fossil fuel emits significant quantities of carbon dioxide (CO2)—the primary “greenhouse gas”—into the atmosphere. In addition, large amounts of the now-banned chlorofluorocarbon gas (CFC) are emitted during the enrichment of uranium. CFC gas is not only 10,000 to 20,000 times more efficient as an atmospheric heat trapper (“greenhouse gas”) than CO2, but it is a classic “pollutant” and a potent destroyer of the ozone layer. While currently the creation of nuclear electricity produces only one-third the amount of CO2 emitted from a similar-sized, conventional gas generator, this is a transitory statistic. Over several decades, as the concentration of available uranium ore declines, more fossil fuels will be required to extract the ore from less concentrated ore veins.Within ten to twenty years, nuclear reactors will produce no net energy because of the massive amounts of fossil fuel that will be necessary to mine and to enrich the remaining poor grades of uranium. (The nuclear power industry contends that large quantities of uranium can be obtained by reprocessing radioactive spent fuel. However, this process is extremely expensive, medically dangerous for nuclear workers, and releases large amounts of radioactive material into the air and water; it is therefore not a pragmatic consideration.) By extension, the operation of nuclear power plants will then produce exactly the same amounts of greenhouse gases and air pollution as standard power plants.>

### Nuclear Energy Bad – Power plants routinely emit radioactive gases which can lead to epidemics of cancer, leukemia, and genetic disease in local populations.

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### Nuclear Energy Bad – Nuclear power is expensive and unreliable. The cherry on top is global supplies of usable helium will not be accessible for more than nine years.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

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### Nuclear Energy Bad – Nuclear power plants are easy targets for hijackers who could cause hundreds of thousands of deaths which would have long-lasting impacts such as disease.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<In this day and age, nuclear power plants are also obvious targets for terrorists, inviting assault by plane, truck bombs, armed attack, or covert intrusion into the reactor’s control room. The subsequent meltdown could induce the death of hundreds of thousands of people in heavily populated areas, and they would expire slowly and painfully, some over days and others over years from acute radiation illness, cancer, leukemia, congenital deformities, or genetic disease. Such an attack at the Indian Point reactors, thirty-five miles from Manhattan, for instance, would effectively incapacitate the world’s main financial center for the rest of time. An attack on one of the thirteen reactors surrounding Chicago would wreak similar catastrophic medical consequences. Amazingly, security at U.S. nuclear power plants remains at virtually the same lax levels as prior to the 9/11 attacks.>

### Nuclear Energy Bad – Nuclear power plants provide non-nuclear nations with the capacity to develop atomic weapons leading to global proliferation and security destabilization.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<Adding to the danger, nuclear power plants are essentially atomic bomb factories. A 1,000 megawatt nuclear reactor manufactures 500 pounds of plutonium a year; normally ten pounds of plutonium is fuel for an atomic bomb. A crude atomic bomb sufficient to devastate a city could certainly be crafted from reactor grade plutonium. Therefore any non-nuclear weapons country that acquires a nuclear power plant will be provided with the ability to make atomic bombs (precisely the issue the world confronts with Iran today). As the global nuclear industry pushes its nefarious wares upon developing countries with the patent lie about “preventing global warming,” collateral consequences will include the proliferation of nuclear weapons, a situation that will further destabilize an already unstable world.>

### Nuclear Energy Bad – Every dollar spent on nuclear power is a diversion of resources from genuinely renewable power sources. Renewable energy sources will add much more world energy capacity than nuclear energy will.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<Meanwhile, every billion dollars spent on the supremely misguided attempt to revivify the nuclear industry is a theft from the production of cheap renewable electricity. Think what these billions could do if invested in the development of wind power, solar power, cogeneration, geothermal energy, biomass, and tidal and wave power, let alone basic energy conservation, which itself could save the United States 20% of the electricity it currently consumes. A Greenpeace report issued in October 2005 predicted that solar power could supply clean electricity to 100 million people living in sunny parts of the world by the year 2025. Such an enterprise could create 54,000 jobs and be worth $19.9 billion. In just two decades, the amount of solar electricity could be equivalent to the power generated by seventy-two coal-fired stations—for example, enough to supply the needs of Israel, Morocco, Algeria, and Tunisia combined. (Egypt is currently one of the few countries in the world that hosts a government department solely devoted to the development of renewable energy sources) The Carbon Trust, an independent company established by the British government, estimates that, with the correct amount of investment, marine energy—tidal and wave power—could provide up to 20% of the United Kingdom’s current electricity needs. As Marcus Rand, chief executive of the British Wind Energy Association, said, “The report provides impetus behind the vision that Britain can rule the waves and the tides making a significant dent in our carbon emissions alongside creating new world-class industries for the UK.” According to Amory Lovins, CEO of the Rocky Mountain Institute, in 2004 the amount of electricity supplied by renewable energy sources—wind, co-generation, biomass, geothermal, solar, hydro (excluding electricity generated from large hydro dams)—added 509 times the total capacity worldwide that nuclear power contributed, and raised the global electricity production 2.9 times more than nuclear power contributed. These “minor” electricity sources already dwarf the annual growth of nuclear power generation, and experts predict that by 2010, they will add 177 times more capacity than nuclear power provides.>

### Nuclear Energy Bad – The assertion that nuclear power can be used to reduce the US reliance on foreign reliance is simply wrong. Oil is not used to generate electricity but to power combustion engines and heat buildings.

Caldicott 6 – Helen Caldicott, World’ Leading Spokesperson For The Antinuclear Movement And President Of The Nuclear Policy Research Institute, September 20, 2006, “Nuclear Power Is Not The Answer,” The New Press, Online: <http://tria.fcampalans.cat/images/Nuclear%20Power%20is%20not%20the%20answer%20-%20H.%20Caldicott.pdf>

<When nuclear proponents say that nuclear power can be used to reduce the United States’ insatiable reliance on foreign oil, they are simply wrong. Oil and its byproduct gasoline are used to fuel the internal combustion engines in automobiles and trucks. Oil is also used to heat buildings. But oil does not power the electric grid. The grid, which is used to power electric lights, computers, VCRs, fans, hair dryers, stoves, refrigerators, air conditioners, and for industrial needs, is powered primarily through the burning of coal, other fossil fuels, and, currently, through nuclear power. (Oil does generate an infinitesimal amount of electricity—2% in the United States.)>

## He3 Advantage---Oil Exploration---Solvency

### Helium-3 Good – Oil Exploration – Helium-3 neutron detectors are used to locate oil, natural gas, and water. Specifically, background gamma radiation levels do not interfere with the accuracy of measurements while He-3 detectors can withstand harsh underground conditions. Much oil activity will likely stop if no alternative to He-3 is produced.

Anderson 10 – Thomas R. Anderson, Product Line Leader of GE Energy and Reuter Stokes Radiation Measurement Solutions, April 22, 2010, Written Testimony of Thomas R. Anderson, Product Line Leader GE Energy, Reuter Stokes Radiation Measurement Solutions Before the Subcommittee on Investigations and Oversight Committee on Science And Technology U.S. House of Representatives Hearing on “Caught By Surprise: Causes And Consequences Of The Helium-3 Supply Crisis,” http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/042210\_Anderson.pdf

<Oil and Gas

Helium-3 neutron detectors are also widely used in oil and gas exploration. These detectors are used in conjunction with a neutron source to locate hydrogenous materials such as oil, natural gas, and water. Neutron measurements in conjunction with inputs from other drill string instruments are used to locate hydrocarbon reservoirs during drilling, and to further delineate the reservoirs during logging operations. The overwhelming majority of nuclear porosity tools used in the oil and gas industry today depend on the unique properties of Helium-3 neutron detectors.

Helium-3 neutron detectors have high neutron sensitivity, which enables them to be packaged to fit inside the tool string. The excellent gamma discrimination characteristic of Helium-3 means that background gamma radiation levels do not interfere with the accuracy of the neutron measurements. These detectors must also operate reliably and survive at temperatures up to 200oC under severe vibration and shock levels up to 1,000 times the force of gravity. It is likely that without Helium-3, exploration for new reserves, development drilling of existing fields, and logging of both new and existing wells will be severely curtailed until an alternative technology is developed.>

## He3 Advantage---Energy Security---Solvency

### Helium-3 Good – Lunar Helium-3 will serve as a potential energy source which can help free the world from fossil fuels. The potential awards outweigh the difficult challenges.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<A sample of soil from the rim of Camelot crater slid from my scoop into a Teflon bag to begin its trip to Earth with the crew of Apollo 17. Little did I know at the time, on Dec. 13, 1972, that sample 75501, along with samples from Apollo 11 and other missions, would provide the best reason to return to the moon in the 21st century. That realization would come 13 years later. In 1985, young engineers at the University of Wisconsin discovered that lunar soil contained significant quantities of a remarkable form of helium. Known as helium-3, it is a lightweight isotope of the familiar gas that fills birthday balloons. HOT PROPERTY: America’s last mission to the moon brought back evidence of large amounts of helium-3, a potential energy source. Small quantities of helium-3 previously discovered on Earth intrigued the scientific community. The unique atomic structure of helium-3 promised to make it possible to use it as fuel for nuclear fusion, the process that powers the sun, to generate vast amounts of electrical power without creating the troublesome radioactive byproducts produced in conventional nuclear reactors. Extracting helium-3 from the moon and returning it to Earth would, of course, be diffi cult, but the potential rewards would be staggering for those who embarked upon this venture. Helium-3 could help free the United States—and the world—from dependence on fossil fuels.>

### Helium-3 Good – The Moon, unlike Earth, has much accessible Helium-3 because of a lack of a magnetic field and atmosphere which prevent the collection of solar wind particles.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 250-251

<He-3 is a component of "solar wind" comprised of gas and charged particles continuously emitted by the sun into the solar system in the course of its thermonuclear fusion processes.12 During more than four billion year's in which die solar wind has impacted the Moon, significant amounts of He-3, in addition to particles of other ionized components of the solar wind, have become embedded in the Moon's regolith—the loose and dusty upper layer of rocks and soil comprising much of the Moon's surface.19 While He-3 constitutes only a minute proportion of the lunar regolith," it is estimated that, altogether, there may be as much as one million metric tons of He-3 potentially recoverable

from the Moon's surface.181 This amount of He-3 is theoretically equivalent to ten times the energy content of all of the coal, oil, and natural gas economically recoverable on Earth.16 Since the Earth, unlike the Moon, possesses a magnetic field and atmosphere that deflect the solar wind, He-3 is rarely found naturally on Earth.17 The small amounts of He-3 available for research and experiment on Earth are derived principally from the decay of tritium used in thermonuclear weapons.1">

### Nuclear Fusion Good – With Earth’s supply of fossil fuels dwindling in the 21st century a new source of clean, reliable energy is in high demand. Fossil fuels can be replaced by nuclear fusion power.

**Schmitt And Kulcinski 90** - H.H. Schmitt, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, G.L. Kulcinski, Director of the Fusion Technology Institute at the University of Wisconsin, October 1990, “Fusion Power From Lunar Resources,” Fusion Technology Institute, University of Wisconsin-Madison, pg. 1

OCR USED. DID NOT SCAN WHOLE ARTICLE.

<One of the most important resources for the next century will be a safe, reliable and clean supply of energy. Without it, the Earth could not support its present population of five billion peopleand certainly not the 10 to 12 billion people likely to inhabit the planet in the 21st century. This energy is necessary to feed, protect, and clothe the world's population as well as to keep them healthy in the face of an environment under increasing stress. Indeed, the developed, and undeveloped, nations of the world are already highly dependent on a steady flow of energy to maintain their very existence.

Since the 1930s, fossil fuels such as coal, oil and natural gas have been the major energy resources driving the economy of the world. As the year 2000 approaches, two factors are limiting our continued reliance on these fuels for the 21st century. The first is the fact that there is a finite limit to fossil fuels and they are being rapidly depleted. Based on the present rate of world per capita energy consumption (Fig. 1) and accounting for a population growth to the 10 billion level (Fig. 2). practically all of the presently economically recoverable fossil fuels will be exhausted by the middle of the 21st century if no new energy resources are discovered (Fig. 3).

Secondly, the massive burning of fossil fuels is damaging the quality of the environment worldwide. Energy use in developed and underdeveloped nations of the world is presently responsible for the emission of more than five billion tons of carbon, in the form of carbon dioxide (CO), into the atmosphere each year. This increasing COconcentration may eventually cause global warming via the "greenhouse effect". If this occurs, the warming could result in widespread resettlement of the world's population to accommodate rising seas and shifting rainfall patterns. The ancillary effects of fossil fuel utilization, such as acid rain and land despoilment, will also shorten the future of these fuels as major energy resources.

Nuclear energy in the form of fission technology has been proposed to replace fossil fuels as the primary energy resource for the future.>

### Lunar Exploration Good – The Moon is a potential source of energy which would power the world for many years to come. He-3 is the cash crop of the Moon which may be the answers to our energy needs.

Wakefield 00 – Julie Wakefield, SPACE Author Of “One Small Step for Space Tourists,” June 30, 2000, “Researchers And Space Enthusiasts See Helium-3 As The Perfect Fuel Source,” SPACE, Online: http://www.space.com/scienceastronomy/helium3\_000630.html.

<Researchers and space enthusiasts see helium 3 as the perfect fuel source: extremely potent, nonpolluting, with virtually no radioactive by-product. Proponents claim its the fuel of the 21st century. The trouble is, hardly any of it is found on Earth.But there is plenty of it on the moon. Society is fighting to keep pace with energy demands, expected to increase eightfold by 2050 as the world population swells toward 12 billion. The moon just may be the answer. "Helium 3 fusion energy may be the key to future space exploration and settlement," said Gerald Kulcinski Director of the Fusion Technology Institute (FTI) at the University of Wisconsin at Madison. Scientists estimate there are about 1 million tons of helium 3 on the moon, enough to power the world for thousands of years. The equivalent of a single space shuttle load or roughly 25 tons could supply the entire United States' energy needs for a year, according to Apollo17 astronaut and FTI researcher Harrison Schmitt. Cash crop of the moon When the solar wind, the rapid stream of charged particles emitted by the sun, strikes the moon, helium 3 is deposited in the powdery soil. Over billions of years that adds up. Meteorite bombardment disperses the particles throughout the top several meters of the lunar surface. "Helium 3 could be the cash crop for the moon," said Kulcinski, a longtime advocate and leading pioneer in the field, who envisions the moon becoming "the Hudson Bay Store of Earth."Today helium 3 would have a cash value of $4 billion a ton in terms of its energy equivalent in oil, he estimates. "When the moon becomes an independent country, it will have something to trade.">

### Helium-3 Good – He-3 nuclear fusion reactors are a big deal. Not only can He-3 prevent our reliance on fossil fuels but He-3 can help meet Earth’s energy needs for 500 years.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg.

<2. Outer Space's Potential to Create Innovative Energy Solutions

Many nations in the international community have begun to strongly emphasize the need to develop energy solutions that reduce the world's reliance on fossil fuels.n162 Many theories have been advanced, n163 and it is possible that the most workable theories have yet to be conceived. However, the proposed helium-3 fusion reactor is an intriguing thought which deserves some attention.

Helium-3 is a helium isotope that is rare on Earth but is believed to be abundant on the Moon.n164 The Apollo program's research [\*506] on the lunar surface indicated that microwaves could be used to draw helium-3 out of the Moon's surface. n165Once removed, the isotope can be used in a fusion reaction that is cheap to produce, long lasting, and produces nominal amounts of radioactive waste. n166 One group of physicists theorizes that the total amount of helium-3 on the Moon could meet the totality of Earth's energy needs for 500 years. n167>

### Helium 3 an solve world’s energy needs

Lee 10-Adrian Lee, former national newspaper journalist and four years on staff of times and daily express, March 25, 10, “Truth behind new space race,” http://www.allbusiness.com/science-technology/astronomy-space-space-exploration/14168588-1.html

Not far from its surface lies a source of power which, if successfully mined, could solve many of the world's energy needs for thousands of years to come.

The Moon has acted like a sponge and soaked up Helium-3, emitted from the Sun in the form of solar winds. According to space scientist and author Dr David Whitehouse, just two payloads full of Helium-3 in a Space Shuttle-style vessel could provide sufficient power for the United States for a year, created using nuclear fusion. It's been estimated that more than one million tonnes of this fuel lie buried on the Moon.

If ways of getting heavy equipment to the Moon can be found, the technology exists to extract Helium-3, says Dr Whitehouse.

Only a handful of other nations, currently led by China, are anywhere near ready to put a man on the moon.

Russia - which has already stated its intention to mine Helium-3 - Japan and India are the others. A European alliance has the technology to land there and we even have a trainee astronaut, Major Tim Peake, working for the European Space Agency.

### Retrieving Helium 3 helps to establish control of the global energy market

Lasker 06, John Lasker, freelance journalist, Dec. 23, 2006, “Race to the moon for nuclear fuel,” http://www.wired.com/science/space/news/2006/12/72276?currentPage=2;

Russian space geologist Erik Galimov told the Russian Izvestia newspaper that NASA's plan to colonize the moon will "enable the U.S. to establish its control of the global energy market 20 years from now and put the rest of the world on its knees as hydrocarbons run out."

Schmitt told a Senate committee in 2003 that a return to the moon to stay would be comparable "to the movement of our species out of Africa."

The best way to pay for such a long-term mission, he said, would be to mine for lunar helium-3 and process it into a fuel for commercial fusion .

In a 1998 op-ed for Space News, Schmitt criticized the 1979 United Nations- sanctioned Moon Treaty, which forbids ownership of lunar territory by individuals or separate nations.

"The mandate of an international regime would complicate private commercial efforts," Schmitt wrote. "The Moon Treaty is not needed to further the development and use of lunar resources for the benefit of humankind -- including the extraction of lunar helium-3 for terrestrial fusion power."

Schmitt declined to comment for this article. But Kulcinski said their lunar helium-3 research is entirely separate from their NASA duties.

"The NAC is purely an advisory council to Dr. Griffin," he said. "It has very broad responsibilities dealing with science, exploration, human capital, education and operations, to name a few. Our appointments to this advisory committee have nothing to do with our specific research interests."

Kulcinski has been studying helium-3 fusion for more than 20 years. When his UW fusion team realized 15 years ago that helium-3 could be extracted from lunar soil, he called it a "rediscovery."

### Energy Solvency – Helium-3 solves a slew of problems by replacing fossil fuels and nuclear fission reactors even with uncertain technological and economic feasibility.

Bilder 10 - Richard B. Bilder, Foley & Lardner-Bascom Professor of Law at the University of Wisconsin-Madison , January 2010, “A Legal Regime For The Mining Of Helium-3 On The Moon: U.S. Policy Options,” Fordham International Law Journal, Volume 33, Number 2, [SSRN:](http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1611202_code546503.pdf?abstractid=1486273&mirid=2) pg. 246-247

<While the technological and economic feasibility of fusion based nuclear energy, particularly fusion reactors utilizing He-3 as fuel, is still uncertain and contested, and its commercial realization at best decades away,5 the implications of such a development could be far-reaching and profound. Fusion energy could significantly reduce the world's heavy dependence on fossil fuels, which are associated with environmental pollution, greenhouse gas emissions, and global warming-not to mention their rising price and role in recurrent geopolitical and economic tensions. Fusion energy could also provide a safer alternative to many countries' growing reliance on energy generated from nuclear fission reactors, which hold the potential dangers of nuclear accidents, terrorism, weapons proliferation, and radioactive waste disposal. Moreover, in contrast to the prospect of depletion of terrestrial fossil fuels, it is estimated that there is sufficient He-3 present on the Moon to meet humanity's rapidly growing energy needs for many centuries to come.6 Thus, despite the problematic future of He-3-based fusion energy, it is not surprising that the United States and other major powers are beginning to position themselves to ensure their future access to lunar He-3 resources.>

### Energy Solvency – The Moon is a potential source of energy which would power the world for many years to come. He-3 is the cash crop of the Moon which may be the answers to our energy needs.

Wakefield 00 – Julie Wakefield, SPACE Author Of “One Small Step for Space Tourists,” June 30, 2000, “Researchers And Space Enthusiasts See Helium-3 As The Perfect Fuel Source,” SPACE, Online: http://www.space.com/scienceastronomy/helium3\_000630.html.

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## He3 Advantage---Energy Security---Inpacts

### Peak Oil Bad – Our civilizations have continued to grow on the foundation of unlimited oil yet when oil peaks in the near future, nations will face the dim prospect of economic collapse, global hunger, and violent conflict over resources.

Heinberg 5 – Richard Heinberg, 2005, “Powerdown: Options And Actions For A Post-Carbon World,” European Business Review, 17(5), pg. 476-479, Emerald

<My most recent book, Powerdown, is an exploration of the realistic options that will be available to industrial societies, and individuals in those societies, in the dawning era of oil and natural gas depletion. It is a starkly frank look at our prospects as the industrial period winds toward its inevitable conclusion, and a discussion of what we can do to build a truly sustainable culture for our children and grandchildren. Oil has been the cheapest and most convenient energy resource ever discovered by humans. During the past two centuries, people in industrial nations accustomed themselves to a regime in which more fossil-fuel energy was available each year, and the global population grew quickly to take advantage of this energy windfall. Industrial nations also came to rely on an economic system built on the assumption that growth is normal and necessary, and that it can go on forever. When global oil production peaks, as it will in the next few years, that assumption will come crashing down. How can we be sure that oil will become less abundant? Consider these simple facts. The oil industry started in America, and the US is the most-explored region on the planet. Thus, America's experience with oil will eventually be repeated elsewhere. Oil discovery in the US peaked in the 1930s; oil production peaked roughly 40 years later. Since 1970, the US has had to import more oil nearly every year in order to make up for its shortfall from domestic production. The same is happening elsewhere. Global discovery of oil peaked in the early 1960s. One after another, oil-exporting nations are reaching their all-time production peaks and falling into decline, becoming oil-importing nations. Britain is a classic example: it is slated to become a net importer once again this year. Between 18 and 24 of the world's 45 most important oil-producing nations are, like the US and Britain, past-peak. According to a growing chorus of oil experts, the global peak will arrive between now and 2010. Clearly, we need immediately to find substitutes for oil. But an analysis of the current energy alternatives is not reassuring. Solar and wind are renewable, but most nations now get only a tiny portion of their energy budgets from them; rapid and costly growth will be necessary if these alternatives are to replace a significant fraction of the energy shortfall from post-peak oil. Nuclear power is dogged by the problem of radioactive waste disposal. Hydrogen is not an energy source, but an energy carrier: it takes more energy to produce a given quantity of hydrogen than the hydrogen itself will yield. Moreover, nearly all commercially produced hydrogen now comes from natural gas - whose production will peak only a few years after oil begins its decline. Unconventional petroleum resources - heavy oil, tar sands, and shale oil - are plentiful but costly to extract, and the rate of extraction cannot be increased arbitrarily. The hard math of energy resource analysis yields an uncomfortable but unavoidable prospect even if efforts are intensified now to switch to alternative energy sources, after the oil peak industrial nations will have less energy available to do useful work - including the manufacturing and transporting of goods, the growing of food, and the heating of homes. If there is any solution to industrial societies' approaching energy crises, renewables plus conservation will provide it. Yet in order to achieve a smooth transition decades will be needed, and we do not have decades before the peak comes. Moreover, even in the best case, the transition will require the massive shifting of investment from other sectors of national economies toward energy research and conservation. And the available alternatives will likely be unable to support the kinds of transportation, food, and dwelling infrastructure we now have; thus the transition will entail a complete redesign of industrial societies. The likely economic consequences of the energy downturn are enormous. All human activities require energy - which physicists define as "the capacity to do work." With less energy available, less work can be done - unless the efficiency of the process of converting energy to work is raised at the same rate as energy availability declines. It will therefore be essential for all economic processes to be made more energy-efficient. However, efforts to improve efficiency are subject to diminishing returns, and so a point will be reached where reduced energy availability will translate to reduced economic activity. This is problematic given the fact that most economies are currently based on the need for perpetual growth. The consequences for global food production will be no less profound. Throughout the twentieth century, food production expanded in country after country, mostly due to increased energy inputs. Without fuel-fed tractors and petroleum-based fertilizers, pesticides, and herbicides, it is questionable whether crop yields can be maintained at current levels. The oil peak will also impact international relations. Many wars of the twentieth century were fought over resources - often, oil. But those wars took place during a period of expanding resource availability; the coming decades of heightened competition for fading energy resources will likely see more frequent and deadly conflicts - many of them likely centered in the Middle East and Central Asia.>

### Peak Oil Bad – Our industrial societies need to experience a fundamental change of direction if we are to enjoy the quality of life we enjoy right now. Considerable efforts to improve our energy use efficiency must begin now to prevent devastating consequences.

Heinberg 5 – Richard Heinberg, 2005, “Powerdown: Options And Actions For A Post-Carbon World,” European Business Review, 17(5), pg. 476-479, Emerald

<If humankind is to avoid ruthless competition, cooperative efforts toward conservation will be needed. The ways cooperation and conservation could be achieved are limitless in detail, but the broad-scale options are few and easily surveyed. Industrialized societies will have to forego further conventional economic growth in favor of a costly transition to alternative energy sources. All nations will have to limit per-capita resource usage. To avoid wasteful competitive struggle, powerful countries will have to reduce disparities of wealth both among their own people, and also between themselves and poorer nations. Not only will oil, coal, and natural gas need to be conserved, but also fresh water, topsoil, and other basic and limited resources. Moreover, as energy available for industrial transportation declines, economies will have to be unlinked from the global market and re-localized. Everyone - especially those in rich, industrial nations - will have to undertake a change in lifestyle in the direction of more modest material goals more slowly achieved. And inevitably, with the conservation of resources will come the necessity to stabilize and reduce human populations. These are far from being entirely new ideas. In the early 1970s the Club of Rome commissioned, from a MIT-based international team of researchers led by Donella Meadows, a study on the future of industrial society. Published as The Limits to Growth in 1972 (LTG), the book provoked a debate that is still ongoing. The study concluded that if (then) present growth trends continued, fundamental resource limits would be reached in the middle of the twenty-first century, leading to a dramatic, uncontrollable collapse of population, food production, and other significant measures of social viability. Several economists resorted to misrepresentation and misquoting in order to attempt to debunk LTGs conclusions. However, in fact, rather than having been refuted or debunked, the LTG study has well withstood the test of time and is widely regarded as an early landmark in the literature on sustainability. While the main message of the book was worrisome, LTG's second important conclusion was that it might be possible establish a state of global equilibrium in which society would be "sustainable without sudden and uncontrollable collapse" and "capable of satisfying the basic material requirements of all of its people." I mention the LTG study because both its analysis and its recommendations clearly framed the terms of the effort we must now take up in earnest - which I have termed Powerdown. This would imply a fundamental change of direction for industrial societies - from the larger, faster, and more centralized, to the smaller, slower, and more locally-based; from competition to cooperation; and from boundless growth to self-limitation. If this recommendation were taken seriously, it could lead to a world a century from now with fewer people using less energy per capita, all of it from renewable sources, while enjoying a quality of life enviable by the industrial urbanite of today. Human inventiveness could be put to the task of expanding artistic satisfaction, finding just and convivial social arrangements, and deepening the spiritual experience of being human. Living in smaller communities, people would enjoy having more control over their lives. Traveling less, they would have more of a sense of rootedness, and more of a feeling of being at home in the natural world. Renewable energy sources would provide some conveniences, but not nearly on the scale of fossil-fueled industrialism. This will not, however, be an automatic outcome of the energy decline. Such a happy result can only come about through considerable effort, beginning immediately.>

The book begins with an updating of information on petroleum depletion in my previous volume, The Party's Over: oil, War and the Fate of Industrial Societies. It then explores the four pathways that will be available to humanity as available energy declines. The first consists of ruthless competition for the world's remaining resources, a path I call "Last One Standing." The main alternative is "Powerdown," a strategy that will require tremendous effort and economic sacrifice in order to reduce per-capita resource usage in wealthy countries, develop alternative energy sources, distribute resources more equitably, and humanely but systematically reduce the size of the human population over time. The world's environmental, anti-war, anti-globalization, and human rights organizations are pushing for a mild version of this alternative, but for political reasons they de-emphasize the level of effort required and play down the population issue. Meanwhile the vast majority of the world's people are in the dark. They do not understand the challenge facing us, nor the options realistically available. Politicians and the media actively help to maintain this condition of ignorance by encouraging denial and offering false hopes (for an easy transition to a hydrogen economy, or for simple market-based solutions), a path I call "Waiting for the Magic Elixir." Finally I suggest that, if Powerdown efforts fail, we should prepare for the ensuing collapse of industrial civilization by building cultural lifeboats - communities of preservation and service that would seek to protect natural ecosystems and teach the skills of sustainability and self reliance. In the final chapter, "Our Choice," I explore how three important groups within global society - the power elites, the opposition to the elites (the antiwar movement, anti-globalization movement, etc. - the "Other Superpower"), and ordinary people - are likely to respond to these four options. I suggest that the most fruitful response is likely to be a combination of Powerdown (in its most severe form) and Lifeboat Building. This chapter ends with a plea for the preservation of our highest human values and ideals during a time when human life may begin to appear cheap and superfluous, and when fear and hate may seem increasingly justified. Powerdown offers no facile answers to the dilemmas ahead. Its purpose is not to persuade but to inform. It dares to speak frankly about the human condition, but avoids cynicism and despair. It acknowledges that we are probably living in the early collapse phase of industrial society. By taking reality (rather than hopeful fantasy) as a starting point, it offers readers plain talk about what is happening now, what is likely to unfold in the next few decades, and what we can do.

# \*\*\*Rare Earth Elements Advantage\*\*\*

## Rare Earth Advantage---Uniqueness---Supply Shortfall

### An REE supply shortfall is coming- a 40,000 ton production gap will occur by 2014

Humphries 10- Marc Humphries, Analyst in Energy Policy for the Congressional Research Service, September 30, 2010, “Rare Earth Elements: The Global Supply Chain,” http://www.fas.org/sgp/crs/natsec/R41347.pdf

Demand for Rare Earth Elements World demand for rare earth elements is estimated at 134,000 tons per year, with global production around 124,000 tons annually. The difference is covered by above-ground stocks or inventories. World demand is projected to rise to 180,000 tons annually by 2012, while it is unlikely that new mine output will close the gap in the short term.4 By 2014, global demand for rare earth elements may exceed 200,000 tons per year. China’s output may reach 160,000 tons per year (up from 130,000 tons in 2008) in 2014. An additional capacity shortfall of 40,000 tons per year may occur. This potential shortfall has raised concerns in the U.S. Congress. New mining projects could easily take 10 years for development. In the long run, however, the USGS expects that reserves and undiscovered resources are large enough to meet demand. While world demand continues to climb, U.S. demand for rare earths is also projected to rise, according to the USGS Commodity Specialist Jim Hedrick.5 For example, permanent magnet demand is expected to grow by 10%-16% per year through 2012. Demand for rare earths in auto catalysts and petroleum cracking catalysts is expected to increase between 6% and 8% each year over the same period. Demand increases are also expected for rare earths in flat panel displays, hybrid vehicle engines, and defense and medical applications.

### Now is the key time for the US to develop a domestic supply of REEs- China has cut exports by 72%

Humphries 10- Marc Humphries, Analyst in Energy Policy for the Congressional Research Service, September 30, 2010, “Rare Earth Elements: The Global Supply Chain,” http://www.fas.org/sgp/crs/natsec/R41347.pdf

Access to a reliable supply to meet current and projected demand is an issue of concern. In 2009, China produced 97% of the world’s rare earth elements (measured in rare earth oxide content) and continues to restrict exports of the material through quotas and export tariffs. China has plans to reduce mine output, eliminate illegal operations, and restrict REE exports even further. There are some immediate supply concerns with lower rare earth export quotas in China. China has cut its exports of rare earth elements from about 50,000 metric tons in 2009 to 30,000 metric tons in 2010. According to a Bloomberg news report, a July 2010 announcement by China’s Ministry of Commerce would cut exports of REEs by 72%, to about 8,000 metric tons, for the second half of 2010.24

### China’s internal growth has forced it to limit REE exports- the US needs to find a new source

Humphries 10- Marc Humphries, Analyst in Energy Policy for the Congressional Research Service, September 30, 2010, “Rare Earth Elements: The Global Supply Chain,” http://www.fas.org/sgp/crs/natsec/R41347.pdf

Spurred by economic growth and increased consumer demand, China is ramping up for increased production of wind turbines, consumer electronics, and other sectors, which would require more of its domestic rare earth elements. Safety and environmental issues may eventually increase the costs of operations in China’s rare earth industry as domestic consumption is becoming a priority for China. REE manufacturing is set to power China’s surging demand for consumer electronics—cell phones, laptops and green energy technologies. According to the report by Hurst, China is anticipating going from 12 gigawatts (GW) of wind energy in 2009 to 100 GW in 2020. Neodymium magnets are needed for this growth.29 China’s policy initiatives restrict the exports of rare earth raw materials, especially dysprosium, terbium, thulium, lutetium, yttrium, and the heavy rare earths. The export restrictions would not likely affect the downstream metal or magnets. According to Hurst, China wants an expanded and fully integrated REE industry where exports of value-added materials are preferred. It is common for a country to want to develop more value-added production and exports if it is possible. Hurst also suggests China wants to build strategic stockpiles of raw materials as South Korea and Japan have done, and thus have better control over global supply and prices. The recent (September 2010) maritime conflict between China and Japan in which Japanese officials claimed that China held up rare earth shipments to Japan (denied by Chinese officials) has heightened the urgency among many buyers to seek diversity in its sources of rare earth materials.

## \*\*\*Solvency\*\*\*

## Rare Earth---Moon Key

### REEs are present on the moon- they have been mapped by NASA’s M3

David 10- Leonard David, has been reporting on the space industry for more than five decades, past editor-in-chief of the National Space Society's Ad Astra and Space World magazines, 04 October 2010, “Is Mining Rare Minerals on the Moon Vital to National Security?” http://www.space.com/9250-mining-rare-minerals-moon-vital-national-security.html

Given all the mineral mischief here on Earth, the moon could become a wellspring of essential resources, but at what quality, quantity and outlay to extract? [10 Coolest New Moon Discoveries] Providing a lunar look-see is Carle Pieters, a leading planetary scientist in the Department of Geological Sciences at Brown University in Providence, R.I. "Yes, we know there are local concentrations of REE on the moon," Pieters told SPACE.com, referring to rare earth elements by their acronym REE. "We also know from the returned samples that we have not sampled these REE concentrations directly, but can readily detect them along a mixing line with many of the samples we do have." Pieters is also principal investigator for NASA’s Moon Mineralogy Mapper, known as M3, which was carried on India?s Chandrayaan-1 lunar-orbiting spacecraft. That probe was lofted by the Indian Space Research Organization in October 2008 and operated around the moon until late August 2009. Among other findings, the M3 gear found a whole new range of processes for mineral concentrations on the moon, unappreciated until now. For example, the M3 experiment detected a new lunar rock ? a unique mixture of plain-old plagioclase ? plentiful in the Earth?s crust and the moon?s highlands ? and pink spinel, an especially beautiful arrangement of magnesium, aluminum and oxygen that, in its purest forms, is prized as a gemstone here on Earth.

### Mining the moon can solve- there are high concentrations of REEs present

Taylor and Martel 03- G. Jeffrey Taylor, Ph. D in geology from Rice University and Director of the Hawai`i Space Grant Consortium, Linda M. V. Martel, instructor for Hawai ‘i Institute of Geophysics and Phetology, 2003, Adv. Space Res. Vol. 31, No. 11, pp. 2403-2412

Evolved igneous rocks Highly evolved igneous rocks are present on the Moon. They are particularly concentrated in a region,

called the Procellamm KREEP terrane by Jolliff et al. (2000), encompassing much of the western Earth-facing side of the Moon. Evolved rocks formed from magmas that fractionally crystallized, leaving a residual magma rich in elements that do not readily enter the major rock-forming minerals. The most common class of evolved lunar rock is KREEP, an acronym referring to enrichments (compared to other lunar materials) in K, rare earth elements (REE), and P. They also contain enrichments in the potentially useful elements Rb, Ba, Y, Zr, Th, and U. The formation of evolved magmas involved extensive fractional crystallization in the lunar magma ocean, a huge magmatic system that surrounded the Moon soon after its formation, followed by partial melting of rocks formed from the residual magma. These secondary magmas could have fractionally crystallized further, creating rocks much richer than those observed so far. Average and maximum observed grades of KREEP rocks are given in Table 2. If KREEP magmas fractionally crystallized, it is easy to envision formation of magmas with up to ten times higher concentrations of these elements. To be somewhat conservative, we have estimated a likely highest grade by multiplying the highest measured values for these non-metals by a factor of five. This could result in deposits containing several percent of Ba, K, and P, a few percent of Zr and some rare earth elements, and 0.05 wt% Th (U would be about 0.01 wto/o).

## Rare Earth---Asteroids Key

### NEAs have vast mineral resources, allows, metals, and contain higher fractions of almost everything compared with the moon

Durda – 06, Dr. Daniel D. Durda, planetary scientist at the Southwest Research Institute in Boulder, CO, summer 2006, “The Solar System Beckons With Resources Unimaginable on Earth”

The near-Earth asteroids (NEAs) represent a vast and, as yet, untapped reservoir of mineral resources for in-space use as we expand the human presence beyond low-Earth orbit. About half the NEAs are made up of the same materials as a typical rocky meteorite. These contain small flakes of nickel-iron alloys and platinum group metals in much greater abundance than typical rocks from the Earth's crust. Most of the rest of the NEA population resembles the carbonaceous meteorites and containa higher fraction of water and carbon-containing minerals. A little less than 10 percent of the NEAs are essentially massive mountains of nearly pure iron and nickel. All of the NEAs represent a resource smorgasbord far richer than the lunar regolith, the bleak soil on the Moon, another favorite target for future off-world mining operations.

## \*\*\*Tech Innovation\*\*\*

## Rare Earth Advantage---Tech Innovation---1AC

### Technology Innovation:

### The offshoring of the rare earth metals industry hurts US technology innovation- Rare Earths are the best opportunity to rebalance the economy

Kennedy 10- James Kennedy, president of Wings Enterprises, Inc and mining engineer, 2010, “Critical and Strategic Failure of Rare Earth Resources,” http://www.phenix.bnl.gov/WWW/publish/ondrejch/misc/JimKennedyRE/NMAB-paperTMS.pdf

First, We Must Understand the Scope of this Failure The scope of failure is multi-fold, interdependent and compounding. Sustainability and growth of a mature economy, like the U.S., is dependent upon innovation. Innovation and research & development are dependent upon the overall macro-economic systems at the private, corporate and public leveli. Sustainable macro-economic systems require balanced economies comprised of producers and consumers. The U.S. economy is grossly imbalanced as the result of two decades of off-shoring and a complete lack of any rational industrial policy. In the absence of balance, the system is self- correctingii. The current banking crisis reflects the magnitude of that imbalanceiii. Looking at the Net Present Value of all future Federal liabilities supported by a failing U.S. economy, shrinking tax base and growing vacancies in our domestic industrial capabilities, the future looks grimiv. The fiscal imbalance for 2009 will exceed $1 trillionv. On the Commercial side the rapidly disappearing manufacturing and industrial base of America begins to resemble the Aral Sea: receding, stagnant, and unable to sustain the life of basic researchvi. There is a growing body of research that shows a strong interdependence between basic research, measured by patents, and the health of the local or national industrial basevii. In other words, if you are shedding industry, innovation slips away. If you are growing technology-hungry businesses, innovation springs to life. This has been well demonstrated in a paper titled “Value Chain Off Shoring and the Location of Innovationviii,” that specifically analyses the REO magnet market for China and the U.S. America is now 100% import dependent upon others for rare earth oxides, elements and alloys. Resulting pricing, supply and tax disadvantages have decimated U.S. competitiveness for all REO related products. Today there are few remaining domestic manufacturers of value added rare earth components. REO enhanced products are typically components in some of the fastest growing markets in the world. For example In 1990 The United States had 12 REO magnet producing facilities with 6000 employees for a global REO magnet market of about $600 million in gross revenues. Today the U.S. has 4 REO magnet producers with less than 600 employees while the global REO magnet market has grown to over $7 billionix. These magnets are in everything we use today, iPods, computer hard drives, automobile sensors, micro-motors, wind turbines and military guidance systems. Nearly all of the production for this rapidly expanding market is increasingly coming from China. Experts agree the REO magnet market will at least double in the next 10 yearsx. The only way to reverse this trend is to rebuild our economy in a way that specifically addresses these imbalances. As a mature economy with high wage, litigation, regulatory and environmental cost America must specifically target the manufacturing of high value goods. Rare earths represent one of the highest value opportunities that the U.S. can develop to overcome these imbalances.REO’s – A Failure of Historic Proportions in the Making The United States, as a Nation, can only survive by leading in the commercial development, application and manufacture of high value products. Wealth creation and improved standards of living can only come from three things: Agriculture, Natural Resources and Manufacturing. Manufacturing is increasingly driven by technology. So, innovate or die... As Rare Earth Oxides, Elements and Alloys are critical in the development and production of enhanced materials performance in many materials science applications. America’s failure to secure, control and produce these materials can only compound the broader failure from an Economic and Defense stand pointxi. REO technologies are increasingly present in the highest value applications, devices and products. These are the prized industrial base for any mature economy with higher cost for wages, capital and environmental issues. The National Defense issues are equally important. Rare Earths are critical components for military jet engines, guided missiles and bombs, electrical countermeasures, anti-missile systems, satellite communication systems and armor, yet the U.S. has no domestic sources.

### Technology innovations from space exploration prevent economic collapse

Feng and Cox 09- Feng Hsu, Ph.D. and Sr. Fellow of the Aerospace Technology Working Group, Ken Cox, Ph.D. and Founder & Director of the Aerospace Technology Working Group, February 20, 2009, “Sustainable Space Exploration and Space Development - A Unified Strategic Vision,” http://www.spaceref.com/news/viewsr.html?pid=30702

Technology innovations have always lifted human society out of the economic gridlocks, and have led mankind from many of the worst economic crises to vast industrialization and enduring prosperity and growth. The history of human civilization has shown that technology innovations and human ingenuity are our best hope to power humanity out of any crisis, and especially a U.S.-lead human economic development into low earth orbit that will not only lift us out of the current acute global depression, but will most certainly bring about the next economic and industrial revolution beyond the confinement of Earth gravity. Commercial aircraft transportation and operations in the past 100 years since the Wright Brothers' first successful test flight have advanced significantly in all areas, and have contributed tremendously to the world economy and modern civilization.

### Econ collapse causes war globally---every major hotspot

Green, CSIS Senior Advisor, and Schrage, CSIS International Business Chair, 9– Michael J. Green, Senior Advisor and Japan Chair at the Center for Strategic And International Studies, and Steven P. Schrage, SCIS Scholl Chair in International Business and former official with the US Trade Representative’s Office, March 26, 2009, “It’s not just the economy,” Asia Times, online: http://www.atimes.com/atimes/Asian\_Economy/KC26Dk01.html

Facing the worst economic crisis since the Great Depression, analysts at the World Bank and the US Central Intelligence Agency are just beginning to contemplate the ramifications forinternational stabilityif there is not a recovery in the next year. For the most part, the focus has been on fragile states such as some in Eastern Europe.

However, the Great Depression taught us that a downward global economic spiral can even havejarring impacts on great powers. It is no mere coincidence that the last great global economic downturn was followed by themost destructive war in human history.In the 1930s, economic desperation helped fuel autocratic regimes and protectionism in a downward economic-security death spiral that engulfed the world in conflict. This spiral was aided by the preoccupation of the United States and other leading nations with economic troubles at home and insufficient attention to working with other powers to maintain stability abroad. Today's challenges are different, yet 1933's London Economic Conference, which failed to stop the drift toward deeper depression and world war, should be a cautionary tale for leaders heading to next month's London Group of 20 (G-20) meeting.

There is no question the US must urgently act to address banking issues and to restart its economy. But the lessons of the past suggest that we will also have to keep an eye on those fragile threads in the international system that could begin to unravel if the financial crisis is not reversed early in the Barack Obama administration and realize that economics and security are intertwined in most of the critical challenges we face.

A disillusioned rising power? Four areas in Asia merit particular attention, although so far the current financial crisis has not changed Asia's fundamental strategic picture. China is not replacing the US as regional hegemon, since the leadership in Beijing is too nervous about the political implications of the financial crisis at home to actually play a leading role in solving it internationally.

Predictions that the US will be brought to its knees because China is the leading holder of US debt often miss key points. China's currency controls and full employment/export-oriented growth strategy give Beijing few choices other than buying US Treasury bills or harming its own economy. Rather than creating new rules or institutions in international finance, or reorienting the Chinese economy to generate greater long-term consumer demand at home, Chinese leaders are desperately clinging to the status quo (though Beijing deserves credit for short-term efforts to stimulate economic growth).

The greater danger with China is not an eclipsing of US leadership, but instead the kind of shift in strategic orientation that happened to Japan after the Great Depression. Japan was arguably not a revisionist power before 1932 and sought instead to converge with the global economy through open trade and adoption of the gold standard.

The worldwide depression and protectionism of the 1930s devastated the newly exposed Japanese economy andcontributed directly to militaristic and autarkic policiesin Asia as the Japanese people reacted against what counted for globalization at the time. China today is similarly convergingwith the global economy, and many experts believe China needs at least 8% annual growth to sustain social stability. Realistic growth predictions for 2009 are closer to 5%.

Veteran China hands were watching closely when millions of migrant workers returned to work after the Lunar New Year holiday last month to find factories closed and jobs gone. There were pockets of protests, but nationwide unrest seems unlikely this year, and Chinese leaders are working around the clock to ensure that it does not happen next year either. However, the economic slowdown has only just begun and nobody is certain how it will impact the social contract in China between the ruling communist party and the 1.3 billion Chinese who have come to see President Hu Jintao's call for "harmonious society" as inextricably linked to his promise of "peaceful development".

If the Japanese example is any precedent, a sustained economic slowdown has the potential to open a dangerous path from economic nationalism to strategic revisionism in China too.

Dangerous states

It is noteworthy that North Korea, Myanmar and Iran have all intensified their defiancein the wake of the financial crisis, which has distracted the world's leading nations, limited their moral authority and sown potential discord. With Beijing worried about the potential impact of North Korean belligerence or instability on Chinese internal stability, and leaders in Japan and South Korea under siege in parliament because of the collapse of their stock markets, leaders in the North Korean capital of Pyongyang have grown increasingly boisterous about their country's claims to great power status as anuclear weapons state.

The junta in Myanmar has chosen this moment to arrest hundreds of political dissidents and thumb its nose at fellow members of the 10-country Association of Southeast Asian Nations. Iran continues its nuclear program while exploiting differences between the US, UK and France (or the P-3 group) and China and Russia - differences that could become more pronounced if economic friction with Beijing or Russia crowds out cooperation or if Western European governments grow nervous about sanctions as a tool of policy.

It is possible that the economic downturn will make these dangerous states more pliable because of falling fuel prices (Iran) and greater need for foreign aid (North Korea and Myanmar), but that may depend on the extent that authoritarian leaders care about the well-being of their people or face internal political pressures linked to the economy. So far, there is little evidence to suggest either and much evidence to suggest these dangerousstates see an opportunity to advance their asymmetrical advantagesagainst the international system.

Challenges to the democratic model

The trend in East Asia has been for developing economies tosteadily embrace democracy and the rule of law in order to sustain their national success. But to thrive, new democracies also have to deliver basic economic growth. The economic crisis has hit democracies hard, with Japanese Prime Minister Aso Taro's approval collapsing to single digits in the polls and South Korea's Lee Myung-bak and Taiwan's Ma Ying Jeou doing only a little better (and the collapse in Taiwan's exports - particularly to China - is sure to undermine Ma's argument that a more accommodating stance toward Beijing will bring economic benefits to Taiwan). Thailand's new coalition government has an uncertain future after two years of post-coup drift and now economic crisis.

The string of old and new democracies in East Asia has helped to anchor US relations with China and to maintain what former secretary of state Condoleezza Rice once called a "balance of power that favors freedom". A reversal of the democratic expansion of the past two decades would not onlyimpact the global balance of powerbut alsoincrease the potential number of failed states, with all the attendant risk they bring from harboring terrorists to incubating pandemic diseases and trafficking in persons. It would also undermine the demonstration effect of liberal norms we are urging China to embrace at home.

### And the plan can solve- domestic supplies are key

Veloso et al 08- Francisco M. Veloso, Professor in the Department of Engineering and Public Policy at Carnegie Mellon University, Cliff I. Davidson, Professor of Civil and Environmental Engineering at Carnegie Mellon Universtiy, Brian J. Fifarek, March 2008, “Offshoring technology innovation: A case study of rare-earth technology,” Journal of Operations Management, Volume 26, Issue 2, Pages 222-238

Overall, regression results suggest that US leadership in REE technology innovation is eroding. This loss in US REE technology innovation leadership is significantly correlated with the offshoring of material supplies, even when controlling for alternative explanations. As described before, existing literature suggests that local suppliers play a unique and critical role in supporting technological change in an innovation system – or ecological – system ([Klevorick et al., 1995] and [Ricart et al., 2004]). The results provide evidence supporting this notion that offshoring components of this system is associated with decreases in the aggregate rate of innovation in the home location. Nevertheless, it is important to note that results do not provide indications as to whether firms active in rare-earth technology innovation increased or decreased their individual rate of innovation. Firms that produce rare-earth permanent magnets in the US are a good example of the trend identified in the regression study. Permanent magnets are dominated by two rare-earth materials, samarium–cobalt (SmCo) and neodymium–iron–boron (NdFeB). Since 1990, four US permanent magnet manufacturers have discontinued their US operations. Consequently, most multinational enterprises active in the production of NdFeB magnets now maintain only sales operations in the US. Meanwhile, the Chinese share of NdFeB magnet production increased from 14.4% in 1988 to nearly 40% in 1997 (Dongpei and Qiming, 1999). Trout (2002) suggests that the powerful combination of locally available rare-earths, inexpensive labor and a desire to make value-added products has led to a large percentage of rare-earth magnets and products containing magnets being exported from China. The current trend indicates most magnet production will leave the US within the next decade, in favor of low labor cost regions, predominantly China (Trout, 2002). Such trends have quickly altered the system of organizations in the US producing and supporting permanent magnet products and innovation. Informal conversations with one firm representative revealed that removing manufacturing from the US has also led to the removal of over 90% of domestic R&D activities on rare-earth permanent magnet materials. More importantly, the knowledge for producing NdFeB magnets within the US has been lost. US based manufacturers can no longer compete with the quality of NdFeB magnets produced in China or Japan. This is analogous to the comparative advantage shift suggested by Gomory and Baumol (2000). Likewise, Magnequench Inc., the top producer of neodymium magnetic powders and magnets and leader in innovation in the NdFeB magnet market, has responded to these significant changes by selling their US permanent magnet manufacturing operations and moving their R&D facilities to Singapore (Magnequench, 2005). These anecdotal developments are in line with the results highlighted above, which indicate that the US may no longer provide the most propitious environment to locate innovative activity for rare-earth permanent magnets. They lend support to some of the concerns of researchers and the public. As Hira and Hira (2005; p. 117) note “[…] from a technological innovation point of view, manufacturing matters greatly. Nearly 41% of American engineers work in the manufacturing sector. The manufacturing sector also accounts for 62% of all research and development (R&D) and 90% of all patents in the US. The prevailing management approach is to locate R&D as close to manufacturing production as possible. As manufacturing moves overseas, it is inevitable that both engineering work and R&D will

## Rare Earth Advantage---Tech Innovation---REE Key

### China’s rare earth monopoly allows it to dominate electronics manufacturing- shortages mean the US can’t compete

Johnson 10– R. Colin Johnson, Technology Editor at EE Times (Electronic Engineering Times), October 24, 2010, “Rare earth supply chain: Industry’s common cause,” online: http://www.eetimes.com/General/DisplayPrintViewContent?contentItemId=4210064

China’s virtual monopoly on rare earths mining and materials portends its rising dominance in electronics manufacturing.

Rare earths—minerals, metals and their oxides—have been a looming problem for several years but became a political football recently when China reduced its export quotas for the second half. Jittery markets responded by upping already rising prices for rare earths, and manufacturers with strategic stockpiles have begun tactical hoarding, a move that analysts warn could drive prices even higher. The cost of rare earths hasn’t yet had much of an impact on the pricing of electronic components that use them. But observers see impending shortages for the rare earths used to make the super-strong magnets designed into everything from hard drive heads to smart bombs, the phosphors used in many LEDs and fluorescent lamps, the slurries used for semiconductor polishing, the dopants sometimes used in optical components such as lasers, the magnetic films used for spin-polarized memories and the oxides used in advanced high-k dielectrics.

### Rare earth supplies are necessary for semiconductor manufacturing

Johnson 10– R. Colin Johnson, Technology Editor at EE Times (Electronic Engineering Times), October 24, 2010, “Rare earth supply chain: Industry’s common cause,” online: http://www.eetimes.com/General/DisplayPrintViewContent?contentItemId=4210064

Rare earths are also used as abrasives in slurries for the chemical-mechanical planarization (CMP) of semiconductor wafers, especially during the shallow trench isolation (STI) step, as well as in slurries for polishing the glass for advanced hard drive platters, LCD screens, HDTV screens and high-end mobile phone displays like the iPhone’s Retina. “China’s monopoly on rare earth is starting to hit home now in semiconductor manufacturing,” said The Information Network’s Castellano. “At the 120-nanometer node, semiconductor manufacturers could get away with using silica [silicon dioxide] instead of the rare earth ceria [cerium oxide] as the abrasive in CMP slurries, but at 90 nm and 65 nm most CMOS chip makers have had to go to ceria-based slurries for STI.” The rare earth-based slurry markets are not large; CMP slurries constitute a $700 million business, but STI accounted for only about $70 million last year. Nevertheless, the materials are critical for moving to more advanced nodes, according to Castellano. Likewise, rare earths are not a big factor in small-form-factor hard drive costs but are critical for taking the drives to higher densities. “The smaller-sized hard disk drives used in mobile devices are going to glass platters, instead of metal; ceria slurries are needed to polish them,” Castellano said. Japanese manufacturers like Hitachi Chemical, Showa Denko and Mitsui are the market leaders in rare earth slurries today, but unless China resumes shipments of cerium to Japan, users will have to buy their slurries from China within two years. “The slurry shortage is just one example of what is happening on a global basis and is a telling sign for the future in many sectors of the high-tech industry,” said Castellano.

### China’s monopoly of REEs has offshored R and D in technology innovation

Veloso et al 08- Francisco M. Veloso, Professor in the Department of Engineering and Public Policy at Carnegie Mellon University, Cliff I. Davidson, Professor of Civil and Environmental Engineering at Carnegie Mellon Universtiy, Brian J. Fifarek, March 2008, “Offshoring technology innovation: A case study of rare-earth technology,” Journal of Operations Management, Volume 26, Issue 2, Pages 222-238

Rare-earth elements of the periodic table (see Table 1 for a list of all these elements) have unique properties that make them valuable for a variety of high technology applications. For example, europium is uniquely employed as the red phosphor in computer monitors and televisions. Erbium is essential for fiber-optic telecommunication cables. High-strength rare-earth magnets have allowed miniaturization of countless electronic components used in many consumer products, automobiles, communication systems, and military equipment. Rare-earth elements are also essential for copious catalysts employed in the chemical, petroleum and automotive industries (Haxel et al., 2002). The US quickly became the dominant producer of REE raw materials after a high-grade deposit of REE ore found in Mountain Pass, CA was opened by Molycorp in the early 1950s. Molycorp invested millions of dollars in researching potential uses for REEs. As these elements became more abundant and research and development activities increased, their applications grew dramatically in diversity and importance. By 1965, this single deposit had become the most significant source of REEs in the world with reserves of 13 million metric tonnes. Mountain Pass was the dominant source of REEs from 1965 to the mid-1980s. This allowed a strong system of innovation to develop in the US supporting research and development on rare earths and the US consequently became the world leader in rare-earth technology innovation. But beginning in the mid-1980s, the firms began to locate components of their business outside of the strong US national system of innovation. For environmental and cost reasons firms began purchasing rare-earth materials from offshore providers leading to a significant change in the agents and firms they collaborated with regularly. First, the production of REEs in China increased dramatically (Fig. 1), supplanting US production and encouraging firms to work with an offshore raw material supplier for lower cost materials. The shift in the supply base of the rare-earth materials was critical because many rare-earth technology innovations were co-developed by US firms and their domestic material supplier. As production moved to Asia, cooperation between US firms and material suppliers was adversely affected; the geographic distance, culture differences, and time zone disparity hindered communication. Second, China considered finely processed REE products as a priority for the nation (Lei, 1998), mobilizing resources and policies towards the development of the industry.

### A lack of REE materials in the US has offshored innovation to China

Veloso et al 08- Francisco M. Veloso, Professor in the Department of Engineering and Public Policy at Carnegie Mellon University, Cliff I. Davidson, Professor of Civil and Environmental Engineering at Carnegie Mellon Universtiy, Brian J. Fifarek, March 2008, “Offshoring technology innovation: A case study of rare-earth technology,” Journal of Operations Management, Volume 26, Issue 2, Pages 222-238

This research looks at the evolution of innovation in high technology that employs rare-earth materials. Since 1975, there has been a progressive offshoring of critical components of organizations active in rare-earth technology. In particular, starting in 1990, China emerged as the dominant producer of REE materials, completely supplanting US production, and a significant portion of manufacturing operations employing REEs has been offshored to Asia. These outcomes have significantly affected rare-earth innovation processes in the US. Using patents as a proxy for rare-earth innovative activity, this study shows that the US is losing its longstanding leadership in many areas of rare-earth technology. Not only is the rate of successful rare-earth patent applications by US organizations decreasing in relation to the rest of the world, but the likelihood that knowledge generated in the US will be used for such innovative activity is also decreasing. The results support the theories suggesting that offshoring elements of a system relevant for technology innovation may reduce the level of R&D and productivity of innovation processes at the home location. When this is the case, one might expect such offshoring activities to weaken US technology innovation leadership over the long-term.

## \*\*\*Hard Power\*\*\*

## Rare Earth Advantage---Hard Power---1AC

### Hard Power:

### Chinese export restrictions of REEs threaten key US defense technology

Humphries 10- Marc Humphries, Analyst in Energy Policy for the Congressional Research Service, September 30, 2010, “Rare Earth Elements: The Global Supply Chain,” http://www.fas.org/sgp/crs/natsec/R41347.pdf

The primary defense application of rare earth materials is their use in four types of permanent magnet materials commercially available: Alnico, Ferrites, Samarium Cobalt, and Neodymium Iron Boron. With the exception of Neodymium Iron Boron, all of the materials are domestically produced. The United States has no production capabilities for Neodymium Iron Boron. Neo magnets, the product derived from Neodymium Iron Boron, and Samarium Cobalt, are considered important to many defense products. They are considered one of the world’s strongest permanent magnets and an essential element to many military weapons systems, as described in the following examples. • Jet fighter engines and other aircraft components, including samarium-cobalt magnets used in generators that produce electricity for aircraft electrical systems; • Missile guidance systems, including precision guidance munitions, lasers, and smart bombs;9 • Electronic countermeasures systems; • Underwater mine detection systems; • Antimissile defense systems; • Range finders, including lasers; and • Satellite power and communication systems, including traveling wave tubes (TWT) rare earth speakers, defense system control panels, radar systems, electronic counter measures, and optical equipment.10 Many scientific organizations have concluded that certain rare earth metals are critical to U.S. national security and becoming increasingly more important in defense applications.11 Some industry analysts are concerned with an increasing dependence on foreign sources for rare earth metals; a dwindling source of domestic supply for certain rare earth metals; and the emergence of a manufacturing supply chain that has largely migrated outside of the United States. In July 2010, the China Ministry of Commerce announced that China would cut its export quota for rare earth minerals by 72%, raising concerns because of estimates that China controls approximately 97% of the global production of rare earth minerals.12 It is also estimated thatby 2012 China’s domestic consumption will outpace China’s domestic production of rare earth minerals. Some experts are concerned that DOD is not doing enough to mitigate the possible risk posed by a scarcity of domestic suppliers. As an example, the United States Magnet Materials Association (USMMA), a coalition of companies representing aerospace, medical, and electronic materials, has recently expanded its focus to include rare earth metals and the rare earth magnet supply chain. In February 2010, USMMA unveiled a six-point plan to address what they describe as the “impending rare earth crisis” which they assert poses a significant threat to the economy and national security of the United States.13 However, it appears that DOD’s position assumes that there are a sufficient number of supplier countries worldwide to mitigate the potential for shortages.

### US military power cannot be maintained without these technologies

Martel 01- William C. Martel, Professor of National Security Affairs, and the Alan B. Shepherd Chair of Space Technology and Policy at the Naval War College, summer 2001, “Technology and Military Power,”      , vol 25:2, pg. 177-187

In the long term, U.S. military capabilities depend on maintaining tech- nologies that are without equal to the breadth and depth of technologies being developed by other states. To evaluate the foundations of U.S. technological power and its implications for American security and international security in the twenty-first century, this article examines the critical defense technologies in which the United States has invested for decades. Given these investments in technology, the United States has achieved a level of military power that can be maintained for as long as it continues the investments. As policymakers acquire the technological tools that are commensurate with great military power, they are discovering that many technologies—notably directed energy, new weapons for targeting, and advanced computer and information technologies—are changing the nature of war, security, and diplomacy.2 Indeed, these are thetechnologies that are most likely to affect U.S. military power and, hence, political power in this century. The underlying question in this article is how technological progress may reshape military power. Not surprisingly, the United States faces complex choices such as which technologies should be developed, how other states might respond to those capabilities, and the consequences for international security if U.S. mil- itary capabilities continue to outpace those of other states.

### Loss of U.S. nuclear primacy causes global nuclear war

Caves 10 – John P. Caves Jr., Senior Research Fellow in the Center for the Study of Weapons of Mass Destruction at the National Defense University, January 2010, “Avoiding a Crisis of Confidence in the U.S. Nuclear Deterrent,” Strategic Forum, No. 252

Perceptions of a compromised U.S. nuclear deterrent as described above would haveprofound policy implications, particularly if they emerge at a time whena nuclear-armed great power is pursuing a more aggressive strategytoward U.S. allies and partners in its region in a bid to enhance its regional and global clout. A dangerous period of vulnerability would open for the United States and those nations that depend on U.S. protection while the United States attempted to rectify the problems with its nuclear forces. As it would take more than a decade for the United States to produce new nuclear weapons, ensuing events could preclude a return to anything like the status quo ante.The assertive, nuclear-armed great power, and other major adversaries, could be willing to challenge U.S. interests more directlyin the expectation that the United States would be less prepared to threaten or deliver a military response that could lead to direct conflict. They will want to keep the United States from reclaiming its earlier power position.Allies and partnerswho have relied upon explicit or implicit assurances of U.S. nuclear protection as a foundation of their security could lose faith in those assurances. Theycould compensate by accommodating U.S. rivals, especially in the short term, or acquiring their own nuclear deterrents, which in most cases could be accomplished only over the mid- to long term. A more nuclear world would likely ensue over a period of years. Important U.S. interests could be compromised or abandoned, or a major war could occuras adversaries and/or the United States miscalculate new boundaries of deterrence and provocation. At worst, war could lead to state-on-state employment of weapons of mass destruction (WMD) on a scale far more catastrophic than what nuclear-armed terrorists alone could inflict.

## Rare Earth Advantage---Hard Power---REE Key

### The United State’s entire defense system is dependent upon rare earths- without supplies we’ll lose our first strike capabilities

Kennedy 10- James Kennedy, president of Wings Enterprises, Inc and mining engineer, 2010, “Critical and Strategic Failure of Rare Earth Resources,” http://www.phenix.bnl.gov/WWW/publish/ondrejch/misc/JimKennedyRE/NMAB-paperTMS.pdf

The entire U.S. Defense system is completely interdependent upon REO enhanced technologies for our most advanced weapons guidance systems, advanced armor, secure communications, radar, advanced radar systems, weapons triggering systems and un-manned Drones. REO dependent weapons technologies are predominantly represented in our ‘first strike’ and un-manned capabilities. This National Defense issue is not a case of limited exposure for first-strike capabilities. This first-strike vulnerability translates into risk exposure in every level of our National Defense System, as the system is built around our presumptive technological and first-strike superiority. Yet the DoD has abandon its traditional procurement protocols for “Strategic and Critical” materials and components for weapons systems in favor of “the principles of free tradexii.”

American Ingenuity – ‘Made in China’

### The United States needs REEs in order to remain competitive and to defend itself from China

Kennedy 10- James Kennedy, president of Wings Enterprises, Inc and mining engineer, 2010, “Critical and Strategic Failure of Rare Earth Resources,” http://www.phenix.bnl.gov/WWW/publish/ondrejch/misc/JimKennedyRE/NMAB-paperTMS.pdf

This paper is a call for self preservation through the pursuit of our National Interests. As our overall macro-economy is vital to the health and future of our nation, this paper calls for the rapid development of a value-added natural resources facility to supply our current “Strategic and Critical” technologies needs of today and to support the high value-added manufacturing and Defense needs of the future.This paper calls for all researchers, scientist, the Departments of Defense and Energy and members of the Commercial and Defense Industry to rally to the cause of a Domestic Rare Earth Refinery and other national endeavors that can translate into domestic advantage. The United States Congress and the Executive Branch of Government have a Constitutional Duty to Protect and Defend The United States. These duties and obligations are clearly defined within our national borders. The laws governing capital flows, taxation, tariffs, export controls, fiscal and monetary policy need to address domestic issues foremost. America’s failure to remain current and relevant in rare earths is accelerating the rate of our decline in participation and competitiveness in what may prove to be the greatest area of future growth in high value manufactured goods. This failure has also left our National Defenses naked and vulnerable to the caprices of China.

### REE supplies are key to maintain US military systems- a rare earth crisis would threaten our national security

Humphries 10- Marc Humphries, Analyst in Energy Policy for the Congressional Research Service, September 30, 2010, “Rare Earth Elements: The Global Supply Chain,” http://www.fas.org/sgp/crs/natsec/R41347.pdf

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### Foreign dependence on REEs hurts US national security

Johnson 10– R. Colin Johnson, Technology Editor at EE Times (Electronic Engineering Times), October 24, 2010, “Rare earth supply chain: Industry’s common cause,” online: http://www.eetimes.com/General/DisplayPrintViewContent?contentItemId=4210064

The rub is that when stockpiles outside China start running out circa 2012, the only place left to buy finished components based on rare earths will be China. “By 2012 several other mines will in operation, but they will not be able to meet demand,” said Kingsnorth. “The shortages will force companies to buy finished goods like rare earth magnets from China, because they will be the only ones with the sufficient supplies of ore to make them.” Most companies buying finished rare earth components, such as rare earth magnets, can shift to buying them from China (instead of Japan, where most are made today) with little impact on their businesses. The Pentagon, however, is loath to use Chinese-mode components in military hardware. The Defense Department is conducting an internal study, due out by the end of this month, on the strategic importance of rare earths to national security.

### Key defense technologies contain REEs- there are no substitutes

Johnson 10– R. Colin Johnson, Technology Editor at EE Times (Electronic Engineering Times), October 24, 2010, “Rare earth supply chain: Industry’s common cause,” online: http://www.eetimes.com/General/DisplayPrintViewContent?contentItemId=4210064

Rare earths are called “group three” elements because they occupy the third column in the Periodic Table. Historically, rare earths are grouped together because they are always found together in nature, mixed into mineral deposits of bastnasite, monazite or laterite. Rare earths include yttrium, scandium and the 15 “lanthanoids”: cerium, dysprosium, erbium, europium, gadolinium, holmium, lanthanum, lutetium, neodymium, praseodymium, promethium, samarium, terbium, thulium and ytterbium. “Most rare earths are used in high-end magnets, batteries, catalysts, phosphors and metal alloys. Currently, rare earths are critical in the energy and auto sectors,” said Intel’s spokesman. “Today, China utilizes greater than 60 percent of these materials in their own manufacturing, and the future demand for these materials will likely remain strong.” Rare earths are used in their natural form as catalysts, such as for petroleum refineries, which deploy lanthanum for fluid catalytic cracking. Lanthanum also plays the important role of the “metal” in the nickel-metal-hydride batteries used in hybrid vehicles. And neodymium improves the magnetic properties of the rare earth magnets used in everything from your iPod’s earbuds (where they enable “a better bass response,” said iSuppli’s Sheppard) to the navigational controls on smart bombs. In defense apps, dysprosium, neodymium and yttrium are used in equipment made by Boeing, General Dynamics, Northrop Grumman and Raytheon. Defense platforms that use rare earths include helicopters (to quiet rotor noise), tanks (for laser gun sights), radar (to image targets more than 22 miles away), missiles (for navigation magnets) and the hybrid electric motors the U.S. Navy is using to cut fuel costs in its advanced destroyers. “Rare earths are often used for neodymium-iron-boron permanent magnets, which are used in virtually every hard drive read/write head on the planet,” said Sims. “They also serve almost every electronic application that uses magnets, such as all the small motors used to power the windows, adjust the mirrors and do a lot of other things in automobiles.” As ferrite magnet replacements, rare earth magnets offer better performance all around, enabling microminiaturization in navigational compasses for smartphones, higher performance in high-density hard drive heads, and gearbox-free designs for wind power generators. “The reason that rare earth magnets are so popular is that they are not only 10 times smaller and lighter but are also 100 times more powerful than ferrite magnets,” said Sims. “For mobile applications such as phones and laptops, the ability to decrease the weight and size of devices is highly prized.” LCD backlights, plasma displays and many LEDs use europium as the red phosphor; no substitute for the material has yet been found, according to the USGS. “The other big electronics application, besides magnets, is phosphors. Virtually every LCD and plasma display uses a small amount of rare earths to create the colors,” said Sims. Likewise, there is no known substitute for optic cable’s use of erbium-doped fibers as laser amplifiers to boost the signal for the long haul between repeaters. And in medical applications, rare earths are used in everything from contrast agents for medical isotopes to improved positron emitters for tomography and scintillation detectors. Hybrid electric vehicles also take advantage of the improved performance afforded by formulations including rare earths in almost every on-board system. According to Sheppard, the battery used for the Toyota Prius’ electric motor contains more than 20 pounds of lanthanum, and the car’s regenerative brake system uses more than 2 pounds of neodymium in its magnets. For the future, green technologies like “no moving parts” magnet refrigeration technologies eliminate the need for compressors by virtue of rare earths. And “direct drive” wind turbines also depend on rare earth magnets to increase efficiency by 70 percent, albeit by requiring about 550 pounds of rare earths per megawatt of generation capacity. “There is a huge upside potential for wind turbines, because they can be direct-drive instead of requiring a gearbox—which is a maintenance headache, especially offshore,” said Peter Dent, vice president of business development at Electron Energy Corp. (EEC; Manheim, Pa.), the only U.S. manufacturer of rare earth magnets. The wind turbine industry is “using rare earth magnets in smaller wind turbines now but would like to use them in the big offshore ones, too—if they can get enough rare earths,” Dent said.

## \*\*\*Green Tech\*\*\*

## Rare Earth Advantage---Green Tech---1AC

### Green Technologies:

### REEs are key to technologies in the green revolution- without mining diversity, we can’t solve warming

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

This transition is already well underway. The world is on the cusp of a clean energy revolution. Here in the United States, the Obama Administration is making historic investments in clean energy. The American Recovery and Reinvestment Act was the largest one-time investment in clean energy in our nation’s history – more than $80 billion. At the Department of Energy, we’re investing our $37 billion in Recovery funds in electric vehicles; batteries and advanced energy storage; a smarter and more reliable electric grid; and wind and solar technologies, among many other areas. Through this investment, we’ll at least double our renewable energy generation and manufacturing capacities by 2012. We’ll also deploy hundreds of thousands of electric vehicles and charging infrastructure to power them; weatherize at least half a million homes; and expand our grid. Other countries are also seizing this opportunity. Indeed, the market for clean energy technologies is growing rapidly all over the world. Today, the Chinese government is launching programs to deploy electric cars in 13 major cities. It’s connecting urban centers with high-speed rail. It’s building huge wind farms, ultra- supercritical advanced coal plants and ultra-high-voltage long-distance transmission lines with low line loss. India has launched an ambitious National Solar Mission, with the goal of reaching 20 gigawatts of installed solar capacity by 2020. In Europe, strong public policies are driving sustained investments in clean energy. Denmark is the world’s leading producer of wind turbines, earning more than $4 billion each year in that industry. Germany and Spain are the world’s top installers of solar photovoltaic panels, accounting for nearly three-quarters of a global market worth $37 billion last year. Around the world, investments in clean energy technologies are growing, helping create jobs, promote economic growth and fight climate change.These technologies will be a key part of the transition to a clean energy future. However today, many of these technologies rely on the special properties of rare-earth metals. There’s no reason to panic, but there’s every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals and other strategic materials.For the clean energy economy to reach its full potential, we must work together to ensure stable supplies of the materials required. That means working together to diversify global supply chains, as well as investing in manufacturing and processing. It means research and development into substitutes. It means finding ways to recycle and re-use scarce materials. U.S. talent and innovative capacity in materials science can be harnessed to create the next generation of rare earth applications and competing technologies. To proactively address the availability of rare earths and other strategic materials required for the clean energy economy, we must take a three-part approach: The first strategy is to globalize supply chains for strategic materials. To paraphrase what Churchill once said about oil: Security rests above all in diversity of supply. To manage supply risk, we need multiple, distributed sources of strategic materials in the years ahead. This means taking steps to encourage extraction, refining and manufacturing here in theUnited States, as well as encouraging our trading partners to expedite the environmentally-sound creation of alternative supplies.

Warming causes extinction

**Tickell 8**- Oliver, The Guardian, August 11, 2008, “On a planet 4C hotter, all we can prepare for is extinction,” online: http://www.guardian.co.uk/commentisfree/2008/aug/11/climatechange)

We need to get prepared for four degrees of global warming, Bob Watson told the Guardian last week. At first sight this looks like wise counsel from the climate science adviser to Defra. But the idea that we could adapt to a 4C rise is absurd and dangerous. Global warming on this scale would be a catastrophe that would mean, in the immortal words that Chief Seattle probably never spoke, "the end of living and the beginning of survival" for humankind. Or perhaps the beginning of our extinction. The collapse of the polar ice caps would become inevitable, bringing long-term sea level rises of 70-80 metres. All the world's coastal plains would be lost, complete with ports, cities, transport and industrial infrastructure, and much of the world's most productive farmland. The world's geography would be transformed much as it was at the end of the last ice age, when sea levels rose by about 120 metres to create the Channel, the North Sea and Cardigan Bay out of dry land. Weather would become extreme and unpredictable, with more frequent and severe droughts, floods and hurricanes. The Earth's carrying capacity would be hugely reduced. Billions would undoubtedly die. Watson's call was supported by the government's former chief scientific adviser, Sir David King, who warned that "if we get to a four-degree rise it is quite possible that we would begin to see a runaway increase". This is a remarkable understatement. Theclimate system is already experiencing significant feedbacks, notably the summer melting of the Arctic sea ice. The more the ice melts, the more sunshine is absorbed by the sea, and the more the Arctic warms. And as the Arctic warms, the release of billions of tonnes of methane – a greenhouse gas 70 times stronger than carbon dioxide over 20 years – captured under melting permafrost is already under way. To see how far this process could go, look 55.5m years to the Palaeocene-Eocene Thermal Maximum, when a global temperature increase of 6C coincided with the release of about 5,000 gigatonnes of carbon into the atmosphere, both as CO2 and as methane from bogs and seabed sediments. Lush subtropical forests grew in polar regions, and sea levels rose to 100m higher than today. It appears that an initial warming pulse triggered other warming processes. Many scientistswarn that this historical event may be analogous to the present: the warming caused by human emissions could propel us towards a similar hothouse Earth.

[Watson is PhD in Chemistry, Award for Scientific Freedom and Responsibility from the American Association for the Advacement of Science]

## Green Tech---Rare Earths Key

### Rare-earths are essential to green technology- including wind turbines, and electric vehicles

The Times – 09, 5/28/09, “Crunch Looms for Green Technology as China Tightens Grip on Rare-Earth Metals” http://business.timesonline.co.uk/tol/business/industry\_sectors/natural\_resources/article6374603.ece

The weight and magnetic properties of rare-earth metals have made them important for wind turbines, essential to hybrid cars, and indispensable if the world ever hopes to covert to fully electric vehicles.One mining company president told The Times that governments that had promised a way out of economic turmoil with bold schemes to subsidise green cars, solar panels and other environmental technology had “spoken without understanding the upstream of modern products”.Top of FormBottom of FormTop of FormBottom of FormDon Burbar, the chief executive of Avalon Rare Metals, said: “The crux of the matter is that there are now a lot of technologies that can’t work without rare earths, and China is currently in effective control of the global supply. China has positioned itself to retain control, and meanwhile politicians around the world do not appreciate how the supply side of green technology works.”

### Without rare earths, green technologies like hybrids, electric vehicles, and biofuels can’t exist

Wilson – 9, Susan Wilson, Bachelor of Science in Humanities, Kansas State University, Manhattan,“Why We Need Rare-Earth Metals for Green Technology” http://green.blorge.com/2009/09/why-we-need-rare-earth-metals/

Neodymium, lanthanum, and dysprosium are all rare-earth metals necessary for a variety of green technologies like hybrid and electric vehicles, biofuels, and batteries.  These elements have other uses in nuclear reactors, compact disks and modern medicine. […] Neodymium makes very strong cheap light magnets. These magnets are used in the brushless engines of hybrids and electric vehicles as seen in the above picture. Neodymium magnets are a key component in the “Induct rack Magnetic Levitation System” being developed by physicist Richard Post at Lawrence Livermore National Laboratory (LLNL) in Calif. for use with maglev trains. Maglev Trains are extremely fast. The metal also is used to color glass and is used in rear view mirrors to cut down on glare. Without Neodymium, hybrids and electric vehicles wouldn’t be possible. Who knows, if Post’s research continues and proves promising, we may see maglev trains crisscrossing the country as an alternative to crowded flights.

### Important sectors of the Green Energy market would be impossible to produce without Rare Earths- zero emission vehicles would not exist

Wilson – 9, Susan Wilson, Bachelor of Science in Humanities, Kansas State University, Manhattan,“Why We Need Rare-Earth Metals for Green Technology” http://green.blorge.com/2009/09/why-we-need-rare-earth-metals/

An important component in nickel-metal hydride batteries, lanthanum is also used for carbon-arc electrodes used in the motion picture industry.Not only are nickel-metal hydride batteries used in some hybrid and electric vehicles, they are the rechargeable batteries that are used in many small electronics and toys. This rare-earth metal is also used in the production of biofuels and medicine. Lanthanum carbonate, a nano technology drug, is used to treat end-stage renal failure by removing excess phosphate.Dysprosium has high magnetic properties like neodymium.Because of its high magnetic properties, it is used in the manufacture of information storage mediums like compact disks.It can be used to replace a portion of neodymium in magnets and motors, but this metal is so scarce that we would quickly run out of it.This rare-earth metal is used in nuclear reactor control rods.Nanofibers of dysprosium are used to reinforce other materials and as a catalyst.In cars, dysprosium is used in liquid fuel injectors. These three rare-earth metals are used in advanced technologies that affect the types of cars that will be available, the types of energy sources we will have and even necessary medicines.Without them, the world of low and zero emissions vehicles would not be possible.

### There are no substitutes for REEs in green technologies

The Energy Report – 10, 7/14/11, “A Rare-Earth Rush in Green Technology” http://www.theenergyreport.com/pub/na/5808

It was an investor frenzy that truly came out of nowhere. In 2009, the hottest commodities around were lithium and rare-earth metals, which were completely off the radar until that point. Even now, many investors could probably not pronounce rare-earth elements such as dysprosium and neodymium in which they have eagerly placed their money. Lithium and rare earths got hot because of one simple fact: the emergence of new green technologies that require these metals in order to function, and specifically hybrid cars when it comes to lithium.There are no substitutes for these commodities, and investors quickly realized that the markets could become more constrained than they realized.

The result was staggering share price gains for any company involved in these spaces in 2009. For a while last summer, it looked like investors did not want to own anything else.
Of course, the frenzy eventually cooled off. And now the question is whether it was a one-time event or the start of a prolonged boom.
Experts in the industry claim it is definitely the latter, even though there are no supply shortages to speak of right now.
"For lithium, the investor frenzy cooled off a little bit, but the corporate frenzy hasn't changed at all," says Jon Hykawy, an analyst at Byron Capital Markets.
He pointed out that auto-makers, which are worried about securing supply of lithium, continue to invest in new projects. Toyota Motor Corp. recently teamed up with Australia's Orocobre Ltd. to develop a lithium project. In Canada, auto parts company Magna International Inc. invested in a little exploration company called Lithium Americas Corp.
Likewise, the exploration companies are working faster than ever.
"It's starting to get stupid. It's hard to find drill rigs for reasonable amounts of money in Argentina," Mr. Hykawy says. "And we're not talking complicated drilling. It's a few hundred meters."

### The unique properties of REEs can be used to increase our energy efficiency

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

Rare earth elements have many desirable properties, including the ability to form unusually strong, lightweight magnetic materials when alloyed with other metals. They also have distinctive and valuable optical properties including fluorescence and emission of coherent light – important for lasers. Many of these properties result from the presence of an unfilled inner electron shell in their atomic structure. These properties and others have made rare earth metals especially valuable in a number of applications, including for clean energy technologies. Lanthanum (atomic number 57) is used in batteries. Neodymium (atomic number 60) is used in magnets for electric motors. Europium (atomic number 63) is used in colored phosphors and lasers. Rare earth metals are also used in manufacturing energy-efficient windows and in capacitors, sensors and scintillators used in electricity transmission.

### The US needs to develop its REE industries and resources to lead in clean energy technology

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So in conclusion, as I said earlier: there’s no reason to panic, but every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals. The United States intends to be a world leader in clean energy technologies. Toward that end, we are shaping the policies and approaches to help prevent disruptions in supply of the materials needed for those technologies. This will involve careful and collaborative policy development. The United States will develop and implement systematic approaches to building a stable, geographically diverse supply chain; encourage technical innovations to identify substitutes as well as minimize the requirements for these key materials; and encourage recycling and re-use wherever possible. We will rely on the creative genius and entrepreneurial ingenuity of the business community to meet an emerging market demand in a competitive fashion. Working together, we can meet these challenges.

## \*\*\*Green Tech\*\*\*

## Green Tech---Rare Earths Key

### Rare-earths are essential to green technology- including wind turbines, hybrid and electric vehicles, and most technologies

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### Rare Earths key to Green Tech

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### Many important sectors of the Green Energy market would be impossible to produce without Rare Earths

Wilson – 9, Susan Wilson, Bachelor of Science in Humanities, Kansas State University, Manhattan,“Why We Need Rare-Earth Metals for Green Technology” http://green.blorge.com/2009/09/why-we-need-rare-earth-metals/

An important component in nickel-metal hydride batteries, lanthanum is also used for carbon-arc electrodes used in the motion picture industry.Not only are nickel-metal hydride batteries used in some hybrid and electric vehicles, they are the rechargeable batteries that are used in many small electronics and toys. This rare-earth metal is also used in the production of biofuels and medicine. Lanthanum carbonate, a nano technology drug, is used to treat end-stage renal failure by removing excess phosphate.Dysprosium has high magnetic properties like neodymium.Because of its high magnetic properties, it is used in the manufacture of information storage mediums like compact disks.It can be used to replace a portion of neodymium in magnets and motors, but this metal is so scarce that we would quickly run out of it.This rare-earth metal is used in nuclear reactor control rods.Nanofibers of dysprosium are used to reinforce other materials and as a catalyst.In cars, dysprosium is used in liquid fuel injectors. These three rare-earth metals are used in advanced technologies that affect the types of cars that will be available, the types of energy sources we will have and even necessary medicines.Without them, the world of low and zero emissions vehicles would not be possible.

### Rare-earth metals are so popular because investors know that there is literally no substitute for them in building green technologies

The Energy Report – 10, 7/14/11, “A Rare-Earth Rush in Green Technology” http://www.theenergyreport.com/pub/na/5808

It was an investor frenzy that truly came out of nowhere. In 2009, the hottest commodities around were lithium and rare-earth metals, which were completely off the radar until that point. Even now, many investors could probably not pronounce rare-earth elements such as dysprosium and neodymium in which they have eagerly placed their money. Lithium and rare earths got hot because of one simple fact: the emergence of new green technologies that require these metals in order to function, and specifically hybrid cars when it comes to lithium.There are no substitutes for these commodities, and investors quickly realized that the markets could become more constrained than they realized.

The result was staggering share price gains for any company involved in these spaces in 2009. For a while last summer, it looked like investors did not want to own anything else.
Of course, the frenzy eventually cooled off. And now the question is whether it was a one-time event or the start of a prolonged boom.
Experts in the industry claim it is definitely the latter, even though there are no supply shortages to speak of right now.
"For lithium, the investor frenzy cooled off a little bit, but the corporate frenzy hasn't changed at all," says Jon Hykawy, an analyst at Byron Capital Markets.
He pointed out that auto-makers, which are worried about securing supply of lithium, continue to invest in new projects. Toyota Motor Corp. recently teamed up with Australia's Orocobre Ltd. to develop a lithium project. In Canada, auto parts company Magna International Inc. invested in a little exploration company called Lithium Americas Corp.
Likewise, the exploration companies are working faster than ever.
"It's starting to get stupid. It's hard to find drill rigs for reasonable amounts of money in Argentina," Mr. Hykawy says. "And we're not talking complicated drilling. It's a few hundred meters."

### Green tech internal- REEs increase energy efficiency

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

Rare earth elements have many desirable properties, including the ability to form unusually strong, lightweight magnetic materials when alloyed with other metals. They also have distinctive and valuable optical properties including fluorescence and emission of coherent light – important for lasers. Many of these properties result from the presence of an unfilled inner electron shell in their atomic structure. These properties and others have made rare earth metals especially valuable in a number of applications, including for clean energy technologies. Lanthanum (atomic number 57) is used in batteries. Neodymium (atomic number 60) is used in magnets for electric motors. Europium (atomic number 63) is used in colored phosphors and lasers. Rare earth metals are also used in manufacturing energy-efficient windows and in capacitors, sensors and scintillators used in electricity transmission.

### Solvency, Green tech Internal, Impact- REEs are key to technologies in the green revolution, mining diversity can solve shortages, green tech solves jobs and warming

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

This transition is already well underway. The world is on the cusp of a clean energy revolution. Here in the United States, the Obama Administration is making historic investments in clean energy. The American Recovery and Reinvestment Act was the largest one-time investment in clean energy in our nation’s history – more than $80 billion. At the Department of Energy, we’re investing our $37 billion in Recovery funds in electric vehicles; batteries and advanced energy storage; a smarter and more reliable electric grid; and wind and solar technologies, among many other areas. Through this investment, we’ll at least double our renewable energy generation and manufacturing capacities by 2012. We’ll also deploy hundreds of thousands of electric vehicles and charging infrastructure to power them; weatherize at least half a million homes; and expand our grid. Other countries are also seizing this opportunity. Indeed, the market for clean energy technologies is growing rapidly all over the world. Today, the Chinese government is launching programs to deploy electric cars in 13 major cities. It’s connecting urban centers with high-speed rail. It’s building huge wind farms, ultra- supercritical advanced coal plants and ultra-high-voltage long-distance transmission lines with low line loss. India has launched an ambitious National Solar Mission, with the goal of reaching 20 gigawatts of installed solar capacity by 2020. In Europe, strong public policies are driving sustained investments in clean energy. Denmark is the world’s leading producer of wind turbines, earning more than $4 billion each year in that industry. Germany and Spain are the world’s top installers of solar photovoltaic panels, accounting for nearly three-quarters of a global market worth $37 billion last year. Around the world, investments in clean energy technologies are growing, helping create jobs, promote economic growth and fight climate change. These technologies will be a key part of the transition to a clean energy future. However today, many of these technologies rely on the special properties of rare-earth metals. There’s no reason to panic, but there’s every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals and other strategic materials.For the clean energy economy to reach its full potential, we must work together to ensure stable supplies of the materials required. That means working together to diversify global supply chains, as well as investing in manufacturing and processing. It means research and development into substitutes. It means finding ways to recycle and re-use scarce materials. U.S. talent and innovative capacity in materials science can be harnessed to create the next generation of rare earth applications and competing technologies. To proactively address the availability of rare earths and other strategic materials required for the clean energy economy, we must take a three-part approach: The first strategy is to globalize supply chains for strategic materials. To paraphrase what Churchill once said about oil: Security rests above all in diversity of supply. To manage supply risk, we need multiple, distributed sources of strategic materials in the years ahead. This means taking steps to encourage extraction, refining and manufacturing here in the United States, as well as encouraging our trading partners to expedite the environmentally-sound creation of alternative supplies.

### Green tech internal- the US needs to develop its REE industries to lead clean energy technolog

Sandalow 10 – David Sandalow, Assistant Secretary for Policy & International Affairs at the Department of Energy, March 17, 2010, Keynote Address at the Technology and Rare Earth Metals Conference 2010, online: http://www.pi.energy.gov/documents/Sandalow\_Rare\_Earth\_Speech\_-\_final\_%282%29.pdf

So in conclusion, as I said earlier: there’s no reason to panic, but every reason to be smart and serious as we plan for growing global demand for products that contain rare earth metals. The United States intends to be a world leader in clean energy technologies. Toward that end, we are shaping the policies and approaches to help prevent disruptions in supply of the materials needed for those technologies. This will involve careful and collaborative policy development. The United States will develop and implement systematic approaches to building a stable, geographically diverse supply chain; encourage technical innovations to identify substitutes as well as minimize the requirements for these key materials; and encourage recycling and re-use wherever possible. We will rely on the creative genius and entrepreneurial ingenuity of the business community to meet an emerging market demand in a competitive fashion. Working together, we can meet these challenges.

# \*\*\*Space Leadership Advantage\*\*\*

## Space Leadership Advantage---Removed 1AC Cards

### U.S. losing its position as a space leader by sitting back-China is mapping every inch of the moon/Russia and India are close behind

The Daily Galaxy 07-The Daily Galaxy, Great Discoveries Channel, August 13, 2007, “China Moon: Is a star wars in our near future?” http://www.dailygalaxy.com/my\_weblog/2007/08/china-moon-heli.html

A week after Russia claimed a vast portion of the Arctic sea floor, accelerating an international race for the natural resources as global warming opens polar access, China has announced plans to map "every inch" of the surface of the Moon and exploit the vast quantities of Helium-3 thought to lie buried in lunar rocks as part of its ambitious space-exploration program. China\_space\_walk\_moon\_landing\_2\_2 Ouyang Ziyuan, head of the first phase of lunar exploration, is quoted on government-sanctioned news site ChinaNews.com describing plans to collect three dimensional images of the Moon for future mining of Helium 3: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of Helium-3 can reach one to five million tons." "Helium-3 is considered as a long-term, stable, safe, clean and cheap material for human beings to get nuclear energy through controllable nuclear fusion experiments," Ziyuan added. "If we human beings can finally use such energy material to generate electricity, then China might need 10 tons of helium-3 every year and in the world, about 100 tons of helium-3 will be needed every year." Helium 3 fusion energy - classic Buck Rogers propulsion system- may be the key to future space exploration and settlement, requiring less radioactive shielding, lightening the load. Scientists estimate there are about one million tons of helium 3 on the moon, enough to power the world for thousands of years. The equivalent of a single space shuttle load or roughly 25 tons could supply the entire United States' energy needs for a year. Thermonuclear reactors capable of processing Helium-3 would have to be built, along with major transport system to get various equipment to the Moon to process huge amounts of lunar soil and get the minerals back to Earth. With China's announcement, a new Moon-focused Space Race seems locked in place. China made its first steps in space just a few years ago, and is in the process of establishing a lunar base by 2024. NASA is currently working on a new space vehicle, Orion, which is destined to fly the U.S. astronauts to the moon in 13 years, to deploy a permanent base. Russia, the first to put a probe on the moon, plans to deploy a lunar base in 2015. A new, reusable spacecraft, called Kliper, has been earmarked for lunar flights, with the International Space Station being an essential galactic pit stop. The harvesting of Helium-3 on the could start by 2025. Our lunar mining could be but a jumping off point for Helium 3 extraction from the atmospheres of our Solar System gas giants, Saturn and Jupiter. UN Treaties in place state that the moon and its minerals are the common heritage of mankind, so the quest to use Helium-3 as an energy source would likely demand joint international co-operation. Hopefully, exploitation of the moon's resources will be viewed as a solution for thw world, rather than an out-moded nation-state solution. In October 2003, China became the third space-faring nation (after the U.S. and Russia) after it launched its first “Taikonaut” into orbit. Europe and India are accelerating their efforts to conduct robotic science on space-born platforms. There’s also a growing interest in space exploration from a dozen other countries around the world, including Kenya, whose equatorial location on the east coast of Africa makes it geographically ideal for space launches. While this emerging international community claims it's slice of the aerospace universe, the U.S., by contrast, is no longer a leader but simply a player, according to nationally renowned astrophysicist Neil deGrasse Tyson, who points out that "we’ve moved backward just by standing still." Earlier this year, the Chinese space agency outlined plans to launch the first probe in the second half of 2007. the Chang'e-1 lunar probe will be launched aboard a Long March 3A rocket. The probe will provide 3D images of the Moon, survey the lunar landscape, study lunar microwaves and estimate the thickness of the Moon's soil. It has now also given a few more details of its plans for phase two, which will see an unmanned rover land on the lunar surface in 2010 and "meticulously" survey the area in which it lands. A sample-return mission is slated for 2012.

Second space race has competition between global superpowers for He3-U.S. risks loss of leadership

Williams 07-Mark Williams, reporter for technology review, August 23, 2007, “Mining the Moon,” <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 recently started blustering, Soviet-style, that it will build a permanent moon base by 2015-2020--will be extracting He3. The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011. Nor does India intend to be left out. (See "India's Space Ambitions Soar.") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, Chandrayaan-1, will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending Chandrayaan-2, a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He3 and bringing it back to fuel fusion-based nuclear reactors on Earth.

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.

## Space Leadership Advantage---Uniqueness

### NASA Credibility Low – NASA’s announcement of Project Constellation can be seen as an admission of failure for scrapping the Apollo program prematurely. While NASA may be trying to foster multilateral solutions, growing space powers Russia and China are forcing NASA to lose bargaining power quickly.

Guterl 7 – Fred Guterl, US Newsweek Correspondent, February 5, 2007, “Race To The Moon,” Newsweek International Edition, Lexis

<All this comes at a time when NASA, the world's premier space agency, is floundering. In December, NASA unveiled a more detailed map for reaching Mars via the moon. The Constellation Program, as it's called, would involve building a new booster rocket, Ares, capable of lugging all the gear needed for a moon trip, with a capsule on top to carry 4 to 6 astronauts. It would involve a lunar rendezvous--one ship waiting in lunar orbit while a second descends to the surface. If it sounds familiar, that's because the plan is strikingly similar to Apollo, last flown in the 1970s.

Some NASA officials argue that the plan is the next logical step in its exploration program. To be sure, the notion of establishing a permanent outpost on the moon goes beyond the mere planting of a flag. "A human presence has been expanded beyond the surface of the Earth for the first time in human history," says Scott Horowitz, NASA's associate administrator for exploration systems. "The next logical step is to expand that bubble to 200,000 miles." But NASA had the hardware needed to get there back in the 1970s, and chose to discard it. Now, after spending roughly $250 billion on the space shuttle and the International Space Station and other projects since the mid-1970s, NASA will have to spend another $200 billion to reinvent the Apollo program. The money will come, in part, from ending the shuttle program by 2010. The new plan could be read as an admission of failure. Indeed, NASA administrator Michael Griffin has said as much. "The period when the United States retreated from the moon and quite deliberately focused only on low Earth orbit will be seen, to me, a mistake," he recently told the New York Times.

The turnabout has cast a pall over the agency's international leadership in space. Although NASA still outspends every other country by far, its international partners--particularly Russia and Europe--will in the coming years have unprecedented leverage in bargaining for more say over what gets built and when. NASA's $16 billion budget, which dwarfs that of any other nation, will keep the agency in the driver's seat as far as international space projects go. But space programs in China and Russia are gathering steam. Eventually NASA could find itself just another player on the world stage.

NASA officials are now making a big deal of bringing the international space community into its latest venture. Before unveiling its new plan, it consulted 14 space agencies on what the goals of the new program should be, and held planning meetings. Experts say this is not just window dressing-NASA is serious about involving partners in the planning of the mission as never before. That's a change from the agency's tack with the International Space Station, in which NASA tended to make important decisions before consulting its partners.

NASA's new taste for diplomacy, however, may also be intended as a salve for past mistreatment. Europe, in particular, is miffed at NASA's abrupt abandoning of the shuttle and space-station projects. In recent years the European Space Agency has focused its manned program on the space station and on an eventual trip to Mars. Europe's launch of the Exomars Martian rover is planned for 2013 and its Mars Sample Return mission is scheduled for 2020 or later. NASA's turnabout means that Europe must now adapt its space program to include a moon plan if it wants to participate as a partner. In the meantime, its space station laboratory, Columbus, has been ready to fly for more than a year but will collect dust at least until the end of 2007, when ESA is expected to get a seat on the shuttle--a molar-grinding frustration to European officials.

Europe, however, has never had more options for space partners than it does now. Its relationship with Roscosmos has strengthened in recent years. When NASA's shuttle program shut down after the Columbia disaster, Russia provided a much needed ride to the space station for European astronauts. Europe is now moving ahead with a plan to collaborate with Russia's Clipper project to build a ship capable of ferrying astronauts to Earth orbit. The Russian resurgence "puts us, the Europeans, in a better position to negotiate with NASA by allowing us to say we might want to partner with the Russians," says Laurence Nardon, director of the space-policy program at the French Institute of International Relations in Paris. "Politically, it allows Europe to play both sides." ESA officials learned their lesson when the shuttle was grounded after Columbia: "You want to avoid relying on a single partner," says Piero Messina, an official at ESA's Directorate of Human Spaceflight, Microgravity and Exploration Program. "In any market, if you don't have a monopoly, you can get good deals."

Had NASA done things differently back in the 1970s, its program today might have looked more like Russia's, minus fiscal and other problems associated with the collapse of the Soviet Union. Roscosmos never had the luxury of starting over from scratch. After the failure of the Soviet moon program, Roscosmos and Energia, the rocket maker, went on to develop a reliable and relatively inexpensive series of boosters that served them well for the next several decades. Its Proton booster--a heavy-load rocket similar in some respects to the Saturn 5--is perhaps the most successful rocket so far. Russia has launched it 324 times since 1965. "Russian launching systems are as simple as clockwork, so they work like clockwork," says Victor Savinykh, editor of Russian Space magazine and rector of Moscow State University of Geodesy and Cartography.

Not surprisingly, Russia's boosters and other space technologies are a hot commodity on the world market. In the last year Russia has raised its prices for launch services by more than 40 percent, to about $90 million. In addition to Europe, Roscosmos is in talks with China, a relative newcomer to manned spaceflight, on a potential collaboration. Russia will have to enter any arrangement cautiously, to keep China from copying key technologies, but the mere fact that talks are ongoing gives Russia leverage with NASA. "The Chinese are still some 30 years behind us, but their space program has been developing very fast," says Anatoly Perminov, head of Roscosmos. "They are quickly catching up with us.">

### US Must Act Now – China is not playing around. They have invested $170 million dollars into a long-term Moon project and with Russian space technology they are quickly becoming a major space power.

Guterl 7 – Fred Guterl, US Newsweek Correspondent, February 5, 2007, “Race To The Moon,” Newsweek International Edition, Lexis

<The Chinese Shenzhou spacecraft, which flew China's first astronaut into orbit in 2003 and two others in 2005, closely resembles the Russian Soyuz for good reason: China bought the basic technology from Russia following a strategic partnership agreement in 1991. China also wants to send up a space station and land a robot probe on the moon by 2010. "We are ready to conquer the moon together with the Americans, but only on equal conditions," says Panarin of Roscosmos. "This is the only acceptable form of cooperation for us."

Beijing's late chairman Mao Zedong had complained in 1957--the year the U.S.S.R. launched its first object into orbit--that China was so undeveloped it couldn't even put a potato into space. Today Beijing has launched close to 100 satellites. In its ambitious lunar-exploration scheme, set to launch in April, China plans to put an unmanned probe in lunar orbit for a year, studying the terrain and geophysics. Beijing plans to put an unmanned moon rover on the lunar surface by 2010, followed by a craft to collect lunar samples and return to Earth by 2020. Later this year it will launch three astronauts into orbit, and it plans to complete its first spacewalk by 2008. Once these preliminary missions are accomplished, Beijing hopes to send astronauts to the moon.

These days the tense anticipation at Aerospace City, a restricted-access facility north of Beijing, is palpable. The sprawling compound houses the command center for China's manned space launches, as well as the astronaut training center, residential buildings and a gleaming exhibition hall. Two huge red banners flanking the doors to the command center exhort workers to "Fulfill the task for moon exploration in order to add another brilliant page for space aviation technology." New construction, enclosed by scaffolding, is still visible on both sides of the building. Inside, four long rows of computer terminals face four gigantic video screens. A fifth row of seating has just been added to accommodate influential members of the Chinese Communist Party Central Committee who are expected to witness this spring's inauguration of China's moon mission. Nearby, in the exhibition hall, lunar themes feature prominently. One of the highest-profile displays is devoted to three phases of the moon program whose price tag is estimated at $170 million: an animated video of a satellite in lunar orbit, a display of a Chinese moon buggy and a diorama of another moon vehicle scooping up rocks to whisk back home.>

### US Must Act Now – Russia and China are primarily motivated in sending men to the Moon for the collection of He-3 to avert the coming energy crisis. NASA cannot maintain a technological lead or fund a new Apollo project now.

Guterl 7 – Fred Guterl, US Newsweek Correspondent, February 5, 2007, “Race To The Moon,” Newsweek International Edition, Lexis

<The chief motivation for China and Russia is energy. With demand soaring into the foreseeable future, Beijing's engineer-leaders are particularly keen to find alternative sources. One possibility is helium-3, an isotope of helium that is rare on Earth but abundant on the moon. Helium-3, scientists think, would make a clean source of nuclear fusion power- burning it would be nonpolluting and leave no residual radioactive waste. For years scientists have bandied about schemes to mine Helium-3 on the moon and return it to Earth in cargo ships for use in reactors, but so far nobody has had the audacity to make plans. The Chinese and the Russians have now crossed that threshold.

NASA's technology lead is still formidable, but not quite as formidable as it used to be. The first mistake was seeing the Apollo program, based on the Saturn 5, as nothing more than a necessary expedient to beat the Russians to the moon. Instead, NASA engineers held fast to the technological ideal of a winged ship that could take off and land like an airplane, but also operate in the vacuum of outer space. By the time this concept wended its way through the bureaucracy of NASA and the U.S. Air Force, it was severely compromised. In the end, the shuttle wasn't built to take off from a runway; instead it was strapped on the side of a booster with two solid-fuel rockets on either side. As the Columbia accident revealed, this piggyback arrangement turned out to be a fatal design flaw--it made the shuttle vulnerable to foam falling off the booster during takeoff. The shuttle, with a per-launch cost of at least half a billion dollars, failed to make access to space cheaper. "NASA did an appallingly bad job of the launch technology," says Bill Sweetman, a space expert at Jane's Defence Weekly. "The shuttle was a dangerous waste of money since the '90s and there has been a lack of will to change policy on the U.S. side." The decision to scrap the Saturn 5 has haunted NASA ever since.

The hugely expensive and troubled International Space Station was, in a sense, a compounding of NASA's error. Designed to take advantage of the shuttle capabilities, the station has proven hugely expensive--$200 billion and counting, even after downgrading its capabilities and crew size. Had NASA kept the Saturn 5 and left the shuttle on the drawing board, it might have succeeded in building a cost-effective space station. "You could have built it with Apollo hardware," says John Logsdon, a space-policy expert at George Washington University, "and it would have been a lot better." Thirty years later, there's nothing like some competition to focus the mind.>

### US Must Act Now – The 2nd race for the moon in the 21st century will be joined by a full roster of global powers including China, India, Japan, and Germany. Each of these participants has expressed intent to exploit lunar exploration for the extraction of He-3 for nuclear fusion experimentation.

Williams 7 – Matt Williams, Contributing Author MIT Technology Review, August 23, 2007, “Mining The Moon,” MIT Technology Review, <http://www.technologyreview.com/energy/19296/page1/>

<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.

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The Chinese, too, apparently believe that helium-3 from the moon can enable fusion plants on Earth. This fall, the People's Republic expects to orbit a satellite around the moon and then land an unmanned vehicle there in 2011.

Nor does India intend to be left out. (See "India's Space Ambitions Soar.") This past spring, its president, A.P.J. Kalam, and its prime minister, Manmohan Singh, made major speeches asserting that, besides constructing giant solar collectors in orbit and on the moon, the world's largest democracy likewise intends to mine He3 from the lunar surface. India's probe, Chandrayaan-1, will take off next year, and ISRO, the Indian Space Research Organization, is talking about sending Chandrayaan-2, a surface rover, in 2010 or 2011. Simultaneously, Japan and Germany are also making noises about launching their own moon missions at around that time, and talking up the possibility of mining He-3 and bringing it back to fuel fusion-based nuclear reactors on Earth.>

## Space Leadership Advantage---Uniqueness---China

### China is gaining an edge in space race against U.S.

Sasha 6-9-Deng Sasha, Editor for xinhuanet news, 6-9-11, “China’s second moon orbiter Chang’e 2 goes to outer space,” <http://news.xinhuanet.com/english2010/china/2011-06/09/c_13920425.htm>

BEIJING, June 9 (Xinhua) -- China's second moon orbiter Chang'e-2 on Thursday set off from its moon orbit for outer space about 1.5 million km away from the earth, Chinese scientists said Thursday. The orbiter left its moon orbit at 5:10 p.m. and it will take about 85 days for the orbiter to reach outer space, according to the State Administration of Science,Technology and Industry for National Defence (SASTIND). The orbiter had finished all its tasks within its designed life span of six months by April 1. Scientists decided to let it carry out additional exploratory tasks as the orbiter still had fuel in reserve. Traveling into outer space from the moon's orbit is the most important task among five additional ones, according to the SASTIND. "It's the first time in the world for a satellite to be set off from the moon in remote outer space," said Zhou Jianliang, deputy chief engineer of the Chang'e-2 measure and control system of the Beijing Aerospace Control Center (BACC). Moon exploration means about 400,000 km away from the earth, but outer space exploration means 1.5 million km, posing great challenges to the country's technology in measure and control, telecommunications, data transaction and orbit design, scientists said. Before flying away, the orbiter had finished two additional tasks as of May 23. One was to take photos of the northern and southern poles of the moon. The other was to descend again to the perilune orbit, about 15 km away from the surface, to catch high-resolution images of the Sinus Iridum, or Bay of Rainbows, the proposed landing ground for future moon missions. Scientists hope the satellite can continue operations until the end of next year. "We are developing outer space measure and control stations in outer space and they will be capable to carry out tasks by the end of the second half next year," said an SASTIND scientist, who declined to be named. At that time, the satellite can be used to test the two stations' functions, the scientist said. Challenges exist as Chang'e-2 was not designed for the additional task and it is now in extended service without extra capacities to deal with abnormal risks, Zhou said. Meanwhile, long-distance brings many problems like weakening signals and difficulties in measure and control, Zhou said. The Chang'e probes are named after a legendary Chinese moon goddess who flew to the moon. Besides the current operations, China's ambitious three-stage moon mission will include a moon landing and launch of a moon rover around 2012 in the second phase. In the third phase, another rover will land on the moon and return to earth with lunar soil and stone samples for scientific research around 2017. The country has no plan or timetable for a manned moon landing for now. China launched its first lunar probe, Chang'e-1, in October 2007. It became the third country after Russia and the United States to send a person into space in 2003. Two more manned space missions followed with the more recent in 2008 involving the country's first human space walk.

## Space Leadership Advantage---Uniqueness---Russia

### Space Race Internal- Russia is searching for REEs on the moon

RIANovosti 06- 05/06/2006, “Russia plans to produce rare-earth metals on Moon - space agency,” http://en.rian.ru/russia/20060605/49044511.html

MOSCOW, June 5 (RIA Novosti) - Russia plans produce rare-earth metals on the Moon, a deputy head of the Federal Space Agency said Monday. Following a May announcement from the country's largest rocket corporation that it intended to seek helium-3 on the Moon for nuclear fusion, Yury Nosenko said that the agency was aiming to produce the metals for more mundane purposes. "Rare-earth metals will be used for semi-conductors in modern electronics and medical equipment," he said. He said the Moon had good conditions for setting up telescopes and navigation stations, but thorough research was still needed as little was known about the Moon. "We still know very little about the Moon and its geological composition and that is why we need to research everything to make a correct decision on its practical use," Nosenko said. Energia Rocket and Space Corporation said last month that it was planning to extract lunar reserves of helium-3 as soon as the re-usable Clipper spacecraft was put into operation. "The Moon has vast reserves of helium-3 and this is the closest place to Earth where it can be extracted," said Nikolai Sevastyanov, the corporation's head. He said the Moon's industrial development could solve the problem of the shortage of energy resources on Earth.

## Space Leadership Advantage---Moon Key

### **Foreign superpower can easily take U.S.’s leadership position in space by taking the lead in lunar exploration**

Jain 11-Naveen Jain, Philanthropist, entrepreneur and a technology pioneer. Naveen Jain is founder of Moon Express and Intelius. Previosuly, Naveen Jain founded InfoSpace. Naveen Jain took InfoSpace public in 1998 on the NASDAQ and served as CEO until he left to start Intelius. Before starting InfoSpace, Naveen Jain was a senior executive at Microsoft Corporation. Naveen Jain is Co-Chairman of "Education and Global Development" at the X Prize Foundation, April 20, 11, “Our Sputnik Moment: US Entrepreneurs Needed for the "Space Race"” http://www.huffingtonpost.com/naveen-jain/our-sputnik-moment-us-ent\_b\_851312.html

Fifty years ago, Russian cosmonaut Yuri Gagarin became the first man in space. It was an event that spurred on America to catch up and exceed Russia's achievement, as President John F. Kennedy outlined in 1962: "...this country of the United States was not built by those who waited and rested and wished to look behind them. This country was conquered by those who moved forward -- and so will space."

Moving forward to 2011, it looks like we're in a similar "catch-up" position. Russia is greatly expanding its space program and is considering investing $7 billion to build a base on the Moon as part of a plan to send a mission to Mars. China's Lunar Exploration Program has announced its intention to mine the Moon for the substance Helium-3, and the Russian government has made similar statements about its wish to harvest it.

While Kennedy exhorted Americans to throw their support behind the government's efforts to reach the Moon, President Obama has made it clear that this job now belongs to private enterprise. In his 2011 State of the Union speech, he referred to this generation's "Sputnik moment" -- that is, the realization that a foreign superpower could usurp our economic leadership position. The president has indicated that the private sector should take over the job of Moon exploration, so now's the time to use private enterprise know-how to tap into resources beyond those of the Earth.

There have been some steps in the right direction. NASA has committed $30 million to buy information that is gleaned from future missions to the Moon; the money has been contracted to six teams who are also competing for the Google Lunar X PRIZE, managed by the X PRIZE Foundation. That's a good beginning, but government and private enterprise need additional mechanisms to find funding, and make government expenditures for data worth the investment.

As Obama has logically said, NASA's mission should focus on exploring deep space, and private companies should take on the task of building ships to carry cargo and passengers to the International Space Station, and to the Moon. Rocket companies can get in on this market, as can mining companies. The time may be right to think about going to the Moon as a business rather than a hobby. That's the goal of Moon Express, a new company of which I am a cofounder. We're working on building vehicles that can deliver payloads to the Moon and search the lunar surface for precious materials.

### **Not getting to Moon’s resources first risks overdependence on other countries and loss of leadership**

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Why does this discussion of space exploration matter now, especially at a time when so many problems demand our attention here on this planet? Are we trying to go back to the Moon just because we can or is there a benefit to the world in lunar exploration? The answer is the latter. Moon exploration promises to yield new energy sources that could finally break our hold on fossil fuel, and our overdependence on sometimes hostile nations that control its supply. But this time around, we don't need to rely on government funding to fuel Moon exploration -- we can encourage private entrepreneurs to take on this role.

The value in Moon exploration comes in part from the presence of valuable resources such as Helium-3, a source of energy that is rare on Earth but is abundant on the Moon. It can "generate vast amounts of electrical power without creating the troublesome radioactive byproducts produced in conventional nuclear reactors," a Popular Mechanics article explains. In addition, platinum is present on the Moon, and could be mined for use in energy applications, where it is a key catalyst for fuel-cell vehicles.

If China and Russia succeed in their goals to obtain Helium-3 and other rare resources for the development of energy, the U.S. could end up relying on these countries for its own energy needs.That's a tricky thing from a political standpoint: What happens if our relations with these countries turn sour? What happens if Russia and China decide to severely restrict the sale of Helium-3 to other countries, which will drive prices sky-high? We'll be in the same boat that we're in now, where we are beholden to oil-rich countries that are often in turmoil.

However, if we allow private enterprise to explore and take advantage of the Moon's resources, we may set ourselves on the road to energy independence.

To re-launch our space program, we need private enterprise to step into the void. Government funding only needs to take us to the point where the technology has been developed to get us to the Moon -- and we already have that. It's a model that's been used successfully in the past: the military first developed the Internet, and private enterprise then seized on its commercial potential; the same thing occurred with GPS technology.

Naturally, there are barriers to entrepreneurs leading the charge to the Moon. For one thing, ownership is always a point of discussion -- but the fact is that "everyone" and "no one" owns the Moon. Much like when mining resources from international waters (as in fishing), entrepreneurs would need to respect the rights of other business and government players. There is legal precedent for explorers finding and keeping resources that they have uncovered via private investment.

There's also the question of whether we can transport resources from the Moon in a cost-effective manner. Perhaps the cost of rocket launches -- by far the greatest expense for a Moon mission -- will come down as more entrepreneurs move into this market, or new technology will make them cheaper. It's even possible to create rocket fuel from resources on the Moon, which would slash return costs and even lower launch costs from Earth.

On the other hand, mining and transporting these resources back to the Earth could depress prices as supplies grow, making such ventures less appealing to entrepreneurs. As with all private market endeavors, many will want to take a wait-and-see approach to the Moon's market potential. But therein lies the opportunity for early movers who apply entrepreneurship to the opening of whole new markets, and in the case of the Moon, a whole new world.

### If U.S. lags behind in search for lunar resources other countries like Russia, China, India, and Japan will fill in the gap-U.S. will lose leadership position

Kaufman 06-Marc Kaufman, Washington Post writer, Dec. 4, 2006, “NASA looks to the future with eye on the past,” http://www.sdu.umd.edu/~white/RomaniSpring08/NASA%27s%20Vision/NASA%20Looks%20to%20the%20Future%20With%20Eye%20on%20the%20Past.pdf

“In the long run, we know that Earth and its resources are finite,” Griffinsaid. “There are resources in space – solar power or particular materials orprecious metals, or basic things like water or fuel which, in the context of aspace–based economy, can be very valuable. As we learn and develop the artsand sciences of spaceflight, we will want to make use of those resourcesrather than bringing them up from Earth.”

Some intriguing possibilities include extracting oxygen from the moon’s soilto help power rockets, collecting helium–3 (a non–radioactive isotope of the gas) for nuclear power back on Earth, and the mineral anorthite to makealuminum.

“This won’t happen tomorrow or in our grandchildren’s day,” he said. “But who would have thought that it would be profitable to make wine in Australia and ship it to the United States? In a few short decades, we’ve made a very significant part of the Earth’s economy to be a global economy and not a patchwork of national economies.”

In the same way that globalization was the result of a thousand years of exploration and development, Griffin argued, a space–based economy will appear only after thousands of missions – some successful and some not. “You will – if you can live long enough – see the resources of the solar system similarly incorporated into humanity’s sphere of influence,” Griffin said. “In the long run, that’s what the expansion of humankind into space is all about.” Whether this vision is achievable or even desirable is a subject of debate, and there is already substantial concern that NASA’s exploration plans will, over time, drain funds from its highly successful science programs.

“It’s good to have such an enthusiast like Griffin at NASA, but that whole messianic vision is pretty far from the current state of technology,” said Robert Kirshner, an astronomy professor at Harvard University and past president of the American Astronomical Society. “Many of us worry that it will suck the juice out of other very promising projects to learn more about our universe.”

Griffin said that NASA intends to maintain the financial balance between manned exploration and pure science in its $17 billion yearly budget, a ratio that is now about two dollars for manned exploration for each one spent on pure science. The billions more needed for the moon–Mars missions will be redirected from the costly shuttle and space station programs, which are due to wind down in 2010.

But Wes Huntress, a former NASA associate administrator and ex–member of the NASA science advisory board, said that ever since Bush announced the space exploration vision, the administration has refused to give the agency additional funding to accomplish its mission.

The result is that “Griffin has had to cannibalize the agency to get the money for the new program,” Huntress said. “Even at that, I don’t think there are sufficient funds to support even the return to the moon once the program gets really moving.”

In Griffin’s big–picture view,the stakes in space are high – which helpsexplain why he is so driven about return to manned lunar exploration andbeyond. Not only are there major national security issues involved – thecountry relies on space–based defense like no other nation –but the NASAadministrator said the United States can remain a preeminent civilizationonly if it continues to explore space aggressively.

If the United States pulls back, Griffin said, others will speed ahead. Russiaand China have sent astronauts into low–Earth orbit, and India, Japan andthe Europeans all have the technical ability to do the same now – and farmore in the future.

International cooperation has been ingrained into the government’s thinkingabout space, butthe United States and others remain committed tomanufacturing their own rockets and space capsules and will be looking forinternational cooperation only once they are on the moon or Mars or someasteroids in between.

“I absolutely believe that America became a great power in the world,leapfrogging other great powers of the time, because of its mastery of the air,”Griffin said.“In the 21st century and beyond, our society and nation, if wewish to remain in the first rank, must add to our existing capacities… toremain preeminent in the arts and sciences of space flight.“Space is important to our nation and will be forevermore.”

### U.S. can gain a lot from lunar exploration-Leadership and scientific and cultural benefits

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

A strategic framework for the Moon must weave together the economic, social,scientific, national security, and civil aspects that have evolved largely in isolation since the inception of the space age. The United States—based on its historical dependence upon space assets, exploration heritage, and global leadership position,—has the most to gain and lose by the tenor of its leadership in this framework’sdevelopment and implementation. A permanent presence on the Moon, combined with the use of lunar and space resources, offers the means to create a new space age. Lunar exploration offers many scientific and cultural benefitsand has significant historic implications. In addition, this extension of human reach beyond low Earth orbit, and the ability to regularly access and use cislunarspace is critical for addressing emerging national, economic, and scientific challenges.An analogy to this strategic moment is the development of United States maritime policy at the beginning of the 20th century.

Introduction

The Moon is the Earth’s offshore continent, the recorder of our cosmic past and future. Human footprints, echoes of an earlier timeand era, have only barely marked its surface. The impendingdevelopment of a sustained human presence on the Moon willmark a new era in human exploration and development. The Moon stands ready to help us unfold a new age in space and on The ideas and opinions expressed in this work are those of the authors and do notnecessarily represent the positions or opinions of the organizations with which the authorsare affiliated.

Earth—one that will open the secrets of our past and energize and advance all sectors of human endeavor.

Earth and its Moon are inexorably linked in space and time.The tides induced by the Moon’s tug expose tidal flats at the sealand boundary, whose presence enabled life to emerge from the sea. Lunar rhythms are reflected in many biological and climatic processes, indicating its silent, constant influence on the pulse of the Earth. More recently, the Moon stands as a distant, visible shoreline, far enough away to be separate, yet an accessible and challenging destination. Countless myths and stories from cultures throughout the world are based on its sentinel presence. The story of our past and future is etched in its craters, valleys, and plains. The materials and energy needed to unleash humanity from the bounds of gravity and to create an open system of growth without limits, await development on the Moon.

### U.S. should take lead in moon race to maintain leadership position

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

Just as humans emerged from the savannahs of Africa to cross seas and land bridges into the unknown, so too will we venture inexorably to Mars, the other planets in our solar system and destinations beyond. But for now, such a journey would have little to no strategic connectivity or practical benefit, unless it is born out of the sustaining activities that can be permanently developed and expanded in cislunar space, the space between the Earth and lunar orbit, and on the Moon. Our human reach to Mars and other destinations goes through the Moon. By learning to use cislunar space in a manner that creates new spacefaring capability, develops needed technology, and increases the security, innovation, and development of our own planet, we will orchestrate the next generation of human endeavor.

Permanently extending human presence to the Moon anddeveloping the ability to utilize space and lunar resources willestablish the capability to have regular access to cislunar space ina manner that can fundamentally transform security, commerce,and science, while also serving as the debarkation point for humanity’sjourney into the solar system. To this end, an overarching strategic framework is needed for exploring and using the Moon— a framework that accounts for the Moon’s place in our culture and consciousness, its importance in moving out into our solar system and its long-term significance to a wide range of national and international interests. Based on such a framework, the United States(U.S.) can lead the rest of the world on a path that will utilize,expand, protect, and synthesize all activities and entities thatdepend on and use space.

### Moon allows for geopolitical, technological, economic, and security trends

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

National Context and Current Framework

Because of its familiarity and presence, the strategic value of the Moon has been given little consideration. Since Sputnik was launched in 1957, cislunar space has seen an explosion of activity that continues to expand and increase in diversity. Outlining this value requires sorting through and across a spectrum of national, commercial, scientific, exploration, and cultural considerations that have evolved largely in isolation from each other since the Space Age began. These isolated themes are now inexorably growing and merging. It is thus an appropriate time to step back andexamine the role the Moon plays in humanity’s development onEarth and movement into the universe.

The Moon as a destination is visible in the adoption of a newU.S. space policy, the Vision for Space Exploration (Vision or VSE), announced by President George W. Bush in January 2004.1 The unfurling of the Vision represents a watershed opportunity to recast the direction of the space program and its relevance to our national and international development. An analog to this fundamental turning point is the development of modern naval policy at the beginning of 20th century.2 At that time, geopolitical,technological, economic, and national security trends cametogether with national leadership to chart a fresh framework forU.S. strategic development, enabled by its maritime capabilitiesthat focused on the challenges and opportunities presented byextended and permanent U.S. interests beyond our shores.

The Vision largely centers on providing the National Aeronautics and Space Administration (NASA) a long-term strategic direction for its current and future human spaceflight programs, supported by robotic systems, and came about in response to a major review of the national space program following the loss of the Space Shuttle Columbia in 2003.3

### Solvency-use of lunar resources are emphasized and exploitation of resources can build systems to reach space

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

In addition to these hardware tasks the Vision calls for a return to the Moon, first by robotic spacecraft and then by humans, with the goal of living and working there for increasing periods of time. Several activities on the Moon are specified, but in particular, thedevelopment and use of lunar resources is emphasized.4 The clear implication of the Vision is that we will learn to live and work on the Moon to use it productively but also to prepare for journeys to Mars and other destinations.

Also challenging and creating a new context for NASA, Congress endorsed the Vision and provided an overall architectural framework for agency activities with the NASA Authorization Act of 2005.5 This law directs NASA to create a sustained human presence on the Moon for national preeminence, commercial, and scientific purposes. This law also calls for NASA to develop a human spaceflight capability to replace the Shuttle as soon after its retirement as possible. The law also addresses key elements needed in the development of a cis-lunar space presence, including the importance of shifting low-Earth orbit space activities towards a broader national and commercial focus.

This fundamental shift in space policy emphasis challenges our current national security and strategic focus on space, which centers on assured access, launch on demand, and replenishment of assets, primarily in low Earth orbit.6 However, such a framework clearly has limits, as only so much material can be lifted off the Earth. To transition to a new paradigm of spaceflight, it is necessary and inevitablethat we redirect our efforts towards the use of space resources, strategic depth, repair, extension, and replenishment on-orbit, and the gradual expansion of human reach beyond low Earth orbit. It is the destiny of this nation, built on exploration and discovery, to continue this tradition into the arena of space. The Moon’s resources of material and energy can be exploited to buildsystems that extend our reach and capability in space. A transportationinfrastructure that can routinely reach the Moon can also routinelyaccess cislunar space—that zone where many of the world’smost valuable space borne assets reside. Currently, ongoing space operations require fabrication and launch of a system, its use for some period of time, and then its eventual abandonment. With a transportation system in cislunar space, we will routinely visit and repair, maintain, refurbish, expand, and upgrade satellites on a regular basis. Spacecraft will no longer be built to a planned obsolescence and then abandoned, but instead will be designedto permit unlimited lifetime and capability for expansion and extension.In short, we will evolve from the existing ‘‘sortie’’ approach tospace travel to an approach that allows sustained, constant, and routineaccess to all locations in cislunar space.

### Transition in getting to the moon key to U.S. leadership

Cremins and Spudis 07-Thomas Cremins and paul D. Spudis, National Aeronautics and Space Administration/John Hopkins University Applied Physics Laboratory, Aug. 6, 2007, “Viewpoint: The strategic context of the moon echoes of the past, symphony of the future,”http://www.spudislunarresources.com/Papers/Cremins%20and%20Spudis%202007%20Astropolitics.pdf

We must begin this transition towards a national cislunarcapability by tapping personnel and by gathering infrastructureand capabilities that support human spaceflight in low earth orbit(LEO) and the ISS. We will not (and cannot) build this new infrastructurefrom scratch. Current Shuttle and Station assets help ensure that the U.S. government does not get into the position of relying on foreign access to space or upon nascent commercial providers. If we do not build a cislunar fleet to ensure regular access to all parts of Earth-Moon space to advance our interests and future in space, we will then be held hostage by capabilities that only extend to the close coastal regions of space. This transition is acritical element as to whether the U.S. maintains leadership in creatingthe new space age, or becomes tethered to scientific andpolitical infighting.

### General Solvency – US leadership can take us back to the moon. An American entrepreneurial spirit will drive government and private efforts to effectively mine lunar He-3.

Schmitt 4, Former Apollo 17 Astronaut and Adjunct Professor of Engineering Physics University of Wisconsin-Madison, “Mining The Moon,” October, POPULAR MECHANICS, <http://www.searchanddiscovery.com/documents/2004/schmitt/images/schmitt.pdf>

<That vision seemed impossibly distant during the decades in which manned space exploration languished. Yes, Americans and others made repeated trips into Earth orbit, but humanity seemed content to send only robots into the vastness beyond. That changed on Jan. 14, 2004, when President George W. Bush challenged NASA to “explore space and extend a human presence across our solar system.” It was an electrifying call to action for those of us who share the vision of Americans leading humankind into deep space, continuing the ultimate migration that began 42 years ago when President John F. Kennedy fi rst challenged NASA to land on the moon. We can do so again. If Bush’s initiative is sustained by Congress and future presidents, American leadership can take us back to the moon, then to Mars and, ultimately, beyond. Although the president’s announcement did not mention it explicitly, his message implied an important role for the private sector in leading human expansion into deep space. In the past, this type of public-private cooperation produced enormous dividends. Recognizing the distinctly American entrepreneurial spirit that drives pioneers, the President’s Commission on Implementation of U.S. Space Exploration Policy subsequently recommended that NASA encourage private space related initiatives. I believe in going a step further. I believe that if government efforts lag, private enterprise should take the lead in settling space. We need look only to our past to see how well this could work. In 1862, the federal government supported the building of the transcontinental railroad with land grants. By the end of the 19th century, the private sector came to dominate the infrastructure, introducing improvements in rail transport that laid the foundation for industrial development in the 20th century. In a similar fashion, a cooperative effort in learning how to mine the moon for helium-3 will create the technological infrastructure for our inevitable journeys to Mars and beyond.>

## Space Leadership Advantage---He3 Key

### Great power status dependent upon Helium 3 space race-U.S. has massive competition

Hatch 10-Bejnamin D. Hatch, Emory International law review, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” http://www.iew.unibe.ch/unibe/rechtswissenschaft/dwr/iew/content/e3870/e3985/e4139/e6403/sel-topic\_4-hatch\_ger.pdf

Until recently, Russia was the only country, other than the United States, that had actually sponsored manned spaceflight. The Soviet Union was responsible for the first artificial satellite to orbit the Earth as well as the first animal space test in 1957. n84

While Russia has never landed a person on the Moon, the Kremlin has announced plans to put a cosmonauton the Moon by 2025, with a permanent Moon base to follow shortly thereafter. n85 Apparently, Russia had offered to have a cooperative Moon base with the United States, but its offer was rejected, n86 although further details as to why have not been made available. n87

Russia has openly admitted that its aims for lunar exploration are tied to the extraction of Helium-3. n88Moreover, individuals within the Russian government have questioned American motives and suggested that NASA's Constellation Program's true lunar aim is Helium-3 extraction. n89 Erik Galimov of the Russian Academy of Sciences seemed to best articulate what the Kremlin was thinking, when he opined that NASA's plan would "enable the US to establish its control of the energy market 20 years from now and put the rest of the world on its knees as hydrocarbons run out." n90 [\*241]

3. The People's Republic of China

On October 15, 2003, China became the third country to successfully put a human into outer space. n91Chinaintends to have a permanent facility that orbits the Moon by 2020 n92 and to conduct a moonwalk by 2024. n93China views the exploration of the Moon as competitive and beneficial, as made clear by Ouyang Ziyuan, the head of the Chinese lunar program, when he stated: "We will provide the most reliable report on helium-3 tomankind... . Whoever first conquers the moon will benefit first." n94 According to Ouyang, "when obtaining nuclear power from helium-3 becomes a reality, the resource on the moon can be used to generate electricity for more than 10,000 years for the whole world." n95

4. Europe

While the only states that have placed humans in outer space are the United States, Russia, and China, they are not the only members of the club of spacefaring states. The nations of Europe, while not technically a state, do share a number of common agencies, one of which is the European Space Agency ("ESA"). n96 Although the ESA is not affiliated with the European Union, the members of the ESA include nearly all Western European states. n97The ESA has ambitions to not only send humans into space but also to participate in the development of theMoon.

[\*242] The ESA launched its first lunar satellite in September 2003. n98 The satellite's mission was successfully completed upon its planned crash into the Moon's surface in September 2006. n99 This first, small step for the ESA will not be the last. The ESA's new Aurora Programme is an international effort with the purpose of deploying humans and robots on the Moon and Mars in the foreseeable future. n100 Part of this development will be the construction of lunar bases. According to the current schedule, the ESA will construct a "global robotic village" on the Moon in 2016, to be followed in eight years by a manned base. n101

5. The Republic of India

India, like China, has both an overpopulation problem n102 and an ambitious design on space. India successfullylaunched its first lunar probe in November 2008. n103 It intends to conduct its first manned spaceflight by 2014and a manned lunar mission by 2020, which would put India ahead of regional rival China in reaching the Moon. n104

While India is motivated by the potential for Helium-3 mining, its space development has an additional focus - national security. n105 India's Chief of the Army Staff stated that the space race between India and China needed to be accelerated so that India could counter Chinese attempts to militarize space. n106

6. Japan

Japan launched lunar probes in 2007, n107 and one Japanese Aerospace Exploration Agency ("JAXA") official has been quoted as saying that "the [\*243] building of a manned moon base is part of our long-term plan, looking to about 20 years from now." n108 A plan to have a Moon base in place by 2025 was submitted to the Japanese government in 2005. n109 However, funding difficulties may delay or defeat Japanese lunar ambitions. n110

7. Summary

All of the leading world powers, and those states which aspire to enter "great power" status, are interested in theMoon.Given the American rejection of proposed Russian cooperation and the statements by the Indian militarychief of staff, it is clear that the controversial theories about Helium-3 and fusion are leading to a global spacerace, with at least the head of the Chinese lunar program convinced that the first one there will win the prize. n111 Yet, getting to the Moon is just the first step. As one article has put it, there will be a lunar land grab. n112 With as many as five or six players, the Moon has the potential to be the battleground for the next "Great Game." n113 As in any other game, there need to be mutually agreed upon rules that will guide players' conduct. The only problem is that the current body of law that regulates outer space is ill-suited to provide a functional set of rules for the disposition of the Moon, as Part II will demonstrate.

### Moon-Space Dominance, leadership, democracy

Schmitt, Daga, and Plesica 09- Harrison H. Schmitt, Andy Daga, Jeff Plescia, Dr. Schmitt was selected as a scientist-astronaut by NASA in June 1965. He was instrumental in providing Apollo flight crews with detailed instruction in lunar navigation, geology, and feature recognition. Dr. Schmitt was appointed NASA Assistant Administrator for Energy Programs in May 1974/Andy Daga has extensive experience in advanced technology R&D in the energy and aerospace sectors/Jeff Plesica is a research scientist at the Jet Propulsion Laboratory -- the home of NASA's robotic missions to Mars. He has an M.S. and Ph. D. in geophysics from the University of Southern California and a B.S. in geology from the University of Miami, Dec. 2009, “Geopolitical Context of Lunar Exploration and Settlement,” http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf)

Introduction

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

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

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

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

Current Background

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

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

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

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

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

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

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

Future Course

### Moon-Leadership, fastest and feasible option, greatest path for international cooperation

Schmitt, Daga, and Plesica 09- Harrison H. Schmitt, Andy Daga, Jeff Plescia, Dr. Schmitt was selected as a scientist-astronaut by NASA in June 1965. He was instrumental in providing Apollo flight crews with detailed instruction in lunar navigation, geology, and feature recognition. Dr. Schmitt was appointed NASA Assistant Administrator for Energy Programs in May 1974/Andy Daga has extensive experience in advanced technology R&D in the energy and aerospace sectors/Jeff Plesica is a research scientist at the Jet Propulsion Laboratory -- the home of NASA's robotic missions to Mars. He has an M.S. and Ph. D. in geophysics from the University of Southern California and a B.S. in geology from the University of Miami, Dec. 2009, “Geopolitical Context of Lunar Exploration and Settlement,” http://www.lpi.usra.edu/decadal/leag/DecadalGeopolitical.pdf)

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

What, then, should be the focus of national space policy in order tomaintain leadership in deep space? Some propose that we concentrate only on Mars. This would be naïve and self-defeating. The country is simply not technically ready to go to Mars at present, and it will be a long time until we are ready to do so. Returning to the Moon, however, provides the fastestpath for humans to go to Mars. Without the experience of returning to the Moon, we will not have the engineering or physiological insight for many decades to either fly to Mars or land there. Without lunar water resources,radiation protection for the long voyage to Mars may not be possible. Without the development of lunar helium-3 fusion technology applied tointerplanetary propulsion, we may not be able to reduce the transit time toMars to an acceptable duration. Without lunar operational experience, including learning to operate outside of communications with Earth, we vastly increase the risk of early Martian flights. Without lunar oxygen and water, Earth launch payloads to Mars may be prohibitively large and expensive, not to mention the continued uncertainties about sustainable resources on Mars. Without lunar rocket fuel resources, that is, hydrogen, oxygen and/or methane, we may not be able to land on Mars because of complicating presence of just some atmosphere and not a lot. Indeed,4without returning to the Moon, future opportunities of leadership, includinga much greater potential for international cooperation in scientific endeavorsrelated to the Moon and beyond, cannot be realized.

Others suggest going to an asteroid. As important to human survival on Earth as asteroid diversion may someday be, just going there is hardly a stimulating policy initiative; and it is a capability that comes automatically with a return to the Moon. Suggestions also have been made for missions to Lagrange points – a mission which has aptly been referred to “as mission to nowhere - except for their potential as a location for observatories. One should note that, between 1968 and 1973 during the Apollo Program, we had the rocket capability necessary to reach a comet or asteroid on an impact trajectory toward Earth, something the Space Shuttle would be incapable of doing. With the Apollo Saturn V, had it been necessary, we could have placed a propulsion source on such a body and altered its path so as to miss the Earth; a much better solution than to just blow it up. Former President George W. Bush began development of a Saturn V-class capability with the Constellation Program's Ares V rocket. The Ares V or an up-ratedSaturn V, combined with a helium-3 fusion propulsion system, would be agiant step toward protecting the Earth in the future.

Implications

Returning to the Moon and to deep space constitutes the right coursefor the United States. Human exploration of space embodies basic instincts— the exercise of freedom, betterment of one’s conditions, and curiosityabout nature. These instincts have been manifested throughout history in desires for new homelands, trade and knowledge. For Americans particularly, such instincts lie at the very core of our unique and special society of immigrants.

Over the last 150,000 years or more, human exploration of Earth has yielded new homes, livelihoods, know how and resources as well as improved standards of living and increased family security. In historical times, governments (e.g., Portugal, England, Spain, and the United States) have directly and indirectly played a role in encouraging exploration efforts. Private groups and individuals often have taken additional initiatives to explore newly discovered or newly accessible lands and seas. Based on their specific historical experience, Americans can expect that the benefits sought and won in the past also will flow from their return to the Moon, future exploration of Mars, and the long reach beyond. To realize such benefits,however, Americans must regain its rapidly disappearing leadership role5human activities in deep space.

With a permanent resumption of the exploration of deep space, one thing is certain: Our efforts will be comparable to those of our ancestors as they migrated out of Africa and into a global habitat. Further, a permanent human presence away from Earth provides another opportunity for the expansion of free institutions, with all their attendant rewards, as humans face new situations and new individual and societal challenges.

Conclusion

The competitive international venue remains at the Moon. Returningthere now meets the requirements for a U.S. space policy that maintainsdeep space leadership, as well as providing major new scientific returns and opportunities. Without a lunar focus, the nation’s human space activity will consist of PowerPoint presentations about what might be done and not about what will be done. Properly conceived and implemented, however, returning to the Moon prepares the way for a new generation to go to Mars.The current Constellation Program contains most of the technicalelements necessary to implement a policy of deep space leadership,particularly development of a heavy-lift launch vehicle, the Ares V. In addition, Constellation includes a large upper stage for transfer to the Moonand other destinations, two well-conceived spacecraft for transport andlanding of crews on the lunar surface (Orion and Altair), strong concepts forexploration and lunar surface systems, and enthusiastic engineers and managers to make it happen if adequately supported. The one major missing component of a coherent and sustaining architecture may be a welldeveloped concept for in-space refueling of spacecraft and upper rocket stages. On the other hand, the experience base for developing in-space refueling capabilities clearly exists based on a variety of past activities, including ISS construction.

If we continue to abandon leadership in deep space to other nations orgroup of nations, particularly a non-democratic regime, the ability for theUnited States and its allies to protect themselves and liberty for the worldwill be at great risk and potentially impossible. To others would accrue thebenefits — psychological, political, technical, economic and scientific —that the United States harvested as a consequence of Apollo’s success 40years ago. This lesson has not been lost on our ideological and economiccompetitors.

American leadership absent from space? Is this the future we wish forour progeny?

### American loss to china in the “moon race” risks loss of leaderships and free markets on the new frontier

Spudis 10-Dr. Paul D. Spudis, Studies the Moon largely by remote sensing, whereby composition and physical properties are determined through analysis of data returned by orbiting spacecraft and from Earth-based telescopic sensing. Was the Deputy Leader of the Clementine Science Team in 1994. They are conducting several interesting studies of the Moon using Clementine mission data, Feb. 9, 2010, “The New Space Race,” http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

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

The struggle for soft power projection in space has not ended. If space resource extraction andcommerce is possible, a significant question emerges – What societal paradigm shall prevail inthis new economy? Many New Space advocates assume that free markets and capitalism is theobvious organizing principle of space commerce, but others might not agree. For example, toChina, a government-corporatist oligarchy, the benefits of a pluralistic, free market system arenot obvious. Moreover, respect for contract law, a fundamental reason why Western capitalismis successful while its implementation in the developing world has had mixed results, does notexist in China. So what shall the organizing principle of society be in the new commerce ofspace resources: rule of law or authoritarian oligarchy? An American win in this new race for8space does not guarantee that free markets will prevail, but an American loss could ensure thatfree markets would never emerge on this new frontier.

### Going to the moon establishes both hard and soft power

Spudis 10-Dr. Paul D. Spudis, Studies the Moon largely by remote sensing, whereby composition and physical properties are determined through analysis of data returned by orbiting spacecraft and from Earth-based telescopic sensing. Was the Deputy Leader of the Clementine Science Team in 1994. They are conducting several interesting studies of the Moon using Clementine mission data, Feb. 9, 2010, “The New Space Race,” http://www.spudislunarresources.com/Opinion\_Editorial/NewSpaceRace.pdf

Why are we going to the Moon?

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

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

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

### U.S. losing its position as a space leader by sitting back-China is mapping every inch of the moon/Russia and India close behind

The Daily Galaxy 07-The Daily Galaxy, Great Discoveries Channel, August 13, 2007, “China Moon: Is a star wars in our near future?” http://www.dailygalaxy.com/my\_weblog/2007/08/china-moon-heli.html

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

China\_space\_walk\_moon\_landing\_2\_2 Ouyang Ziyuan, head of the first phase of lunar exploration, is quoted on government-sanctioned news site ChinaNews.com describing plans to collect three dimensional images of the Moon for future mining of Helium 3: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of Helium-3 can reach one to five million tons."

"Helium-3 is considered as a long-term, stable, safe, clean and cheap material for human beings to get nuclear energy through controllable nuclear fusion experiments," Ziyuan added. "If we human beings can finally use such energy material to generate electricity, then China might need 10 tons of helium-3 every year and in the world, about 100 tons of helium-3 will be needed every year."

Helium 3 fusion energy - classic Buck Rogers propulsion system- may be the key to future space exploration and settlement, requiring less radioactive shielding, lightening the load. Scientists estimate there are about one million tons of helium 3 on the moon, enough to power the world for thousands of years. The equivalent of a single space shuttle load or roughly 25 tons could supply the entire United States' energy needs for a year.

Thermonuclear reactors capable of processing Helium-3 would have to be built, along with major transport system to get various equipment to the Moon to process huge amounts of lunar soil and get the minerals back to Earth.

With China's announcement, a new Moon-focused Space Race seems locked in place. China made its first steps in space just a few years ago, and is in the process of establishing a lunar base by 2024. NASA is currently working on a new space vehicle, Orion, which is destined to fly the U.S. astronauts to the moon in 13 years, to deploy a permanent base.

Russia, the first to put a probe on the moon, plans to deploy a lunar base in 2015. A new, reusable spacecraft, called Kliper, has been earmarked for lunar flights, with the International Space Station being an essential galactic pit stop.

The harvesting of Helium-3 on the could start by 2025. Our lunar mining could be but a jumping off point for Helium 3 extraction from the atmospheres of our Solar System gas giants, Saturn and Jupiter.

UN Treaties in place state that the moon and its minerals are the common heritage of mankind, so the quest to use Helium-3 as an energy source would likely demand joint international co-operation. Hopefully, exploitation of the moon's resources will be viewed as a solution for thw world, rather than an out-moded nation-state solution.

In October 2003, China became the third space-faring nation (after the U.S. and Russia) after it launched its first “Taikonaut” into orbit.

Europe and India are accelerating their efforts to conduct robotic science on space-born platforms. There’s also a growing interest in space exploration from a dozen other countries around the world, including Kenya, whose equatorial location on the east coast of Africa makes it geographically ideal for space launches.

While this emerging international community claims it's slice of the aerospace universe, the U.S., by contrast, is no longer a leader but simply a player, according to nationally renowned astrophysicist Neil deGrasse Tyson, who points out that "we’ve moved backward just by standing still."

Earlier this year, the Chinese space agency outlined plans to launch the first probe in the second half of 2007. the Chang'e-1 lunar probe will be launched aboard a Long March 3A rocket. The probe will provide 3D images of the Moon, survey the lunar landscape, study lunar microwaves and estimate the thickness of the Moon's soil. It has now also given a few more details of its plans for phase two, which will see an unmanned rover land on the lunar surface in 2010 and "meticulously" survey the area in which it lands. A sample-return mission is slated for 2012.

### China’s ability to exploit lunar resources challenges U.S. leadership

### **Garibaldi 05**-Gabriele Garibaldi,Gabriele Garibaldi holds an MIA from the University of Pisa. As a freelance analyst, he introduced the Italian public to the issue of "space weaponization" by publishing a book and several articles in all the most influential Italian reviews of international relations, 5-9-2005, “Chinese Threat to American Leadership in Space,” http://www.globalpolitician.com/print.asp?id=699

This information has led the USA to seriously examine the Chinese space challenge, and despite the American advantage, they remain nervous about China's next goal on the agenda: the Moon.

According to Robert Walker, former president of the Commission on the future of the American aerospace industry, China is engaged in an aggressive space program focused on a Moon landing, followed by establishing a permanent base within a decade. According to Japanese experts, China will be able to reach the Moon within three to four years and eventually aiming for Mars in the future. It will be sufficient for it to spend 1% of its GDP over the next few years in order to provide the financing for a significantly competitive space program.

The U.S., on the other hand, at least according to Walker, is no longer able to repeat the Moon mission of thirty-five years ago. This inability to compete in a new Moon race is more than an issue of national pride: it also raises serious strategical questions over China's rising potential as a lunar power. China, if it succeeded in its goal, would acquire enormous international prestige. However, most significantly, by establishing permanent bases on the Moon, China would gain the ability to exploit lunar resources and therefore gain important technological advantages over other nations (including nuclear fusion, using the helium 3 isotope), with concrete consequences on Earth's activities.

Walker's conclusion is that the Chinese space program has yet to be taken seriously by American politicians. Nevertheless, it represents a serious challenge to the US leadership in Space. The US must answer such a challenge by developing new technologies (for instance, the nuclear plasma propulsion system) in order to reach the Moon and Mars faster than currently possible, and to travel more frequently and thriftily into Earth's low orbit.

George W. Bush had heard Walker's warning, and in the President's 14 January 2004 speech, he relaunched the US space programs with increased fervour. It is impossible not to link the US's renewed enthusiasm to the current race against China's rapid rise in Space strategy. Three months after the success of the Shenzhou 5, China announced that it would launch the next manned mission in 2005, when the new Shenzhou 6 will transport more than just a single astronaut, and will remain in Space for a longer period of time. In the meantime, in 2004 China will launch ten new satellites into orbit. Asked by Western journalists about the Chinese perception of US space programs - there were already rumours some weeks prior to Bush's speech that the US intended to establish a permanent base on the Moon - the Chinese Foreign Minister responded by diplomatic note, congratulating the USA on the success of its Martian rover Spirit, but neglecting to mention the rumoured US aim of establishing a permanent base on the Moon as a starting point for manned missions towards Mars.

### Perceptions of U.S. leadership in the world will dramatically decline if U.S. does not win Moon Race

Lele 10-Ajey Lele, Research Fellow, Institute for Defence Studies and Analyses (IDSA), New Delhi, India, Oct. 2, 2010, “An Asian Moon Race?” http://www.sciencedirect.com/science/article/pii/S0265964610000846#bbib43

As we have seen, while space exploration may not hold the same strategic logic of the 1960s, this does not mean that its strategic significance has totally evaporated. However, the USA may be trying to downplay the strategic significance of the Moon today. In 1961 the then US Defence Secretary called the Apollo programme “part of the battle along the fluid front of the Cold War”. But in his 14 January 2004 speech then President George W Bush stated that the current Moon exploration initiative should be seen as a “part of a journey and not a race” [42].

The USA may be taking the view officially that it has already achieved much in this field and that others are just trying to imitate it and that too after a gap of four decades. But it fully understands that the purpose of looking at the Moon today is entirely different.

Few in the USA want to see the country appear to lag behind in this new Moon race. As former NASA administrator Michael Griffin put it, “If China were to achieve this before the return of a manned American spacecraft to the moon for the first time since 1972, the bare fact of accomplishment will have enormous, and not fully predictable, effects on global perceptions of the US leadership in the world”. According to the Washington Post, this observation was part of the draft of a statement prepared by Mr Griffin to submit to Congress but was subsequently deleted [43].

At least until the advent of the Obama administration NASA’s opinion on Moon and Mars programmes has had a nationalistic character. The October 2006 announcement of the new national US space policy and the US Air Forces’s Strategic Master Plan for FY 2006 and beyond designates space as the ‘ultimate high ground of US military operations’ [44]. Overall US space policy indicates that it has given substantial importance to space technologies in its strategic planning and the same would be the case with its deep space thinking.

Given its potential as a base for geological study, a platform for astronomy, a laboratory to study the long-term effects of reduced gravity on humans, a test bed for future manned missions to Mars, or even a launch pad for unmanned craft on their way to the outer reaches of Solar System [45], not to mention achievable options in regard to energy security and replenishment of minerals on the Earth’s surface, it is nature that the USA will not want to miss the Moon bus and will make every effort to be the first in every related field. Japan, China and India understand the US dilemma and the former and latter may engage it in their Moon journey, at least in token form. On the other hand, China seems keen to catch the opportunity before the global programme of returning to the Moon is in full swing [46] Andrew Lawler, The new race to the moon, Science 300 (May 2, 2003), p. 726.[46].

### **U.S. will lose leadership if they do not go to moon**

The Economist 08-The Economist, Sept. 25, 08, “Shooting the Moon,” http://www.economist.com/node/12305754

Worries in America are likely to grow if China’s space programme keeps up its steady pace of development. Subsequent Shenzhou missions are expected to focus on building a space station. Another programme, which began last October with the launch of a lunar probe called Chang’e, aims to put an unmanned rover on the surface of the moon around 2017 and return it to earth with samples.

Jiao Weixin of Peking University says that with the development in the next few years of a new rocket, the Long March V, with a heavier lift capability, “it’s a matter of time” before China formally announces plans for landing a man on the moon. According to the Washington Post, Michael Griffin, the head of America’s space agency, NASA, has given warning that if China were to achieve this before the return of a manned American spacecraft to the moon for the first time since 1972, “the bare fact of this accomplishment will have an enormous, and not fully predictable, effect on global perceptions of US leadership in the world.” The newspaper said this comment appeared in a draft of a statement Mr Griffin was preparing to submit to Congress this year, but it was deleted by White House budget officials.

During the cold war between America and the Soviet Union, the two were closely matched in their struggle for supremacy in space. Now, however, America remains far ahead of China in military and civilian space capabilities. Chinese officials, anxious not to appear threatening, are at pains to stress this. But Japan and India have space ambitions that are similar to China’s, and, like America, have uneasy political relations with it. Gaining an edge on its neighbour, Japan launched a lunar probe shortly before China did last year. India plans to do the same next month.

First Taiwan, then Mars

National pride is at stake. “Some of the concerns are prestige-based,” says Adam Segal of the Council on Foreign Relations in New York, “viewing the manned Chinese space programme as a symbol of China’s power in the region, possibly at the expense of Japan.” As for security worries, he says, Japan, like America, is wary of China’s efforts to improve its ability to cripple or destroy enemy satellites. It also worries that China’s (still fledgling) Beidou satellite-positioning system could improve the accuracy of its weapons.

Such anxieties, along with the perennial worries about North Korea, helped prompt Japan’s parliament, or Diet, in May to rescind a 1969 resolution mandating that Japan only pursue peaceful uses of space. The new policy allows space technologies to be used for “national security” as well. This is seen as a green light for the deployment of new spy and early-warning satellites used for missile-defence systems.

Russia still holds a few cards. China has drawn extensively on its neighbour’s expertise to get its manned space programme going. It has even sent its astronauts for training by Russians. In October next year a Russian rocket will launch a Chinese probe to Mars. Some Americans fret that they too may have to depend on Russia between the scheduled retirement of the Space Shuttle programme in 2010 and the introduction of a new launch vehicle, which will probably not appear before 2015. Vincent Sabathier, of the Centre for Strategic and International Studies in Washington, says this would be a good opportunity for America to look to China for help. But nobody in Washington, he says, wants to talk about it.

### China has capabilities to beat U.S. to lunar exploitation-will hurt U.S. image

O’Neill 08-Ian O’Neill, Discovery News Space Science Producer, space physics doctor,Science communication, solar physics research, July 15, 08, “Griffin: China Could Beat US in Moon Race,” http://www.universetoday.com/15559/griffin-china-could-beat-us-in-moon-race/

More bad news for NASA: even their administrator thinks China could beat the US to the Moon. Speaking with the BBC today, Michael Griffin shared his views about the Chinese space aspirations, pointing out that the super-state could, if they wanted to, send a manned mission to the lunar surface within a decade. NASA’s return mission to the Moon is planned to launch, at the earliest, in 2020, so this news is bound to knock the wind out of the US space agency’s hopes to continue where it left off in 1972…

In the last five years, China has been teetering on the edge of a full-manned space program. In 2003, the nation became only the third country to put a national into space (following the Russia and the USA), blasting Yang Liwei into orbit for 21 hours on the Shenzhou 5 spacecraft. Shenzhou 6 was launched with two astronauts (or “taikonauts”) on board, spending five days orbiting the Earth in 2005. This year, shortly after the Beijing Olympics in October, China is sending another manned mission into orbit, only this time it is hoped a spacewalk will be possible. With this rapid succession of successful manned launches, it comes as no surprise that attention is swinging away from NASA and to China for the next big step into space.

The last time man set foot on the Moon was in 1972 when Eugene Andrew Cernan, last man on the Moon, boarded the Apollo 17 lunar module. That was 36 years ago and space flight has changed significantly since then, now NASA has more competition, as highlighted by Griffin during a visit to London:

“Certainly it is possible that if China wants to put people on the Moon, and if it wishes to do so before the United States, it certainly can. As a matter of technical capability, it absolutely can.” – Dr Michael Griffin

### Russia and China are planning to get to the moon for helium 3

Barnatt 09,Christopher Barnatt, A lecturer and futurist, and Associate Professor of Computing and Future Studies in Nottingham University Business School. Author of six traditional books on computing and future studies, 2009, https://mail.google.com/mail/?shva=1#inbox

Due to the above it is perhaps hardly surprising that a serious interest is being taken in lunar helium-3. In 2006 Nikolai Sevastyanov, head of the Russian space corporation Energia, was reported to have said that Russia is planning to mine lunar helium-3, with a permanent Moon base to be established by 2015 and industrial-scale helium-3 production to commence by 2020. The Americans also have plans, with NASA having announced its intention to establish a permanent base on one of the Moon's poles by 2024, and with helium-3 signalled as one of the reasons behind this mission.

As reported by China View, China is also in the race, and plans to put a man Moon by 2017. One of the goals of the mission will be to measure the thickness of the lunar soil and the amount of helium-3 on the Moon. There have also been reports that India, Japan and Germany are taking an interest in lunar exploration linked to helium-3 as a potential future nuclear fuel.

A Flower in the Darkness?

The subject of mining helium-3 on the Moon as a fuel for future clean, safe nuclear power plants is a fascinating one that raises many questions. Some of these questions are highly technical, and relate to the feasibility of the involved nuclear physics. Other questions concern the not inconsiderable practicalities associated with getting to the Moon, mining and super-heating large quantities of lunar rock (Space.com report a suggestion of roughly one million tons of lunar soil being needed to be mined and processed for every 70 tonnes of helium-3 yield), and then getting the precious cargo back to the Earth. However, the far more interesting questions arguably relate to why this is a topic that is receiving so little media and public attention.

As noted above, several of the largest governments on the planet have made announcements that they are either actively considering or planning to go to the Moon to mine helium-3. Whether or not the science will actually work, this is surely major, major, major news. Given that public debates concerning the construction of future nuclear fission power plants and even wind farms now rage with great vigour and a high media profile, why on Earth (and in future the Moon) helium-3 power plants as part of a potential future energy strategy are rarely if ever even mentioned is exceptionally hard to fathom.

Nobody is trying to hide the potential of future lunar helium-3 power generation. However, like a rose in a dark room, there is a potential danger that something of beauty will fail to gain the light it requires if more attention does not start to be languished on what could end up as a very big part of the solution to Peak Oil and other fossil fuel resource depletion, not to mention climate change.

### Space Race for helium 3-Russia, India, China competing against U.S

Lee 10-Adrian Lee, former national newspaper journalist and four years on staff of times and daily express, March 25, 10, “Truth behind new space race,” http://www.allbusiness.com/science-technology/astronomy-space-space-exploration/14168588-1.html

India, China, Brazil and now even Britain have announced massive new space projects - all competing with NASA to harvest the Moon's priceless compound that could power our planet - Helium 3

WHEN the first grainy pictures were beamed back from the Moon they signalled victory for the United States in the space race. The giant leap for mankind taken by Neil Armstrong in 1969 was intended to be the catalyst for further manned exploration. Vice president Spiro Agnew declared grandly that his nation would put a citizen on Mars by the mid Eighties.

It was a hollow boast, underlined recently by an announcement that the US is abandoning plans to return to the Moon. The rulers of space for the past four decades are, it seems, ready to surrender their dominance.

The result is a new space race, involving other nations desperate to compete for a share of spoils thousands of miles above Earth.

Even the UK is trying to get in on the act, unveiling a new space agency yesterday. Billed as a mini NASA, it will have a GBP 270million annual budget and the government hopes it will inspire a new generation of British space enthusiasts.

The Moon, neglected since the last landing in 1972, remains a source of untapped riches.

### China has good chance of getting lunar resources first-U.S. will lose perception of leadership

Lee 10-Adrian Lee, former national newspaper journalist and four years on staff of times and daily express, March 25, 10, “Truth behind new space race,” http://www.allbusiness.com/science-technology/astronomy-space-space-exploration/14168588-1.html

However, there's little enthusiasm to put a Briton, or European, on the Moon, says Dr Whitehouse.

"China sees the benefits of Helium-3 and psychologically it would also affect America, " he adds. "India is also training astronauts, although it's a bit of a puzzle because they don't have rockets powerful enough to put people into space.

Under axed proposals, the US intended to reclaim the Moon in 2020.

"That's still possible, " says Dr Whitehouse. "Now, though, I think it is 50-50 whether China will get there first."

For Britain, the last developed nation to have its own space agency, it's a case of too little, too late. "Sadly, it's hard to see Britain ever getting independently involved in manned space flights. The government only seems interested in sending satellites into space. Our space programme has just ambled along for years. We should be spending more money."

Some experts insist there's little to be gained from going back to the Moon but Dr Whitehouse believes the next country to conquer our near neighbour, 240,000 miles distant, will gain a major advantage.

"This time it will not be grainy black and white pictures but in high-definition colour and it will carry whole new meaning for whoever gets to the Moon next, " he says. "In my opinion, abandoning the Moon is a big mistake."

The discovery last year of a significant amount of water under the lunar south pole brings the reality of establishing a permanent base on the moon a step closer. The surface of the Moon is drier than any desert on our planet but scientists have long speculated that some permanently shadowed places might harbour huge stores of water, perhaps delivered by impacting comets billions of years ago. This water could sustain astronauts based at the lunar poles.

However, efforts to tap into these wells seem more remote than ever. The US space industry has not been at a lower ebb since 1957 when the

India, China, Brazil and now even Britain have announced massive new space projects - all competing with NASA to harvest the Moon's priceless compound that could power our planet - Helium 3

However, efforts to tap into these wells seem more remote than ever. The US space industry has not been at a lower ebb since 1957 when the Soviets launched the first satellite, Sputnik.

The Russians followed up that success by sending the first man, Yuri Gagarin, into orbit - but all that was overshadowed when the US narrowly won the biggest prize of all, the race to put man on the Moon.

Given Spiro Agnew's ill-conceived boast about Mars, there are some who believe the US rested on its laurels afterwards.

One Briton, Steve Bennett, who is battling to launch tourists 62 miles to the edge of space for an unforgettable experience, says: "The Americans are allowing other countries to steal a march. This is a very bad decision."

Bennett faces a constant struggle for funding to achieve his lifelong ambition and has been testing his inventions for years with varying success. Despite a lack of formal training he aims to be at the controls in 2013 when blast-off is finally achieved at 3,500 miles-per-hour.

He says: "How will people in the States feel when they see China celebrating a Moon landing and bringing back souvenir parts from the US lunar modules which are still up there?"

Like Dr Whitehouse he regards harnessing power from the Moon and space as a prime reason to continue pushing boundaries. He says: "If you put satellites into space eventually you will be able to harvest energy from the Sun and beam it back to Earth. The resources up there are tremendous. It's cheap, clean, energy which will last forever."

Bennett believes scrapping the programme is also short-sighted for military reasons. "China is a sleeping giant in space exploration and when it wakes, the world is going to be shocked. If you have control of space, you have control of the world. If you are on the Moon it's like being on a big battleship."

Brazil is behind in the space race but is hoping to revive an unmannned programme that has been on hold since a launchpad disaster killed 21 people in 2003.

Worryingly, it's been reported that Iran, while still many years behind the Americans, has a fledgling space programme and is planning to send satellites above the Earth. Clearly, there are plenty of vultures circling the Moon to feast on the pickings.

Looking even further ahead, Bennett says heavy industry could eventually be sited on the moon, or floating in space, leaving the Earth as a "garden planet".

The US still has its International Space Station but if Obama's threats are carried through America will, in future, have to rely on the Russians to transport its astronauts there.

How humiliating for the nation which triumphed in the first space race back in the Sixties to rely on its old foe to act as a glorified taxi service into space.

India, China, Brazil and now even Britain have announced massive new space projects - all competing with NASA to harvest the Moon's priceless compound that could power our planet - Helium 3

## Space Leadership Advantage---Aerospace Impact

### Other countries gaining a lead in the space race (China, India, Canada, Australia, EU)-not winning risks loss of global leadership

National Aerospace Week 10-Aerospace specializes in leadership in the development and application of technologies to advance progress in national defense, civil aviation and space exploration — all of which are vital to the strength of our economy and our way of life — is a hard won accomplishment, one not surrendered easily, Sept 12-18 2010, “Aerospace and Defense: The strength to lift America,” http://www.nationalaerospaceweek.org/wp-content/uploads/2010/04/whitepaper.pdf

Implications on the trade front are also important. Our strong competitiveposition in aerospace is being challenged by the European Union, Australia, Canada andother countries. They are already outpacing us in implementing NextGen technologies.China and India, which will witness the greatest growth in aviation travel for years tocome, will look to either the United States or Europe for leadership as they develop their respective air traffic control systems. If the United States does not promptly deploythese technologies, opportunities for U.S. manufacturers and workers will be lost.

The United States must remain a leader in human and robotic space — aposition that is perishable if not properly supported. Research aboard the InternationalSpace Station and human and robotic exploration beyond low Earth orbit must remainnational priorities. These activities demonstrate global leadership, sharpen our expertisefor future long-range space travel, add to our scientific knowledge and inspire our youthto pursue engineering and science disciplines.

Space systems often go unnoticed in our daily lives, but their impact is very real.It is imperative that we as a nation have the right plans, strategies and budgets in placeto keep our space industry competitive and our space systems, and their supportingEarth-based infrastructure, operating when we need them. It is increasingly importantthat the United States develop and maintain a cohesive national approach to our effortsin space — one that crosses civil agencies, the Defense Department and the intelligence community.

# \*\*\*Resource Wars Advantage\*\*\*

## Resource Shortages---Impact/Uniqueness

### Depletion of Earth’s resources will destroy the economy and the environment

Dixon – 11, Thomas Homer-Dixon, holds the Centre for International Governance Innovation Chair of Global Systems at the Balsillie School of International Affairs in Waterloo, Canada, and is a Professor in the Centre for Environment and Business in the Faculty of Environment, University of Waterloo, January/February 2011, “Economies Just Can’t Keep on Growing” http://www.foreignpolicy.com/articles/2011/01/02/unconventional\_wisdom?page=0%2C1&sms\_ss=facebook&at\_xt=4d5030e7468d2428%2C0

Humanity has made great strides over the past 2,000 years, and we often assume that our path, notwithstanding a few bumps along the way, goes ever upward. But we are wrong: Within this century, environmental and resource constraintswill likely bring global economic growth to a halt.Limits on available resources already restrict economic activity in many sectors, though their impact usually goes unacknowledged. Take rare-earth elements -- minerals and oxides essential to the manufacture of many technologies. When China recently stopped exporting them, sudden shortages threatened to crimp a wide range of industries. Most commentators believed that the supply crunch would ease once new (or mothballed) rare-earth mines are opened. But such optimism overlooks a fundamental physical reality. As the best bodies of ore are exhausted, miners move on to less concentrated deposits in more difficult natural circumstances. These mines cause more pollution and require more energy. In other words, opening new rare-earth mines outside China will result in staggering environmental impact.

Or consider petroleum, which provides about 40 percent of the world's commercial energy and more than 95 percent of its transportation energy. Oil companies generally have to work harder to get each new barrel of oil. The amount of energy they receive for each unit of energy they invest in drilling has dropped from 100 to 1 in Texas in the 1930s to about 15 to 1 in the continental United States today. The oil sands in Alberta, Canada, yield a return of only 4 to 1.

### Earth based resource depletion is unsustainable- in this century the economy would be gutted by rampant climate change and world-wide starvation

Dixon – 11, Thomas Homer-Dixon, holds the Centre for International Governance Innovation Chair of Global Systems at the Balsillie School of International Affairs in Waterloo, Canada, and is a Professor in the Centre for Environment and Business in the Faculty of Environment, University of Waterloo, January/February 2011, “Economies Just Can’t Keep on Growing” <http://www.foreignpolicy.com/articles/2011/01/02/unconventional_wisdom?page=0%2C1&sms_ss=facebook&at_xt=4d5030e7468d2428%2C0>

Coal and natural gas still have high energy yields. So, as oil becomes harder to get in coming decades, these energy sources will become increasingly vital to the global economy. But they're fossil fuels, and burning them generates climate-changing carbon dioxide. If the World Bank's projected rates for global economic growth hold steady, global output will have risen almost tenfold by 2100, to more than $600 trillion in today's dollars. So even if countries make dramatic reductions in carbon emissions per dollar of GDP, global carbon dioxide emissions will triple from today's level to more than 90 billion metric tons a year. Scientists tell us that tripling carbon emissions would cause such extreme heat waves, droughts, and storms that farmers wouldlikely find they couldn't produce the food needed for the world's projected population of 9 billion people. Indeed, the economic damage caused by such climate change would probably, by itself, halt growth.

### Growth of the economy is critical to maintaining human dignity, and liberty- growth as a product of basic fuel and resources, is also key to prevent extinction

Dixon – 11, Thomas Homer-Dixon, holds the Centre for International Governance Innovation Chair of Global Systems at the Balsillie School of International Affairs in Waterloo, Canada, and is a Professor in the Centre for Environment and Business in the Faculty of Environment, University of Waterloo, January/February 2011, “Economies Just Can’t Keep on Growing” <http://www.foreignpolicy.com/articles/2011/01/02/unconventional_wisdom?page=0%2C1&sms_ss=facebook&at_xt=4d5030e7468d2428%2C0>

Humankind is in a box. For the 2.7 billion people now living on less than $2 a day, economic growth is essential to satisfying the most basic requirements of human dignity. And in much wealthier societies, people need growth to pay off their debts, support liberty, and maintain civil peace. To produce and sustain this growth, they must expend vast amounts of energy. Yet our best energy source -- fossil fuel -- is the main thing contributing to climate change, and climate change, if unchecked, will halt growth.

We can't live with growth, and we can't live without it. This contradiction is humankind's biggest challenge this century, but as long as conventional wisdom holds that growth can continue forever, it's a challenge we can't possibly address.

## Resource Shortages---Lunar Mining Key

### Exploration internal- going to the moon is key to the economy and resource wars

Feng and Cox 09- Feng Hsu, Ph.D. and Sr. Fellow of the Aerospace Technology Working Group, Ken Cox, Ph.D. and Founder & Director of the Aerospace Technology Working Group, February 20, 2009, “Sustainable Space Exploration and Space Development - A Unified Strategic Vision,” http://www.spaceref.com/news/viewsr.html?pid=30702

History has brought mankind to the brink of an unprecedented era of crisis and challenges. However, crisis and challenges encompass new opportunities for all of mankind, as implied in the Chinese word for "crisis," which also means "opportunity." Our crisis in the world economy, energy resources and global climate change are dire, but our opportunities for science, technology advancement and human economic expansion in space are enormous. Having evolved and survived on earth for millions of years, through constant struggle for change, we humans must once again, expand and adopt new economic spheres, and elevate from an Earth-bond civilization to a spacefaring civilization in the face of crisis. Much like our ancestors learned to adapt using fire and tool-making skills, and evolved from primitive tribal-based societies into the collaborative agricultural civilization; from isolated regional economies to a globalized world economy. Now is the time for humanity to develop space and industrialize the Earth-Moon system, making it a key part of global economic revitalization for a whole new sustainable and elevated human civilization. Many of us believe that mankind must solve all our crises on earth before expanding into space can be achieved successfully and peacefully. In fact, humanity isn't going to solve all its problems here on earth, ever. While resolving some of our crises, humanity always creates more. Regardless, mankind goes into space for reasons that our ancestors had historically gone elsewhere: for adventure with unknowns, resources, freedom, and better lives. The recent human history of industrial revolutions, along with the current collapses of the world's economy and energy and financial markets, has taught us a harsh lesson: that merely manipulating financial capital and producing services has failed to build a sustainable global economy for mankind. Instead of fighting over what's limited and restricting human development on this planet, we must now expand our horizons, and look upward and outward for resources, embarking on economic and commercial development into space. Bold strategic vision supported by strong government and global leadership in technology and infrastructure development has always brought humanity out of our economic and political crises, much like the bold vision of the transcontinental railway systems supported by president Lincoln in the mist of the civil war crisis, or like the infrastructure buildup of the massive U.S. interstate highway systems called for by president Eisenhower in the aftermath of the great depression back in the 1930s, or like the government investment of Internet technology and information infrastructure buildups in the early 1990s supported by president Clinton. Now is the time, more than ever, for yet another bold vision and for America's strategic leadership to bring humanity out of our crisis by promoting and investing heavily on the final frontier of human development in space. Indeed, whether to make space industrialization an integral part of our strategy, and a key component of a stimulus for our economic recovery is all about the crossroads the U.S. and the rest of the world must decide on in the face of the many crises humanity has encountered.

### Lunar Exploration Good – The significant political conflict of the twenty-first century will be over the control of non-renewable resources and the Moon represents a potential solution to this impending energy crisis and will be an important region in the coming future.

Hatch 10 – Benjamin D. Hatch, Executive Notes and Comments Editor, Emory International Law Review; J.D. Candidate, Emory University School of Law; B.A., Southern Methodist University, 2010, “DIVIDING THE PIE IN THE SKY: THE NEED FOR A NEW LUNAR RESOURCES REGIME,” 24 Emory International Law Review 229, Lexis: pg.229-230

<TEXT:

 [\*229]

The dominant political conflict of the twenty-first century will likely be over control of non-renewable resources. n1 Recently, a wealth of literature has appeared alleging that the world's resource-rich states have been overstating their oil and non-energy mineral reserves. n2Those reserves that have been properly catalogued are also being rapidly depleted. n3This depletion will not only have catastrophic effects on local economies, but it will also lead to an increase in global violence and neo-imperialism in lesser developed but resource-rich states. n4

In preparation for the inevitable worsening scarcity of available energy resources, states and non-governmental organizations are researching and investing in alternative fuel sources. n5 While experts debate the merits of [\*230] "green" energies that seek to harness natural forces (like wind, geothermal, hydroelectric, and solar power), many developed states are beginning to look toward another part of nature as a potential solution to the impending energy crisis - the Moon.

This Comment will do four things. First, it will show that the Moon is and will increasingly be an important area of international law, especially given current plans by six different state actors to travel to and occupy the Moon within the next thirty years. Second, it will discuss the current state of lunar law, pointing out both textual deficiencies in the current agreements defining and governing the Moon as an international common space and observing overarching policy concerns which should compel governments to desire a new, functional, legal system for the Moon. Third, it will survey theoretical and actual approaches to resource management, noting the successes and failures of each approach. Fourth, it will conclude by providing recommendations, based on the analysis in the third Part, for the contents of a new lunar proprietary regime.>

## Resource Shortages---Asteroids Key

### The resources available on Near Earth Asteroids are infinite, and convenient for us to procure

Sonter, February 9, 2006 “Asteroid Mining: Key to the Space Economy” (Mark, B.Sc, Dip.Ed (UNSW), Physics & Geology, M.App.Sc (Medical Physics), Queensland Institute of Technology, 1979) <http://www.space.com/2032-asteroid-mining-key-space-economy.html>

Professor John Lewis has pointed out (in Mining the Sky) that the resources of the solar system (the most accessible of which being those in the [Near Earth Asteroids]) can permanently support in first-world comfort some quadrillion people.  In other words, the resources of the solar system are essentially infinite... And they are there for us to use, to invest consciousness into the universe, no less.  It's time for humankind to come out of its shell, and begin to grow!!

### The case outweighs EVERY imaginable impact- Without mining Asteroids, extinction is guaranteed- our precious resources will be used up in this century- failure to act NOW damns us to imprisonment, because we won’t even have the resources to launch a vehicle into space to retrieve resources- by then it will be too late

Zeusse Evan M. Zuesse (probably unqualified, semi-insane) will come back to this at some point later http://blog.foreignpolicy.com/posts/2008/11/26/think\_again\_manned\_space\_flight

In the long term (by which I mean over the next thousand, ten thousand or hundred thousand years) what policies we put in place for climate change, financial stabilization, the defense against jihadi Islam and secular extremisms such as Communism or the new fascism of Russia and China, the nuclear weapons race, etc., etc., all pale into utter insignificance when compared to the existential importance for humanity of the space program.There quite simply is, aside from medical research and nanotechnology, no other initiative as essential to the survival and well-being of humanity as this.At present we aregoing through a world-wide technology explosion that relies upon the availability of precious metals and rare elements.We are feverishly mining the earth for all kinds of minerals that we use for a year or two, and then trash. But these are not renewable resources. They are finite, and perhaps within the next century or two some of the less common of them will be used up. That means that hundreds of thousands of years into the future the human race will not have them available on earth. We could get to the point where even if we have the science for travel between the stars, we will not have the raw materials to do it with. We will be locked here on earth. But if other tendencies prevail, e.g., ruination of the environment, both by pollution and by erroneous "climate change" policies, a nuclear holocaust brought on by jihadi Islamic states, the spread of failed states, or other future unknown nightmares, we may well have ruined large portions of the earth or otherwise created hell-holes. Earth then will be our prison, condemning untold numbers of future generations to declining expectations and poor lives, from which there can be no escape, no second chance. Our present century might then be seen in future ages as the peak of human attainment and prosperity instead of a stage toward even better societies. And we now would be damned in future generations for having ruined the possibilities for all later generations.It is therefore essential for the long-term future of humanity that we develop space facilities to mine Mars and the asteroid belts, and that we have a basis for further space exploration if earth itself becomes a mined-out and polluted planet.

### Lack of Terrestrial resources cause economic and environmental damage, drive up oil and tech prices for consumers, and spark regional and global conflicts over resource- mining asteroids solves

Ross – 01, Shane D. Ross, Assistant Professor of Dynamical systems at Virginia Polytechnic Institute and State University, 12/14/01 “Near-Earth Asteroid Mining” http://www.esm.vt.edu/~sdross/papers/ross-asteroid-mining-2001.pdf

Many terrestrial resources, such as precious metals and fossil fuels, are running out. As new terrestrial sources are sought, materials are obtained at increasing economic and environmental cost. Society pays for this depletion of resources in the form of higher prices for manufactured goods, would-be technologies that are not developed for lack of raw materials, global and regional conﬂicts spurred by competition for remaining resources, and environmental damage caused by development of poorer and more problematic deposits.Utilization of asteroid resources may provide a partial solution to the problem, as they hold the potential for becoming the main sources of some metals and other materials.Precious metals and semiconducting elements in iron meteorites, which form the metallic cores of asteroids, are found in relatively large concentrations compared to Earth sources. In such sources, it may be possible to extract up to 187 parts per million(ppm) of precious metals, which includes Au, the Pt-group metals (Pt, Ru, Rh, Pd, Os, and It), Re, andGe. More than 1000 ppm of other metals, semiconductors, and nonmetals may may one day be extractedand imported by Earth from asteroids, such as Ag, In, Co, Ga, and As.

# \*\*\*AT: Politics\*\*\*

## Plan Popular---Ends China Reliance

### Pltx link turn- NASA cuts have forced NASA to cooperate with China on lunar spaceflight, unpopular

Bortnicker 10- Cory Bortnicker, October 25, 2010, “Rare Metals on the Moon Have Yet to Spark Modern Moon Race,” http://www.minyanville.com/dailyfeed/rare-metals-on-the-moon/

China’s abundance of rare earth metals has been the talk of the town, as of late. And for good reason.They’ve got about 90% of the Earth’s supply of compounds like Neodymium, Dysprosium, Cerium and thus, can dole them out as they wish while the rest of the world squirms, begs, and barters. But thanks to a little known science called “astronomy,” there could be an alternative locale for mining rare Earth metals…the moon. The AFP reports that researchers at Brown University have analyzed particles of lunar dust and found a “surprisingly rich mixture that, in addition to the silver, included water and compounds like hydroxyl, carbon monoxide, carbon dioxide, ammonia, and free sodium.” Brown geologist Peter Schultz said “This place looks like it's a treasure chest of elements, of compounds that have been released all over the Moon.” Score! And the best news? The US has serious plans to launch extensive missions to the moon! Er…actually, scratch that. Not the US. We mean China. On October 11th, President Obama signed the NASA Authorization Act 2010, effectively ending the Constellation program, which aimed to return humans to the Moon. Meanwhile, on October 1st, the Chinese Lunar Exploration Program (CLEP) launched its Chang E 2 lunar probe, the second lunar orbiter launched in three years. In 2004, the Chinese government authorized a three-stage robotic lunar exploration that will: Stage 1: Orbiters will circle the moon and collect data. Stage 2: Robotic probes will land on the lunar surface to collect and analyze lunar samples and transmit the data back to Earth. Stage 3: After landing on the moon, the robotic probe will return to Earth with a set of moon rocks and soil sample. NASA’s behind-the-times approach isn’t lost on NASA Administrator Charles Bolden, who recently traveled to China for talks about cooperative spaceflight. As you can imagine, lawmakers are less than thrilled. Rep. Frank R. Wolf (R-Va.), who is on the subcommittee that oversees NASA’s budget, wrote “It should go without saying that NASA has no business cooperating with the Chinese regime on human spaceflight. China is taking an increasingly aggressive posture globally, and their interests rarely intersect with ours." Well, if finding and mining precious metals in an effort to ween ourselves off of a Chinese monopoly isn't enough to inspire us to get back to the moon, maybe those damn UFOs will?

# \*\*\*AT: Privatization CP\*\*\*

## Privatization CP---2AC

### The USFG has to do the plan- businesses wouldn’t want to- too high risk, whopping overheads, and unsatisfactory payback for businesses all disincentivized private action

O’Neill – 09, Ian O’Neill, PHD in Solar Physics, University of Wales, at Aberstwyth, and founder of AstroEngine.com, 6/29/09, “Mining Asteroids: Not At Those Overheads” http://www.astroengine.com/2009/06/mining-asteroids-not-at-those-overheads/

Naturally, we assume it’s going to be businesses (not governments) wanting to mine asteroids, and we assume mining/spaceflight technologies that could possibly be available within the next few decades (and no, we didn’t consider nanotech; I’m thinking rock-eating nanobots wont be available in stores for a long while yet). We also assumed these space mining companies will want to make a profit (we might be wrong). Unfortunately, asteroid mining doesn’t make an awful lot of sense from a business perspective. The risk is too high, the overheads are whopping, and the payback — while impressive — won’t pay the bills.And then there’s nasties like space pirates and industrial accidents to consider, adding to the ‘risk’ factor.All in all, it’s not a very attractive business proposition to build a mining fleet and send it on an interplanetary joyride; most businesses would rather set up a mining installation in the middle of Antarctica. But we’re not pouring cold water on the whole venture either, we’ve worked out a few ways future businesses can actually turn asteroid mining into an industry.

## Privatization CP---2AC---Legal Certainty

### Space Law Needed – The mining of Earth’s Moon, Mars, and Near Earth Asteroids is a lucrative endeavor. Legal uncertainty regarding space property rights will make it impossible for firms and nations to consider mining in space.

Zell 6 – Jeremy L. Zell, J.D. Candidate, 2007, University of Minnesota Law School; B.A., 2004, University of South Dakota, Summer, 2006, “Putting A Mine On The Moon: Creating AN International Authority To Regulate Mining Rights In Outer Space,” 15 Minnesota Journal of International Law 489, Lexis: pg. 490-491

<Today, a twenty-first century space race is on the verge of beginning. n6 This race will be different in spirit and kind than its predecessor. It will include new actors. China in particular has made astonishing strides toward outer space supremacy since beginning its space program in 1992. n7 The new actors will not be limited to nations. Private firms have begun to see commercial possibilities in the stars. n8The first space race was rooted in cold war politics. n9 Now that the ability of nations to enter space and conduct activities there has been proven, the new space race will be grounded in economic principles. Commercial interests such as tourism and outer space mining will drive private firms to engage in activities in outer space. n10

The mining of Earth's Moon, the planet Mars, and Near Earth Asteroids (NEAs) holds the potential to be a very lucrative endeavor. n11 Scientists believe that silicon on Mars, Helium-3 on the Moon, and other precious ores such as platinum on NEAs could sustain information and energy technologies on Earth for decades or centuries. n12However, the current legal uncertainty [\*491] regarding property rights on the Moon and other celestial bodies limits the possibility of outer space mining. Legal scholars and nations have hotly debated ambiguous language in the Outer Space Treaty and Moon Agreement declaring outer space to be the "common heritage of mankind." n13 Until this confusion is resolved, it will be difficult or impossible for firms or nations to realistically consider the feasibility of mining outer space, and it will continue to be seen as a science fiction fantasy.>

## Privatization CP---2AC

### Solvency Deficit – General

### 1. Private sector space capabilities are far behind NASA’s with uncertain safety and cost.

Santini 10 – Jean-Louis Santini, AFP News Writer, February 4, 2010, “Private Industry In Space A Risky, Slow Business: Experts,” PHYSORG, Online: <http://www.physorg.com/news184483614.html>

NASA's plan for the private sector to build spacecraft to fly astronauts to the International Space Station is a high-risk undertaking that won't show results for years, experts said. The abrupt shift "harnesses our nation's entrepreneurial energies, and will create thousands of new jobs," the White House Office of Science and Technology Policy said in a statement issued as the budget for the fiscal year that begins October 1 was unveiled Monday. It also reflects a key recommendation made by the high-level Augustine Commission, which President Barack Obama set up last year to review US human space flight plans and come up with a successor to the space shuttle, which winds down in late 2010 after nearly 30 years of service. The US space agency's plan to turn manned space flight over to private enterprise was met with a less-than-enthusiastic reception in some quarters. Obama has "accepted the move to put our human access to space on a commercial footing, with great uncertainty as to safety, schedule and cost," wrote four-time space shuttle astronaut Tom Jones in the magazine Popular Mechanics. John Logsdon, former head of the Space Policy Institute at George Washington University, said critics of the new policy were "mainly concerned about safety." Similar concerns about commercially built space vehicles figured high up in a report issued last month by the Aerospace Safety Advisory Panel (ASAP). "No manufacturer of commercial orbital transportation services is currently qualified for human-rating requirements, despite some claims and beliefs to the contrary," ASAP's panel of independent experts said. The annual report also warned it would be "unwise" to drop NASA's Ares 1 rocket, part of the costly Constellation project that was effectively killed by the budget plans, and hand over the ferrying of astronauts to the ISS to private industry. ASAP was set up by Congress in 1967 after a flash fire ripped through a command module during a launch pad test of the Apollo/Saturn space vehicle, killing three astronauts on board. Elon Musk, chief executive of SpaceX, one of the new generation of privately-owned companies with an eye on space, ripped into the ASAP report as "random speculation." "If they are to say such things, then they ought to say it on the basis of data, not on random speculation," Musk, whose eight-year-old company has built and tested a launcher, said in an interview with Spaceflight Now. Charles Precourt, former chief of NASA's astronaut corps and now an executive at aerospace and defense firm Alliant Techsystems, said in The Wall Street Journal that farming out large portions of the manned space program to private firms would be an "extremely high risk" path. Putting all of NASA's spacecraft-building eggs in the basket of private industry was foolhardy, former astronaut Tom Jones said. "Gambling our nation's sole access to space on industry's ability to replicate 50 years of NASA experience on the fly is unwise. NASA should fly a new crewed spacecraft as quickly as possible, then move to commercial firms once they have a proven record of reliable cargo services," he wrote. SpaceX already has a launcher, a capsule and a demonstration cargo contract with NASA. Musk said SpaceX could be ready to ferry astronauts into space within three years of landing a human transport contract with NASA -- at a rate of about 20 million dollars per seat, less than half the 50 million that Russia currently charges NASA for seats on its Soyuz spacecraft. SpaceX and other upstarts would be up against industry giants Boeing and Lockheed Martin, which together operate United Launch Alliance (ULA), whose stable includes Atlas V and Delta 4 rockets that have logged considerable flight hours. ULA was awarded 6.7 million dollars on Monday to develop an Emergency Detection System, an element necessary for "a safe and highly reliable human-rated launch vehicle." Logsdon said it was "very likely" that either ULA or one of its parent companies would earn a transport contract, and that the winning proposal would envision a flight-ready craft before 2016, the readiness date for the private sector put forward by the Augustine committee. But he cautioned the date was too ambitious, and that the craft would have to be brought up to human-rated safety standards before they can carry astronauts into space.

### Solvency Deficit – Property Rights

### 1. Property rights are an act of sovereignty which violates current space law.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

In recent years, there has been much excitement over individuals arguing for private land claims on the Moon and Mars as a thrust to commercialize space. There is a fundamental flaw in the logic of those who purport that these bodies or portions thereof may be privately owned. It is true that, “The 1967 Outer Space Treaty prohibits any claims of national sovereignty on the Moon or Mars,” and it is also true that “the treaty says nothing against private property.” It does not follow, however, that without claiming sovereignty, the U.S. could recognize land claims made by private companies that establish human settlements there, as would-be extraterrestrial realtors claim. As a practical matter, property rights exist only if they are granted or recognized by a government and subject to the protection of law. Such grant, recognition, or protection is an act of state, and as such is an exercise of state sovereignty. Title cannot come into existence out of thin air (or the vacuum of space). Legal title must arise from a sovereign power possessing legal authority over the territory in question. For Congress to pass “land claim recognition” legislation legalizing private claims of land in space would be an exercise of state sovereignty, and therefore a violation of international law under the provisions of the Outer Space Treaty. There is little need for this in any case. Has there ever been a serious challenge to the US or Soviet/Russian governments over their ownership (or at least their control) of the material they brought back from the Moon? These precedents established a principle of customary law that “if you take it, it’s yours.” Essentially, this derives from the Roman legal principle of uti possidetis: “as you possess,” so you may continue to possess.

### 2. Any informed policymaker realizes granting nongovernmental corporations claims to space property is a logical fallacy.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

Alan Wasser, a former chairman of the National Space Society (NSS), asserts: Congress could pass legislation providing that for any private, non-government corporation or consortium that financed and built a space transportation system and permanent Moon base, a limited (but still very large) claim to lunar land around the base would be legally “recognized” by the U.S. government. Recognition means the government would acquiesce to, or decide not to contest, the claim, but not assume any sovereignty over it. 3 Wasser proposes federal legislation that would have the United States recognize extraterrestrial claims to real property, based on a unilateral reinterpretation of the Outer Space Treaty. The Space Settlement Initiative appears on the NSS website, although the NSS has not endorsed it. 4 Both the Artemis Society and the Moon Society have endorsed the initiative, and it may also have some support within the Mars Society. Wasser’s idea is based on an obvious logical fallacy. The fact that only states are parties to international agreements cannot be construed to mean that they have no bearing on nongovernmental entities. States bear international responsibility for the activities of nongovernmental entities under their jurisdiction. A state cannot license nongovernmental activities that are prohibited to the state. For example, the US cannot get around the 1963 Test Ban Treaty by licensing a contractor such as Halliburton to detonate a nuclear device above ground. If states were to recognize a real property claim by a nongovernmental entity under its jurisdiction, this would constitute national appropriation by “other means,” in violation of Article II of the Outer Space Treaty. As Leslie I. Tennen states, for a state to recognize a claim of its citizens while not claiming sovereignty “is a distinction without a difference.” 5 Space law specialist Wayne N. White: ...is not aware of any serious, informed lawyers from any nation who argue that states party to the Outer Space Treaty have a right to confer or recognize real property rights which involve any exercise of national jurisdiction over extraterrestrial territory. The only people who make such assertions are uninformed individuals who are neither trained in nor adequately knowledgeable about international space law. 6

### 3. OST Articles II and VI prevent nongovernmental corporation operations.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

It should be noted that Wasser has been promoting his idea for nearly 20 years, yet in all that time, not one member of Congress has introduced such a bill. 7 B. Nongovernmental Appropriation of Real Property White states: Article II of the Outer Space Treaty prohibits territorial sovereignty but does not prohibit private appropriation. Hence, private entities may appropriate area in outer space or on a celestial body, although states may not. 8 Again, this argument conveniently ignores the “any other means” clause of Article II, as well as its tie to Article VI, which obligates states to assure that national activities, including those of nongovernmental entities, are carried out in conformity with the provisions of the treaty. Thus, states have a duty to revoke the license of a national entity, or entity launching from its territory, that violates provisions of the treaty. As space law specialist Lawrence A. Cooper states: Some have argued that OST’s broad definitions allow individual appropriation of space and celestial bodies because it only specifically prohibits appropriation by States; however, States are responsible for the actions of individuals, and property claims must occur through the State’s property laws. Therefore individuals may not claim space or celestial bodies. 9 Economist Sam Dinkin, who advocates the development of real property rights in outer space, likewise believes that they do not exist under current treaty language: The Outer Space Treaty of 1967, which has been ratified by 98 nations and signed by an additional 27, forbade property rights in space. No nations can make property rights claims. Further, the conventional interpretation of the treaty is that no one at all can make property rights claims. 10 In addition to considering arguments based on Articles II and VI, it should be noted that Article I states: Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. 11 Shin Hongkyun has pointed out: “Appropriation of vast tracts of land for their exclusive use violates Article I, and is unnecessary to ensure non-interference in the vicinity of an activity.”

### 4. The concept of arbitrary interpretation is a mockery of legal principle and produces legal inconsistencies.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

12 Certainly the appropriation of Alaskasize and even US-size territories as advocated by Wasser’s Space Settlement Institute is antithetical to “free access.” Some space property rights advocates, such as Arjen van Ballegoyen, would circumvent this inconvenient treaty by unilaterally reinterpreting it: American Institute of Aeronautics and Astronautics 4 Article 2 of the treaty... needs to be interpreted in a restrictive, literal meaning, namely as just the prohibition of national appropriation. This interpretation would allow other entities like private companies and nongovernmental organizations to appropriate territory. 13 Of course, this is no legal remedy at all. Just as with Wasser’s idea that governments can permit private activities that are prohibited to themselves, Ballegoyen’s idea of arbitrary interpretation makes a mockery of legal principle. The Law of Treaties, Article 31, Paragraph 1 states: A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in light of its object and purpose. 14 Meanwhile, White’s statement supra is not intended to assert a theory of unlimited real property rights, as he goes on to clarify: Although proponents of space development would undoubtedly welcome the economic incentive of unlimited appropriation, such claims should not be recognized. This form of property rights could potentially preclude free access to outer space in the same manner as territorial sovereignty would preclude free access. Finally, as a point of law, recognition of real property rights beyond the confines of space facilities would be inconsistent with the common law theory of property. 15 What sort of property rights, then, does White foresee in outer space?

### 5. Functional property rights are subject to Article VIII of the Outer Space Treaty.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

C. Functional Property Rights Nicholas Katzenbach refers to “primary rights... in a localized facility” that exist by virtue of the activity ongoing in the facility, independent of any consideration of real property ownership. 16 White applies this idea to outer space activities: ...[S]tates may legislate with respect to a broad range of both public and private activities; and, in most circumstances, they exercise as much authority within the vicinity of their space facilities as they would within their territory on Earth. Under a regime of functional property rights, title would arise on the basis of a principle entirely different from traditional property rights. Conferral of title would not depend upon a government’s control over a specific area, but rather upon its control over the space objects and personnel at that location. In space, first-come, first-served occupation, and the prohibition against harmful interference with other states’ activities provides states with a similar, albeit less clearly defined, right of exclusion.... Functional property rights would be subject to the limitations of [Outer Space Treaty] Article VIII jurisdiction. These rights would terminate if activity were halted, as for example, if a space object was abandoned or returned to Earth. Finally, rights would be limited to the area occupied by the space object, and to a reasonable safety area around the facility. 17 Article VIII provides: A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. 18 But how does this jurisdiction translate into “functional property rights... around the facility?” Article IX states: If a State Party to the Treaty has reason to believe that an activity or experiment... would cause potentially harmful interference with activities of other States... it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party... would cause potentially harmful interference... may request consultation concerning the activity or experiment. 19 This right to be free of “potentially harmful interference with activities” gives rise to functional rights in the vicinity of the activity. Arguably, this right is implicit in the Outer Space Treaty; however, White proposes that the major launching states conclude a “mini-treaty” to explicitly provide for functional property rights. The idea of a “mini-treaty” is meant to circumvent the forum of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which includes many non-launching states that have sought to limit the rights of launching states to appropriate extraterrestrial resources. In the absence of any new international agreement, however, with the language of the Outer Space Treaty as a springboard, functional property rights might develop as customary law as the national entities of launching states extract such extraterrestrial resources.

### Solvency Deficit – Government Key

### 1. Private enterprise will never develop space infrastructure without government help.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

The real barrier to commercializing space is the huge capital investment that is required to develop a transplanetary infrastructure. Some authors imagine that private enterprise can pull itself up to the Moon and Mars by its own bootstraps. This position ignores the history of opening frontiers. The libertarian mantra that “government is the problem” is nonsensical. Neither is government the entire solution, but it is a necessary partner in the solution--on land and on sea, in the air and in space. Building a transplanetary infrastructure is not something that private enterprise is going to accomplish... ever. First must come the political vision to build rainbow bridges to the heavens, then will come the economic incentive to travel them.

### 2. NASA must prime the commercial pump by developing technology first.

Simberg 7 – Rand Simberg, Recovering Aerospace Engineer And Manager And Commenter On Space Policy, October 3, 2007, “NASA Vs. The Far-Out Space Nuts,” LA Times, Online: http://www.latimes.com/la-op-dustup3oct03,0,4382440.story

Today, Hickam and Simberg address the grudge match between private space entrepreneurs and the federal space agency. Previously, they examined the moon and Mars for signs of human life. Yesterday, they assessed national space ambitions and NASA's role in achieving them. Later this week, they'll talk about the Mars mission, evolution in space, post-communist space exploration and other far-out topics. I frequently hear that NASA is keeping entrepreneurs from conquering space and that we should close down my old agency and turn the design and building of spacecraft over to private enterprise. Well, I'm a rock-ribbed Republican (just as my father, who said the last great American president would be Eisenhower), and I don't like big government. I've seen the government up close and personal and for the most part, it's inefficient and hidebound, and it stifles creativity in any industry it clutches within its well-meaning but slimy tentacles. When and if you get Hillarycare, you'll see what I mean. But I digress. What I'm getting at is that even with my libertarian tendencies, I see a place for federal agencies like NASA to use public funds to accomplish great technological things that are necessary to keep us a great and modern country but that private enterprise simply can't do. Energy is one of those areas (fusion energy and clean-burning coal technology should be national priorities). Another is transportation (the interstate and high-speed rail), and so is pure scientific research in areas that help us understand our planet and ourselves even if they never have any commercial application (e.g. studying the fumaroles at the bottom of the ocean). In NASA's case, the few coins of the public purse the agency gets are for the express purpose of building the machines that will allow us to go into, explore and ultimately live in space. Private enterprise has some interest in seeing that dream accomplished, but the technology to make it happen — beyond brief Rutan-like jumps into space — is currently beyond its capability or interest. NASA has to prime the commercial pump by creating big technology and then handing it over. We have a history of doing that kind of thing, so we know it works. The old Army arsenal system, for instance, invented new ordnance for decades using knowledge and craftsmen not available to normal commerce. An example is the famous World War II-era M-1 Garand, which was a federal arsenal design. So rather than being an impediment, NASA can and should be the driver of commerce, the provider of the technology necessary to make some big money in space. The truth is that private enterprise already has a huge presence up there. It's not NASA but commercial companies that send all those communications satellites rocketing aloft to the tune of billions of dollars of profits every year. Boeing, LockMart and hundreds of other companies, large and small, work in the space business, and they also create new techniques and technology; but they'd be nowhere if NASA and the Department of Defense hadn't shown the way by funding the first big rockets and satellites.

### 3. Private action absent government action will never find the solution to space exploration.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

IV. Social Balance in Space Although there may be regulatory red tape that national governments need to streamline in order to lower barriers to private enterprise in outer space, the hue and cry over extraterrestrial real property rights is a red herring. Opening the floodgates to corporate planetary land grabs would close free access to space that the current international legal regime guarantees. Abrogating the international legal structure that has kept the peace in outer space for four decades would sow the seeds of future interplanetary armed conflict. The real barrier to commercializing space is the huge capital investment that is required to develop a transplanetary infrastructure. Libertarian space cowboys imagine that private enterprise can pull itself up to the Moon and Mars by its own bootstraps. These assertions ignore the history of opening frontiers. In the early days of railroads, a private company might build a line from New York to Buffalo, but New York was already there, Buffalo was already there, and there were Albany and Schenectady in between. On the other hand, the transcontinental railroad that opened the West was a massive US government project to span a vast expanse of nothingness. Similarly, the Russian government built the trans-Siberian railroad. A French joint-stock company went bankrupt beginning the Panama Canal; the US government stepped in and finished the job. The St. Lawrence Seaway was the joint project of two national governments, eh? The US government funded the interstate freeway system, which enabled a massive expansion of the automobile industry, trucking industry, the oil industry, and the suburbs. The airline industry initially developed under federal contracts to transport mail. The Boeing B-707 was developed under an Air Force contract as the KC-135 tanker. The Lockheed L-1011 Tristar development project bankrupted not only Lockheed but Rolls-Royce as well, which was developing the jet engines for that airliner; the US and British governments stepped in to bail out these companies. The commercial space launchers in service today were all originally developed on government contracts. Today, private companies build and operate trucks, ships, aircraft, launch vehicles, and satellites, but it is governments that maintain the highways, seaports, airports, and spaceports--the infrastructure that is the foundation of all of these commercial activities. Developing infrastructure is a huge capital investment, while maintaining and operating it has a very low profit margin at best. This is something that government is better positioned to do than private enterprise. It has long been recognized that government has a legitimate role “to promote the general welfare” by providing the public goods that enable private goods to flourish. American Institute of Aeronautics and Astronautics 9 The libertarian mantra that “government is the problem” is nonsensical. Neither is government the entire solution, but it is a necessary partner in the solution--on land and on sea, in the air and in space. Building a transplanetary infrastructure is not something that private enterprise is going to accomplish... ever. First must come the political vision to build rainbow bridges to the heavens, then will come the economic incentive to travel them. What makes libertarian rhetoric so seductive is that government seems to have dropped the ball. The Golden Age of Mercury, Gemini, and Apollo is long gone. During that time, anything seemed possible. It was anticipated that there would be a fully reusable launch system, a space station, a Moon base, and human expeditions to Mars, all by the early 1980s. The technology for all of this was either in hand or within reach, but there was no political necessity, and there certainly was no economic rationale. Clearly, if government were the problem, private enterprise failed to provide a solution. Private enterprise never built a space station or a Moon base, or sent humans to Mars. Is it likely to in the near future?

### 4. Without government-built infrastructure space development will reach a dead end.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

Government has been getting an increasingly bad rap in the space advocacy community since the end of the Apollo era, but in truth the mad dash to the Moon was unsustainable, and measuring subsequent progress against the Apollo standard reflects unrealistically high expectations. Apollo was a Cold War anomaly that has not been repeated, and that may have no analog in the future. Again, the central problem is infrastructure. When the Apollo program ended, it left some ground infrastructure (assembly and launch facilities later used by the Space Shuttle program) but no space infrastructure, and in that respect it was a developmental dead end. Political motivation for government to build lasting infrastructure is generated by private sector anticipation of colonizing a new human ecology in which it can produce profit. This is the common thread in all of the aforementioned government infrastructure projects. In contrast, no government has bothered to build a tunnel under the Bering Strait; there are no roads on either side, and so there is little prospect of a sustainable human ecology there. This is not to say that there will never be a Bering Tunnel, just not any time soon. This may sound like a chicken-and-egg problem. Private enterprise is ill-positioned to develop infrastructure that it requires to thrive. Technocracy--government-directed technological development--has its limits, and may be politically motivated to develop capabilities that have little or no economic utility. A case in point is the depopulation of Siberia that has been occurring since the collapse of communism.

### 5. Space development success depends on cooperation between all sectors of human society.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

However, developing a spacefaring civilization is not an insoluble chicken-and-egg conundrum. It is more subtle than that, and there are solutions--not in all cases, but on the margins. Obviously, progress does occur, and while the pace of progress is not immutable, it does have constraints. The key conceptualization is of government and private enterprise in a push-pull relationship. When private interest becomes curious about what lies over the five-year return-on-investment horizon, it nudges government to stand straight and see further over that horizon. If the vista is promising, private interest encourages government to build the rainbow bridge to the pot of gold. Government then gets its piece of the action by taxing that pot of gold. The challenge is in recognizing that not every horizon hides a pot of gold, or if it does, it can be too costly to bring it home with the means at hand. Space technology is not a magic wand, and the High Frontier is not the Promised Land. Laissez-faire libertarianism is not the answer to space development any more than commandeconomy technocracy was; rather what is required is, as John Kenneth Galbraith prescribed for the United States half a century ago, a social balance between public goods and private goods. 49 The concept of and need for sociopolitical balance between various economic power centers in society, including government, corporations, organized labor, international civil society, et cetera, is also described in Raymond Miller’s Multicentric Organizational model of political economy. 50 For space development to proceed and to succeed there must be a American Institute of Aeronautics and Astronautics 10 partnership between government and enterprise as well as among governments and enterprises, a transnational partnership of governmental and nongovernmental entities. 51, 52 It is not merely corporations, but all sectors of human society, that must go into space.

### Privatization Bad – Accidents

### 1. Privatization of space risks a higher number of accidents risking hindering access to space.

Gagnon 4 – Bruce Gagnon, Coordinator of the Global Network Against Weapons & Nuclear Power in Space, August/September 2004, “Space Privatization: Road To Conflict,” Impact Press, Online: <http://www.impactpress.com/articles/augsep04/space8904.html>

 The news brings us the story of "space pioneers" launching privately funded craft into the heavens. A special prize is offered to the first private aerospace corporation who can successfully take a pilot and a "space tourist" into orbit. Is this "privatization" of space a good thing? Is there any reason to be concerned about the trend? Are there any serious questions that should be raised at this historic moment? Three major issues come immediately to mind concerning space privatization: space as an environment, space law, and profit in space. We've all probably heard about the growing problem of space junk, where over 100,000 bits of debris are now tracked on the radar screens at NORAD in Colorado as they orbit the earth at 18,000 mph. Several space shuttles have been nicked by bits of debris in the past resulting in cracked windshields. The International Space Station (ISS) recently was moved to a higher orbit because space junk was coming dangerously close. Some space writers have predicted that the ISS will one day be destroyed by debris. As we see a flurry of launches by private space corporations, the chances of accidents–and thus more debris–become a serious reality to consider. Very soon we will reach the point of no return, where space pollution will be so great that an orbiting minefield will have been created that hinders all access to space. The time has certainly come for a global discussion about how we treat the sensitive environment called space before it is too late. When the United Nations concluded the 1979 Moon Treaty, the U.S. refused–and still does–to sign it. One key reason is that the treaty outlaws military bases on the moon, and also outlaws any nation, corporation, or individual from making land "claims" on the planetary body. The 1967 U.N. Outer Space Treaty takes a similar position in regard to all of the planetary bodies. The U.N., realizing we needed to preempt potential conflict over "ownership" of the planetary bodies, made claim that the heavens were the province of all humankind.

### 2. Even a single accident has the possibility of hindering private development indefinitely.

Greenfieldboyce 11 – Nell Greenfieldboyce, NPR News Correspondent, John Hopkins Alumna, B.A. Social Sciences And M.A. Science Writing, January 28, 2011, “NASA Prepares For Risks In Private Space Travel,” NPR, Online: http://www.npr.org/2011/01/28/133308080/nasa-prepares-for-risks-in-private-space-travel

As NASA somberly marks the 25th anniversary of the space shuttle Challenger accident, the agency is looking ahead to the retirement of its aging space shuttle fleet later this year. The next astronauts to travel to space may go instead by private spacecraft designed and owned by commercial companies. But a deadly accident like Challenger could have serious ramifications for the fledgling commercial space industry as it tries to take over the job of ferrying astronauts up to low Earth orbit and the International Space Station. Any accident would probably result in a long investigation and spaceflights being grounded — after Challenger and Columbia, it was years before the shuttles flew again. What would that do to a private company? "A lot depends on how the private company reacts, and a lot of it depends on the root cause of the failure," says Ken Bowersox, a former NASA astronaut who now works on safety issues for SpaceX, one of the private companies vying to someday take NASA astronauts and other paying customers to orbit. "But you can imagine that any company in that situation would have a lot of pressure on it," says Bowersox. NASA would also be under scrutiny, even if it didn't own the spacecraft carrying its astronauts, says Ed Mango, who heads the space transportation planning office at Kennedy Space Center in Florida. For a few years after the space shuttles become museum exhibits, NASA astronauts will get to space on Russian Soyuz capsules. But Mango says that by around 2015 or 2016, it's possible that astronauts could be riding on the outer space version of rental cars — spacecraft designed and owned not by NASA but by private companies. Even if that happens, though, "the responsibility for the mission is still ultimately accountable to NASA," Mango says. "And if the vehicle does not fly right, then we will be held accountable for what has happened." So NASA has been preparing a list of safety standards that a private spaceship would have to meet before any NASA astronaut climbs onboard. Some space industry watchers have criticized a draft of these standards as being too onerous. But Bowersox says his company is just glad to finally get this guidance from NASA. "Safety is our No. 1 priority at SpaceX when it comes to building our rockets," he says. An unmanned test version of the SpaceX capsule has already launched, orbited Earth and returned as planned. If the company has a number of successful missions carrying cargo, people could be next. And just because the SpaceX rocket ship is designed to be cheap, that doesn't mean it won't be safe, says Bowersox. "Let's look at a Ferrari and a Honda Civic," he says. "They're greatly different in cost, but would you say that the little economy cars are less safe or more safe than the Ferrari?" Other companies, such as Orbital Sciences Corporation of Virginia, also hope to soon offer crew launching services for NASA. Handling A Disaster Mango says government officials are discussing what might need to be done to ensure that a commercial space company could financially survive the aftermath of a disaster, if NASA had come to depend on its launch services for astronauts. "In general, we are looking at that," says Mango. "We don't have a solution that's pounded flat. We are looking at it." It's unclear how the public would feel about a major disaster with a private spaceship, if people started riding them. John Logsdon, a space policy expert with George Washington University, says if an accident occurred during some of the first commercial trips up, it might create doubt about whether private companies can really manage the risks of human spaceflight. "But if it's three years in to a regular service, I think it would be, not exactly ho-hum, but more akin to an aircraft accident than a space accident," says Logsdon. After all, these private space companies wouldn't be boldly exploring a new frontier, as NASA used to. They'd just be providing a kind of commuter flight to the space station. "Yes, there are risks involved, but there is nothing written in stone that says the government can manage those risks better than the private sector," says Logsdon.

### Privatization Bad – Gold Rush Conflict

### 1. Private industry will gorge itself in profits and produce conflicts over resources.

Gagnon 4 – Bruce Gagnon, Coordinator of the Global Network Against Weapons & Nuclear Power in Space, August/September 2004, “Space Privatization: Road To Conflict,” Impact Press, Online: <http://www.impactpress.com/articles/augsep04/space8904.html>

As the privateers move into space, in addition to building space hotels and the like, they also want to claim ownership of the planets because they hope to mine the sky. Gold has been discovered on asteroids, helium-3 on the moon, and magnesium, cobalt and uranium on Mars. It was recently reported that the Haliburton Corporation is now working with NASA to develop new drilling capabilities to mine Mars. One organization that seeks to rewrite space law is called United Societies in Space (USIS). They state, "USIS provides legal and policy support for those who intend to go to space. USIS encourages private property rights and investment. Space is the Free Market Frontier." The taxpayers–especially in the U.S. where NASA has been funded with taxpayer dollars since its inception–have paid billions of dollars in space technology research and development. As the aerospace industry moves toward forcing the privatization of space, what they are really saying is that the technological base is now at the point where the government can get out of the way and let private industry begin to make profit and control space, thus the idea that space is a "free market frontier." Of course, now that the taxpayers have paid all the research and development costs, private industry now intends to gorge itself in profits. Rep. Dana Rohrabacher (R-California), an ally of the aerospace industry, has introduced legislation in Congress to make all space profits "tax free." In this vision, us taxpayers won't see any return on our "collective investment." So let's just imagine for a moment that this private sector vision for space comes true, and profitable mining is allowed on the moon and Mars. Who would keep competitors from sneaking in and creating conflict over the new 21st century gold rush? Who will be the space police?

### Privatization Bad – International Regimes

### 1. Privatization will lead to the destruction of international space legal structures.

Gagnon 4 – Bruce Gagnon, Coordinator of the Global Network Against Weapons & Nuclear Power in Space, August/September 2004, “Space Privatization: Road To Conflict,” Impact Press, Online: <http://www.impactpress.com/articles/augsep04/space8904.html>

In the congressional study published in 1989 called "Military Space Forces: The Next 50 Years," we get some inkling of the answer. The forward of the book was signed by many politicians like former Sen. John Glenn (D-OH) and Sen. Bill Nelson (D-FL). The author reported to Congress on the importance of military bases on the moon and suggested that with bases there the U.S. could control the pathway, or "gravity well," between the Earth and the moon. The author also reported to Congress, "Armed forces might lie in wait at that location to hijack rival shipments on return." Plans are now underway to make space the next "conflict zone" where corporations intend to control resources and maximize profit. The so-called private "space pioneers" are the first step in this new direction. And ultimately the taxpayers will be asked to pay the enormous cost of creating a military space infrastructure that would control the "shipping lanes" on and off the planet Earth. After Columbus returned to Spain with the news that he had discovered the "new world," Queen Isabella began the 100-year process to create the Spanish Armada that would protect the new "interests and investments" around the world. This helped create the global war system. Privatization does not mean that the taxpayer won't be paying any more. Privatization really means that profits will be privatized. Privatization also means that existing international space legal structures will be destroyed in order to bend the law toward private profit. Serious moral and ethical questions must be raised before another new "frontier" of conflict is created.

### 2. Authors who promote ownership rights in space are willing to destroy the international regime if necessary.

Gange And Dudley-Rowley 5 – Thomas Gangle, Executive Director, OPS-Alaska, Marilyn Dudley-Rowley, Chief Executive Officer, 2005, “To Build Bifrost: Developing Space Property Rights And Infrastructure,” American Institute Of Aeronautics And Astronautics, <http://www.astrosociology.com/Library/PDF/Submissions/To%20Build%20Bifrost.pdf>

However, some space enthusiasts have concluded that government dropped the ball when it came to space

development. Moreover, they have concluded that government has kept anyone else from picking up the ball and

running with it. As the Apollo era came to a close, it was anticipated that there would be a fully reusable launch

system, a space station, a Moon base, and human expeditions to Mars, all by the early 1980s. The technology for all

of this was either in hand or within reach, so why didn’t any of this happen? Pointing the finger at a convenient

scapegoat, frustrated space enthusiasts have adopted the libertarian mantra that “government is the problem,” and

not just the US government in particular, but national governments in general and the international treaty regime

they have created to govern outer space. Their arguments are overly simplistic and conveniently ignore the fact that

there was never a viable economic rationale for the envisioned “space wonders of the ‘80s.” In any case, the

libertarian space agenda is promoting ownership rights to extraterrestrial resources and real property, in accordance

with current international law where possible, by modifying international law if feasible, but by destroying the

international treaty regime if necessary.

## AT: Spending

### Plan costs at most about 15 billion dollars up front, but is easily financed and pays dividends almost immediately

Dillow – 11, Clay Dillow, Editorial writer, NU educated, 5/05/11, “Former Apollo Astronaut and Senator Says Mining Helium on the Moon Could Solve The Global Energy Crisis” http://www.popsci.com/science/article/2011-05/former-apollo-astronaut-says-moon-mining-could-solve-global-energy-crisis

So how does Schmitt’s plan break down? We’ll need $5 billion for a helium-3 fusion demonstration plant, because as of right now no such thing exists.We’ll also need to invest $5 billion more in a heavy-lift rocket capable of launching regular moon missions, something akin to the Apollo-era Saturn V.A moon base for mining the stuff would cost another $2.5 billion, and though Schmitt didn’t really specify in his [recent presentation](http://www.leaderpost.com/technology/Astronaut%2Bbillion%2Bplan%2Bmine%2Bmoon/4718531/story.html) to a petroleum conference, the other $2.5 billion could easily be chalked up to operating costs in an endeavor of this magnitude. But it could pay for itself while developing critical spaceflight technologies and enabling a mission to Mars. Schmitt says a two-square-kilometer swath of lunar surface mined to a depth of roughly 10 feet would yield about 220 pounds of helium-3. That’s enough to run a 1,000-megawatt reactor for a year, or $140 million in energy based on today’s coal prices. Scale that up to several reactors, and you’ve got a moneymaking operation.Why go to all this trouble? Helium-3 is abundant on the moon and produces little to no radioactive waste that must be cleaned up and stored. The reaction necessary would burn at a much hotter temperature than other fusion reactions, but the chance of environmental disaster via radioactive spill is virtually nil. Plus we would establish a permanent presence on the moon.

### Asteroids are cost competitive with supplies on earth

Sonter, February 9, 2006 “Asteroid Mining: Key to the Space Economy” (Mark, B.Sc, Dip.Ed (UNSW), Physics & Geology, M.App.Sc (Medical Physics), Queensland Institute of Technology, 1979) <http://www.space.com/2032-asteroid-mining-key-space-economy.html>

About 10% of Near-Earth Asteroids are energetically more accessible (easier to get to) than the Moon  (i.e. under 6 km/s from LEO), and a substantial minority of these have return-to-Earth transfer orbit injection delta-v's of only 1 to 2 km/s. Return of resources from some of these NEAs to low or high earth orbit may therefore be competitive versus earth-sourced supplies.

### Mining Asteroids is easier than any alternative due to their proximity to the earth, and have higher quality material than the moon. Additionally, it would cost virtually nothing due to large advertisement deals that would ensue, rights to the footage, the super bole, ect, that the all these independently exceed the cost of any of the current and proposed future NASA missions, costing the government nothing. This could be a solvency card, a link turn to the spending DA, or possibly a no link to Objectivism.

PERMANENT – 2002, PERMANENT, a reference source for experts and anews site on space resources, 2002, “§ 8.1 A Near-Term Private Profitable Manned Mission to a Near-Earth Asteroid” http://www.permanent.com/m-1stmis.htm

The same could be said for lunar materials. However, I think asteroidal materials are cheaper because less fuel is needed (i.e., smaller, cheaper spacecraft), it doesn't need to perform a risky landing and launch from a big gravitational body like the Moon (especially with a sizeable collection of material!), and the quality of material from asteroids is much better. (In the moon vs. asteroids debate, few people question that asteroids offer much better materials in the long run.)How would this first mission make money?First, it would be a media event. The Olympics, the U.S. Super Bowl, and the Apollo 11 mission received immense TV coverage, and the money numbers for advertisements for the Olympics and U.S. Super Bowl are impressive -- they each made much more money from advertising than the total cost of any of the current and proposed future NASA missions to study asteroids. When video footage of the landing and exploration goes onto TV, and all the discussion panels form, the value of the advertisement breaks alone could exceed the total cost of the mission. Understand: The video footage is copyrighted and sold, not given away. This is not NASA or at taxpayer expense. The private launch preparations and in-transit video footage may also be significantly valuable, not just the value of the actual landing and operations on our prospective ore body. The mission planners should copyright, encrypt and sell rights to all the video footage. The publicity should emphasize not only visiting the first asteroid, but also the purpose of starting the historic human expansion into space and an era of space products to benefit Earth in order to maximize public interest and the value of the stock of investing companies.

### The tech for mining asteroids is predominantly already available, and could yield huge profits

IO9 – 10, IO9, a daily publication that covers science, science fiction, and the future, 7/19/10, “Asteroid mining will give us all the platinum we’ll ever need, and maybe start a new Space Age”<http://io9.com/5590330/asteroid-mining-will-give-us-all-the-platinum-well-ever-need-and-maybe-start-a-new-space-age>

So how do we get the stuff? The basic technology is either already available or readily conceivable, and steroid mining has become a serious topic of discussion. Indeed, it could have far-reaching impacts for space exploration as a whole. The quest for super-cheap electronics and mining-based fortunes could spur a rush of private explorers into space in much the same way the lure of gold drove Americans westward in 1849. As crass as it might sound, the chance at some serious profit might be what finally pushes humanity into space once and for all.}

### If we take the leap and mine asteroids first, it could open up an incestive to private companies to subsidize unlimited possibilities of space exploration. This card could potentially get access to every aff on the topic as an add-on

Geere – 10, Duncan Geere, Staff writer fir Wired magazine UK, 7/15/10, “Making Space Exploration Pay by Asteroid Mining” http://www.wired.co.uk/news/archive/2010-07/15/asteroid-mining

Increasing the supply of platinum group metals on earth by sending up specialist mining spacecraft could have two benefits. Firstly, it'd allow the cost of electronics production to go down.More raw material should push down the market price.Secondly, it'd offer a motive for space travel beyond "the pursuit of knowledge". While pursuit of knowledge is a noble goal, it's proved increasing difficult to fund since the days of the space race in the 1960s. Introducing capitalism, corporations and stockholders in that process might seem like an anathema to some space enthusiasts, but it may be necessary to fund the huge amount of space exploration that still needs to be done. In history, great voyages of exploration have rarely been done solely with the goal of furthering knowledge. Columbus discovered America while trying to find a easier, cheaper way of shipping spice from the East to the West, following the fall of Constantinople. The vast expanse of the interior of America was mapped by gold-rushers, seeking their fortune.Similarly, Antarctica was discovered by explorers seeking new sources of seal meat, and much of northern Canada and its lakes were charted by fur traders and those hoping to save time crossing the Pacific from Europe by avoiding having to round Cape Horn in South America.So to those despairing about the recent cutting of space budgets across the world, invest your savings in [asteroid](http://www.wired.co.uk/news/archive/2010-06/15/japanese-hayabusa-returns-from-asteroid-mission) mining. If history is any guide, then once that industry takes off, a whole new frontier will open up for humanity. }

### There are trillions of dollars worth of resources in easily and cheaply accessable NEAs- but the international community is catching on

Bonsor – 2k, Kevin Bonsor, journalist, 11/10/00, “How Asteroid Mining Will Work” http://www.sps.aero/Key\_ComSpace\_Articles/LibTech/LIB-029\_How\_Asteroid\_Mining\_Will\_Work.pdf

Asteroids may be a much better place to get the supplies. Early evidence suggests that there are trillions of dollars' worth of minerals and metals buried in asteroids that come close to the Earth. Asteroids are so close that many scientists think an asteroid mining mission is easily feasible. Several international organizations are developing plans for going up to get these natural space resources.}

### NASA spending benefits the economy- some experts estimate a payback rate as high as 14-1

Chamberlain 10- Ken Chamberlain, contributor for the National Journal, August 27, 2010, “Measuring The NASA Stimulus,” http://www.nationaljournal.com/njonline/no\_20100827\_1798.php

NASA spending has caused "technological advancement to occur at an earlier time than it would have occurred otherwise" if it would have indeed occurred at all, an early Denver Research Institute study concluded. But placing a monetary value on those benefits proved more difficult, even for one of NASA's greatest achievements. The "fact remains that we got to the moon in a decade, but are, as yet, unable to fully measure the present and future economic impact of the science and technology accumulated on the way to the moon (or the aggregate effect of technological progress in general)," noted the authors of a 1971 Midwest Research Institute study. No one's ever really resolved the uncertainty. And as a result, researchers over the years have come up with a wide array of returns on investment for NASA spending. Estimated ratios of revenue generated compared to spending have been as high as 14-to-1. Some early academic and other studies "made very 'generous' assumptions about the spinoffs, goods and services produced as a result of NASA's investments," G. Scott Hubbard, a consulting professor at Stanford University, said in an e-mail. A study commissioned by Hubbard in the mid-2000s when he was director of NASA's Ames Research Center in California on the center's local economic impact found a "more conservative" 2- to 3-to-1 ratio. Trying to find a precise value for the economic benefits of NASA spending, though, may miss the point as long as it's acknowledged that the spending has at least some positive returns, Hertzfeld argues. He said that for a mission-focused organization like NASA, which isn't making a play for profits, any ratio of economic benefits versus spending that exceeds 1-1 "is a success."

### Space exploitation and exploration stimulate the global economy by creating new markets

Mould and Cabbage 07- David Mould, NASA Assistant Administrator for Public Affairs, Michael Cabbage, a member of the Public Affairs senior management team at NASA, Sept. 17, 2007, “NASA Administrator Griffin Discusses Value of the Space Economy,” http://www.nasa.gov/home/hqnews/2007/sep/HQ\_07193\_Griffin\_lecture.html

WASHINGTON - NASA Administrator Michael Griffin kicked off a lecture series honoring the agency's 50th anniversary with an address Monday describing the critical role that space exploration plays in the global economy. The "space economy" was estimated at about $180 billion in 2005, according to a report by the Space Foundation released in 2006. More than 60 percent of space-related economic activity came from commercial goods and services. "NASA opens new frontiers and creates new opportunities, and because of that [NASA] is a critical driver of innovation," Griffin said. "We don't just create new jobs, we create entirely new markets and possibilities for economic growth that didn't previously exist. This is the emerging space economy, an economy that is transforming our lives here on Earth in ways that are not yet fully understood or appreciated. It is not an economy in space -- not yet. But space activities create products and markets that provide benefits right here on Earth, benefits that have arisen from our efforts to explore, understand, and utilize this new medium." Since NASA's birth almost a half-century ago, military and political competition in space largely has faded away. The focus of space exploration today is in the economic arena. Rising living standards and technological advancement around the world mean greater competition from places that were never competitors before. "If technological innovation drives competitiveness and growth, what drives innovation?" Griffin said. "There are many factors, but the exploration and exploitation of the space frontier is one of them. The money we spend -- half a cent of the federal budget dollar -- and the impact of what we do with it, doesn't happen 'out there.' It happens here, and the result has been the space economy. So if America is to remain a leader in the face of burgeoning global competition, we must continue to innovate, and we must continue to innovate in space." NASA is uniquely positioned to drive the space economy with technological innovation. Griffin cited a number of examples where the space economy yields tangible benefits for people here on Earth. "We see the transformative effects of the space economy all around us through numerous technologies and life-saving capabilities," Griffin said. "We see the space economy in the lives saved when advanced breast cancer screening catches tumors in time for treatment, or when a heart defibrillator restores the proper rhythm of a patient's heart. We see it when GPS, the Global Positioning System developed by the Air Force for military applications, helps guide a traveler to his or her destination. We see it when weather satellites warn us of coming hurricanes, or when satellites provide information critical to understanding our environment and the effects of climate change. We see it when we use an ATM or pay for gas at the pump with an immediate electronic response via satellite. Technologies developed for exploring space are being used to increase crop yields and to search for good fishing regions at sea."

### Creating new markets in space prevents economic collapse

Collins and Autino 08- Patrick Collins, a Professor of Life and Environmental Science at Azabu Universtiy, Adriano Autino, the President of the Space Renaissance International, 28 May 2008, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace,” http://www.spacefuture.com/archive/what\_the\_growth\_of\_a\_space\_tourism\_industry\_could\_contribute\_to\_employment\_economic\_growth\_environmental\_protection\_education\_culture\_and\_world\_peace.shtml

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

### ‘Space development creates new industry necessary to restart the economy

Collins 06- Patrick Collins, a Professor of Life and Environmental Science at Azabu Universtiy, 2006, "The Economic Benefits of Space Tourism," JBIS, Vol 59, pp 400-411, online at http://www.spacefuture.com/archive/the\_economic\_benefits\_of\_space\_tourism.shtml

The development of space tourism activities over the past thirty years to the condition shown in Figure 2 would have created a wide range of new business opportunities, and generated large scale employment. This would have been very beneficial for world economic growth, since the world economy is in an unusually poor condition: in particular, unemployment is unusually high more-or-less throughout the world. This includes the USA where the "jobless recovery" since 2000 has created 10 million fewer jobs than previous recoveries [16]; in Europe where France , Germany and Italy have been suffering double-digit unemployment for more than a decade; in Japan where unemployment has been at record levels for much of the past 15 years – as well as in Russia, China, India, and in the countries of South America, Africa and the Middle-East [17]. High unemployment has well-known social consequences - including increasing poverty, social friction, crime, public disorder (exemplified by the riots in France in 2005 and 2006), racial intolerance and eventually political instability and international friction. In addition to suffering high unemployment, the world economic system is unstable, as General Secretary of the International Confederation of Trade Unions, Guy Rider has emphasised: "The global economy is dangerously volatile: extreme currency swings and the risk of stock market collapse are a recurrent feature, bearing an extreme cost in terms of poverty and unemployment" [18]. Although there are multiple contributing causes, both the high level of unemployment worldwide and the volatility of financial flows can be seen as being due in large part to the lack of new industries, as discussed in more detail in [19]. That is, for several centuries humans have been making systematic efforts, on ever large-scale, to make work easier – in other words, to increase labour productivity and so raise incomes. Among other beneficial effects, this has made the lives of those living in richer countries much more comfortable than for most of humanity for most of history. It has also cumulatively reduced the need for labour in each industry thus mechanised and modernised. As a simple example, agriculture used to employ most of the population, but now just a few percent of the population in rich countries can produce more than enough food for everyone; indeed in all the rich countries governments actually pay farmers not to produce more food. The reason why this process has not to date caused massive unemployment has been the successive creation of new industries, supplying new services and products that are popular with large numbers of people, thereby creating new forms of employment on a large scale. Examples of new industries that grew into major employers during the 20th century include the motor industry and its many related industries such as construction and petroleum, and air travel and its many related industries such as airports, hotel accommodation and tourism.

## AT: Cooperation CP

### Inherency – Cooperation Now

### 1. The framework of cooperation found in the 1967 Space Treaty has been expanded.

Gruner 4 – Brandon C. Gruner, J.D. Candidate; Seton Hall University School of Law, B.A. Magna Cum Laude, Phi Beta Kappa, New York University: College of Arts and Science, 2004, “A NEW HOPE FOR INTERNATIONAL SPACE LAW: INCORPORATING NINETEENTH CENTURY FIRST POSSESSION PRINCIPLES INTO THE 1967 SPACE TREATY FOR THE COLONIZATION OF OUTER SPACE IN THE TWENTY-FIRST CENTURY,” 35 Seton Hall Law Review 299, Lexis

President Bush's space program, with its goal of returning to the Moon by 2020 and using a lunar base as a stepping-stone to Mars, may provide some direction to NASA and reinvigorate the drive for colonizing the Moon and Mars. n158 It is more likely, however, to fail, be delayed, or have severe cost overruns - just like every other great [\*319] space initiative since President Kennedy's clear vision for outer space exploration - than be a clear success. n159 President Bush's plan is strikingly similar to the plan his father proposed in 1989, which was a disaster due to escalating mission costs of over $ 400 billion. n160 Furthermore, President Bush's plan defers the need for spending increases until well after his second term in office ends. n161 Essentially, President Bush has promised a return voyage to the Moon, but left future presidents to deal with the prospectively huge costs of such a program. n162 Finally, President Bush's plan to use the Moon as a base before venturing to Mars has already been recognized as a potentially extremely costly sideshow in terms of both time and money - especially given the desert-like conditions on the Moon - while delaying the premier event: Mars. n163 As such, President Bush's new space program has been met with skepticism within the scientific community. n164 Most space initiatives sail off course due to insufficient discipline and sincerity. n165 First, to develop the technology necessary to meet President Bush's goals, NASA and the space program must be restructured to become more focused than it has been for the last thirty years. n166 Second, NASA must also see an era of technological advance and savvy management that has not been seen since Presidents Kennedy and Lyndon Baines Johnson's leadership from 1961 to 1966. n167 Third, any space program that has goals more than [\*320] ten years away is doomed to fail because it is beyond any politician's horizon, and therefore will lack the excitement and formation of political constituencies to support the program. n168 Fourth, President Bush's plan - unlike President Kennedy's Cold War call to excellence - tackles no national political issue, and may have been an election year ploy and a dangerous hedge against the possibility that China will journey to the Moon. n169 Furthermore, if the history of cooperation in the space program is any indication of success, President Bush has likely already placedd the United States down the wrong path n170 by calling his vision "a journey, not a race" and by calling on "other nations to join us on this journey in a spirit of cooperation and friendship." n171 The International Space Station - the bastion of cooperation in space - has been a fiscal and schedule disaster, with cost overruns between $ 30 and $ 100 billion and a final timeframe of sixteen years, neither of which President Ronald Reagan envisioned when he called for the station to be built in 1984 for $ 8 billion and to be completed within a decade. n172 Certainly, cooperation can be useful, since groups may achieve jointly what no nation could ever achieve single-handedly. n173 Solely from a funding and resources standpoint, the ability for all nations with significant space programs to unite their efforts presents an unparalleled opportunity for mankind to achieve great deeds in space very shortly. n174 Cooperation alone, however, can never produce progress. n175 Moreover, mankind's greatest achievements in space have [\*321] been due to competition and the Space Race. n176 Likewise, because all of the space treaties are built upon the foundation of international cooperation, n177 one can easily see how they destroyed the United States' drive for unrelenting, progressive space exploration and colonization. Without adequate incentives and legal certainty to reap the fruits of one's labor, the 1967 Space Treaty has halted all space exploration that focuses on development and exploration.

### Solvency Deficit - Cooperation

### 1. Cooperation devastates development of outer space by denying economic incentives.

Gruner 4 – Brandon C. Gruner, J.D. Candidate; Seton Hall University School of Law, B.A. Magna Cum Laude, Phi Beta Kappa, New York University: College of Arts and Science, 2004, “A NEW HOPE FOR INTERNATIONAL SPACE LAW: INCORPORATING NINETEENTH CENTURY FIRST POSSESSION PRINCIPLES INTO THE 1967 SPACE TREATY FOR THE COLONIZATION OF OUTER SPACE IN THE TWENTY-FIRST CENTURY,” 35 Seton Hall Law Review 299, Lexis

There may be some criticism that this Comment promotes unilateral action by space-faring nations, and given the leadership of the United States in space, likely unilateral action by the United States. Although cooperation is optimal in principle, it is not the [\*356] ideal way to rapidly develop outer space, especially as the law of outer space has developed through the United Nations. Space treaties take too long to negotiate and require too many consenting opinions to be truly effective, causing the simplest, lowest common denominator policies to emerge, n434 rather than detailed regulations that can be used to promote outer space exploration and development. By placing a moratorium on property rights in outer space, the space treaties do nothing more than stagnate the development of outer space and serve the interests of Third World countries. n435 It seems, however, that developing countries speak with forked-tongues: they claim to be acting on behalf of mankind by supporting the status quo, but simultaneously serve their terrestrial interests. n436 Developing countries do not want to be excluded from outer space - and are keeping mankind from reaping its rewards. Thus, the only way to quickly develop outer space so as to avoid overpopulation, resource depletion, or extinction is to implement a system of first possession, which is well-recognized throughout the world as a fundamental legal principle. It is also a system that is proven to quickly conquer a vast frontier. Therefore, asking the United Nations to implement United States-based property law is not self-serving or hubristic. A system of first possession based on rules of discovery and capture, policies of homesteading and prior appropriation, and statutes of bedrock mining worked in the nineteenth century to swiftly develop the American West. n437 Perhaps ironically, it is nineteenth century precedent that holds the greatest promise for allocating property rights in space, "the final frontier." Although a system of "first in time, first in right" is exclusionary by its very nature, appropriating outer space territory in the spirit of the 1967 Space Treaty (i.e., adhering to the principle that space is the "province of all mankind") could nonetheless render equal access to outer space for all of humanity. A system by which an [\*357] appropriating nation allows individual property rights to be claimed by any human being - even those from other nations - on a "first come, first serve" basis would allow all persons equal access to space to reap its rewards. This first possession system would likely turn out to be more egalitarian than the current system promoted by developing nations (i.e., one of equal share for all nations, even for those nations that have not contributed to the exploitation of resources) because the last three decades have demonstrated that a system of res communis gives no incentive to develop any outer space resources. Consequently, the current structure of res communis allows no person or nation to reap any rewards because no development is stimulated and there are no rewards to reap. n438 An equal share in nothing still leaves all persons with nothing!

### Solvency Deficit – Space Race

### 1. If we do not jump on our lead in spacefaring capability we may meet the same end as the Ming Dynasty.

Gruner 4 – Brandon C. Gruner, J.D. Candidate; Seton Hall University School of Law, B.A. Magna Cum Laude, Phi Beta Kappa, New York University: College of Arts and Science, 2004, “A NEW HOPE FOR INTERNATIONAL SPACE LAW: INCORPORATING NINETEENTH CENTURY FIRST POSSESSION PRINCIPLES INTO THE 1967 SPACE TREATY FOR THE COLONIZATION OF OUTER SPACE IN THE TWENTY-FIRST CENTURY,” 35 Seton Hall Law Review 299, Lexis

B. The Inadequacy of the United States' Current Efforts The United States has been poised to exploit its enormous preliminary advantage in space exploration ever since Neil Armstrong first walked on the Moon on July 20, 1969. n120 Instead of exploiting its initial lead through groundbreaking advances, such as building lunar bases, dispatching manned missions to Mars, and establishing permanent Martian bases, the United States has spent the last thirty years spinning in low-Earth orbit examining the effects of zero-G nausea. n121 By choosing not to zealously explore outer space, the United States has left the door open for other nations to catch up, leap, and far exceed its successes. Such weakness and apathy has led to global power-shifting in the past, and with this knowledge in mind, can be avoided in the present. The Ming Dynasty, for example, had the opportunity to exert its influence on all of Earth's societies in the fifteenth century, but due to a lack of vision, turned its back on the world and became isolationist. n122 "History," as the well-known proverb reminds us, "repeats itself": n123 the United States in the 1960s and 1970s had the opportunity to settle outer space, but due to politicking, reverted to remaining a terrestrial society. n124 Most recently, President George W. [\*315] Bush revealed a new outer space vision, n125 but careful scrutiny of his plans shows that humanity's status as a terrestrial species is unlikely to change in the near future. It is time, however, for the United States to learn a lesson from the Ming Dynasty so that it does not share its fate.

### **2. Not exploiting the Moon’s resources first risks overdependence on countries and loss of leadership.**

Jain 11-NAVEEN JAIN, PHILANTHROPIST, ENTREPRENEUR AND A TECHNOLOGY PIONEER. NAVEEN JAIN IS FOUNDER OF MOON EXPRESS AND INTELIUS. PREVIOSULY, NAVEEN JAIN FOUNDED INFOSPACE. NAVEEN JAIN TOOK INFOSPACE PUBLIC IN 1998 ON THE NASDAQ AND SERVED AS CEO UNTIL HE LEFT TO START INTELIUS. BEFORE STARTING INFOSPACE, NAVEEN JAIN WAS A SENIOR EXECUTIVE AT MICROSOFT CORPORATION. NAVEEN JAIN IS CO-CHAIRMAN OF "EDUCATION AND GLOBAL DEVELOPMENT" AT THE X PRIZE FOUNDATION, April 20, 11, “Our Sputnik Moment: US Entrepreneurs Needed for the "Space Race"” http://www.huffingtonpost.com/naveen-jain/our-sputnik-moment-us-ent\_b\_851312.html

Why does this discussion of space exploration matter now, especially at a time when so many problems demand our attention here on this planet? Are we trying to go back to the Moon just because we can or is there a benefit to the world in lunar exploration? The answer is the latter. **Moon exploration promises to yield new energy sources that could finally break our hold on fossil fuel, and our overdependence on sometimes hostile nations that control its supply**. But this time around, we don't need to rely on government funding to fuel Moon exploration -- we can encourage private entrepreneurs to take on this role. **The value in Moon exploration comes in part from the presence of valuable resources such as Helium-3, a source of energy that is rare on Earth but is abundant on the Moon. It can "generate vast amounts of electrical power without creating the troublesome radioactive byproducts produced in conventional nuclear reactors**," a Popular Mechanics article explains. In addition, **platinum is present on the Moon, and could be mined for use in energy applications,** where it is a key catalyst for fuel-cell vehicles. **If China and Russia succeed in their goals to obtain Helium-3 and other rare resources for the development of energy, the U.S. could end up relying on these countries for its own energy needs.** **That's a tricky thing from a political standpoint: What happens if our relations with these countries turn sour? What happens if Russia and China decide to severely restrict the sale of Helium-3 to other countries, which will drive prices sky-high? We'll be in the same boat that we're in now, where we are beholden to oil-rich countries that are often in turmoil.**  **However, if we allow private enterprise to explore and take advantage of the Moon's resources, we may set ourselves on the road to energy independence**. **To re-launch our space program, we need private enterprise to step into the void**. Government funding only needs to take us to the point where the technology has been developed to get us to the Moon -- and we already have that. It's a model that's been used successfully in the past: the military first developed the Internet, and private enterprise then seized on its commercial potential; the same thing occurred with GPS technology. Naturally, there are barriers to entrepreneurs leading the charge to the Moon. For one thing, ownership is always a point of discussion -- but the fact is that "everyone" and "no one" owns the Moon. Much like when mining resources from international waters (as in fishing), entrepreneurs would need to respect the rights of other business and government players. There is legal precedent for explorers finding and keeping resources that they have uncovered via private investment. There's also the question of whether we can transport resources from the Moon in a cost-effective manner. Perhaps the cost of rocket launches -- by far the greatest expense for a Moon mission -- will come down as more entrepreneurs move into this market, or new technology will make them cheaper. It's even possible to create rocket fuel from resources on the Moon, which would slash return costs and even lower launch costs from Earth. On the other hand, mining and transporting these resources back to the Earth could depress prices as supplies grow, making such ventures less appealing to entrepreneurs. As with all private market endeavors, many will want to take a wait-and-see approach to the Moon's market potential. **But therein lies the opportunity for early movers who apply entrepreneurship to the opening of whole new markets, and in the case of the Moon, a whole new world.**

### 3. Perceptions of U.S. leadership in the world will dramatically decline if U.S. does not win Moon Race

Lele 10 - Ajey Lele, Research Fellow, Institute for Defence Studies and Analyses (IDSA), New Delhi, India, Oct. 2, 2010, “An Asian Moon Race?” <http://www.sciencedirect.com/science/article/pii/S0265964610000846#bbib43>

As we have seen, while space exploration may not hold the same strategic logic of the 1960s, this does not mean that its strategic significance has totally evaporated. However, the USA may be trying to downplay the strategic significance of the Moon today. In 1961 the then US Defence Secretary called the Apollo programme “part of the battle along the fluid front of the Cold War”. But in his 14 January 2004 speech then President George W Bush stated that the current Moon exploration initiative should be seen as a “part of a journey and not a race” [42].

The USA may be taking the view officially that it has already achieved much in this field and that others are just trying to imitate it and that too after a gap of four decades. But it fully understands that the purpose of looking at the Moon today is entirely different.

Few in the USA want to see the country appear to lag behind in this new Moon race. As former NASA administrator Michael Griffin put it, “If China were to achieve this before the return of a manned American spacecraft to the moon for the first time since 1972, the bare fact of accomplishment will have enormous, and not fully predictable, effects on global perceptions of the US leadership in the world”. According to the Washington Post, this observation was part of the draft of a statement prepared by Mr Griffin to submit to Congress but was subsequently deleted [43].

At least until the advent of the Obama administration NASA’s opinion on Moon and Mars programmes has had a nationalistic character. The October 2006 announcement of the new national US space policy and the US Air Forces’s Strategic Master Plan for FY 2006 and beyond designates space as the ‘ultimate high ground of US military operations’ [44]. Overall US space policy indicates that it has given substantial importance to space technologies in its strategic planning and the same would be the case with its deep space thinking.

Given its potential as a base for geological study, a platform for astronomy, a laboratory to study the long-term effects of reduced gravity on humans, a test bed for future manned missions to Mars, or even a launch pad for unmanned craft on their way to the outer reaches of Solar System [45], not to mention achievable options in regard to energy security and replenishment of minerals on the Earth’s surface, it is nature that the USA will not want to miss the Moon bus and will make every effort to be the first in every related field. Japan, China and India understand the US dilemma and the former and latter may engage it in their Moon journey, at least in token form. On the other hand, China seems keen to catch the opportunity before the global programme of returning to the Moon is in full swing [46] Andrew Lawler, The new race to the moon, Science 300 (May 2, 2003), p. 726.[46].

### 4. The US has no leadership now, and if we don’t grab the bull by the horns, Russia and Japan will.

**PERMANENT** – 20**02**, PERMANENT, a reference source for experts and a news site on space resources, 2002, “§ 8.1 A Near-Term Private Profitable Manned Mission to a Near-Earth Asteroid” http://www.permanent.com/m-1stmis.htm

Work to date has been performed almost entirely under US government support. However, this well established trend is to spend money and time performing endless additional paper studies and small scale laboratory research without a significant push to go get space resources. This is what's been going on for more than 20 years in the lunar and asteroidal materials utilization field, and there are no significant signs of change with the established technocratic leadership, most of whom seem complacent with their status, income and narrow technical analyses. Moreover, with national budget problems, and lack of strong, visionary, bold leadership all the way up to Bush (i.e., too busy engaging in reactionary moves following existing interest groups, rather than higher leadership), there's little to look forward to on the horizon unless we do something extraordinary ourselves. Between the US and less expensive Russian manned space programs, we have all we need -- manned space capability, especially as a Russian export. We already know enough to make a decision that it would be in the national interest of any country (US, Russia, Japan, or anyone else with launch capability or willing to buy it from another country) to embark on a program to utilize space resources and develop an edge in the technology useful in the high frontier economy - an immense new export market. However, we're all humans, so forget nationalism. Consider multinationalism (and international security).

### The USFG should do the plan.

**Schmeiser - 7/20**, Lisa Schmeiser, financial and business writer for the Korea Times, Business Weekly, and Slate Magazine, 7/20/11, “Is Space Race Over for America?” http://www.koreatimes.co.kr/www/news/opinon/2011/07/137\_91260.html

America needs to recommit to the space program on a national level. A renewed sense of purpose would ignite new generations of scientists, technologists and entrepreneurs. A heftier budget would kindle those sparks. So why should the government be heading up the next phase of manned space exploration? Why not private industry? First, the groundwork that has already been laid belongs to we, the people. Taxpayers funded American space exploration. It is a national asset, not something to be given away for private profit. Secondly, space operations sponsored by NASA are accountable to the American people in a way that private operations would not be. Space exploration is lethal. There will be casualties in the future.Loss of life should never be reduced to the cost of doing business. We will lose intrepid explorers, and when we do, their deaths need to count for something. In a culture of public accountability ― which NASA had, and has ― people have to take responsibility for their work. Transparency in both triumphs and setbacks is the way in which every American maintains their ownership in the mission, and it provides mutual accountability between Americans and space explorers. By contrast, when private industry takes over the manned space exploration game, their catastrophic accidents can be hidden or regarded as an unfortunate condition of reaching profitability. For the past 40 years, NASA has worked with the challenges of a comparatively tiny budget and the restrictions of aging technology pushed to, or past, its limits. Imagine what it could do if better funded and allowed to embrace some of the most successful traits of the private tech sector today. America's identity ultimately rests in its citizens' embracing ideas ― those about freedom, which manifest themselves both in the rights we take for granted and the risks our explorers have taken for decades. Our economy is powered by ideas. Let's boost both by recommitting to our country's space program.

### Solvency Deficit - Delays

### 1. Technological progress necessitates action now. We can’t wait for diplomatic consensus.

Brittingham 10 – Bryon C. Brittingham, J.D. Ohio State University Moritz College of Law, B.A. Political Science And Economics, 2010, “Does The World Really Need New Space Law?” Oregon Review Of International Law, Vol. 12, 31, Online: <http://www.law.uoregon.edu/org/oril/docs/12-1/brittingham.pdf>

I do not disagree with any of these points. However, new technologies, such as Space Elevators, 82 are under development and may greatly reduce the cost of trips outside of the Earth’s gravity. He-3 fusion generators, although presently consuming more energy than they produce, may yet prove practical. 83 Further, methods of mining He-3 have already been developed. 84 These hurdles, with further research, will be easily overcome within the next thirty to fifty years and since to achieve any form of international diplomatic consensus on operating in space may take at least a decade or two, we will need to develop these new rules and regulations for operating in space soon.

### 2. Negotiations will delay and make any legal framework produced useless.

Coffey 9 – Sarah Coffey, Executive Articles Editor “Case Western Reserve Journal Of International Law,” B.A. Alfred University, J.D. Case Western Reserve University School Of Law, 2009, “Establishing A Legal Framework For Property Rights To Natural Resources In Outer Space,” 41 Case W. Res. J. Int’lL. 119, HeinOnline

Important lessons can be learned from UNCLOS III that should be considered when approaching lunar mining. First, it shows that nations are willing to work together to establish order and regulation in the extraction of natural resources from international territory. Though nations differ in their ultimate goals, there is a consensus among nations that international cooperation is needed and that no nation may act without regard to the other nations of the world. The Agreement shows that nations would rather compromise and act within the framework of international law than to disregard it entirely. The fourteen-year process of negotiating the treaty, however, should be a warning that an agreement will not be easy to reach and that the issue of lunar mining needs to be addressed immediately if there is to be an established legal framework by the time lunar mining begins.

### A2 – Implementation Mechanisms

### 1. IGA doesn’t address the ambiguities relating to property rights in the Outer Space Treaty.

Dalton 10 – Taylor R. Dalton, J.D. And LL.M., Cornell Law School, 10-6-2010, “Developing the Final Frontier: Defining Private

Property Rights On Celestial Bodies For The Benefit Of All Mankind,” Cornell Law Library

Rosanna SATTLER points to the Commercial Space Act134 as an analogous type of domestic legislation to the Seabed Act that attempts to fill out the gaps in an international legal regime, namely the International Space Station Intergovernmental Agreement (IGA).135 Nonetheless, this example suffers from the same deficiencies that apply to the Seabed Act. In addition, the IGA does not address the issue of property rights that is at issue in this paper. The IGA ensures that each country will retain ownership and control of each physical module and all activities and personnel within the module.136 This is not an advancement and provides no clarification for private property rights on celestial bodies. It is a well-accepted rule in the outer space treaty system, as well as in the law of the sea, that a ship or vessel remains under the control of the “flag state.”137 The IGA merely governs the use of the International Space Station and reaffirms the customary norms of ownership and jurisdiction that currently exist in international law. Looking to the IGA or any domestic legislation expanding on it is an inadequate approach. Therefore, no proposed interim provision yet proposed seems to address the fundamental ambiguities relating to property rights in the Outer Space Treaty.