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AT: Solvency

AT: Solvency- landing

Landing on an asteroid is no easy task; There are huge technological barriers

Sherwell 2009 (Philip, staff writer for The London Sunday Telegraph, *Forget the Moon, Put Men on an Asteroid,* 25 October, 2009, http://www.lexisnexis.com/hottopics/lnacademic/, AG)

But setting foot on an asteroid may be more complex than landing on the lunar surface. A specially designed landing craft would be required which would in effect "dock'' with the asteroid - slowly approaching its surface until it touches, then firing tethers into the ground to hold it in contact, like tent pegs, in the almost weightless environment.

AT: Solvency- human mining fails

**Human Asteroid Mission fails: duration, safety and lack of gravity**

Borenstein 10 (Seth. National science reporter for AP *Obama's asteroid goal is riskier than moon*. MSNBC. 4/16/2010) TS

CAPE CANAVERAL, Fla. — Landing a man on the moon was a towering achievement. Now the president has given NASA an even harder job, one with a certain Hollywood quality: sending astronauts to an asteroid, a giant speeding rock, just 15 years from now. Space experts say such a voyage could take several months longer than a journey to the moon and entail far greater dangers. "It is really the hardest thing we can do," NASA Administrator Charles Bolden said. Going to an asteroid could provide vital training for an eventual mission to Mars. It might help unlock the secrets of how our solar system formed. And it could give mankind the know-how to do something that has been accomplished only in the movies by a few square-jawed, squinty-eyed heroes: saving the Earth from a collision with a killer asteroid. "You could be saving humankind. That's worthy, isn't it?" said Bill Nye, TV's Science Guy and vice president of the Planetary Society. President Barack Obama outlined NASA's new path during a visit to the Kennedy Space Center on Thursday. "By 2025, we expect new spacecraft designed for long journeys to allow us to begin the first-ever crewed missions beyond the moon into deep space," he said. "We'll start by sending astronauts to an asteroid for the first time in history." On the day the president announced the goal, a NASA task force of scientists, engineers and ex-astronauts was meeting in Boston to work on a plan to protect Earth from a cataclysmic collision with an asteroid or a comet. NASA has tracked nearly 7,000 near-Earth objects that are bigger than several feet across. Of those, 1,111 are "potentially hazardous asteroids." Objects bigger than two-thirds of a mile are major killers and hit Earth every several hundred thousand years. Scientists believe it was a 6-mile-wide asteroid that wiped out the dinosaurs 65 million years ago. Landing on an asteroid and giving it a well-timed nudge "would demonstrate once and for all that we're smarter than the dinosaurs and can avoid what they didn't," said White House science adviser John Holdren. Experts don't have a particular asteroid in mind for the deep-space voyage, but there are a few dozen top candidates, most of which pass within about 5 million miles of Earth. That is 20 times more distant than the moon, which is about 239,000 miles from Earth on average. Most of the top asteroid candidates are less than a quarter-mile across. The moon is about 2,160 miles in diameter. Going to an asteroid could provide clues about the solar system's formation, because asteroids are essentially fossils from 4.6 billion years ago, when planets first formed, said Don Yeomans, manager of NASA's Near Earth Object program at the Jet Propulsion Lab. And an asteroid mission would be a Mars training ground, given the distance and alien locale. "If humans can't make it to near-Earth objects, they can't make it to Mars," said MIT astronautics professor Ed Crawley. Also, asteroids contain such substances as hydrogen, carbon, iron and platinum, which could be used by astronauts to make fuel and equipment — skills that would also be necessary on a visit to Mars. While Apollo 11 took eight days to go to the moon and back in 1969, a typical round-trip mission to a near-Earth asteroid would last about 200 days, [MIT astronautics professor] Crawley said. That would demand new propulsion and life-support technology. And it would be riskier. Aborting a mission in an emergency would still leave people stuck in space for several weeks. The space agency may need to develop special living quarters, radiation shields or other new technology to allow astronauts to live in deep space so long, said NASA chief technology officer Bobby Braun. Even though an asteroid would be farther than the moon, the voyage would use less fuel and be cheaper because an asteroid has no gravity. The rocket that carries the astronauts home would not have to expend fuel to escape the asteroid's pull. On the other hand, because of the lack of gravity, a spaceship could not safely land on an asteroid; it would bounce off the surface. Instead, it would have to hover next to the asteroid, and the astronauts would have to spacewalk down to the ground, Yeomans said. Once there, they would need some combination of jet packs, spikes or nets to enable them to walk without skittering off the asteroid and floating away, he said. "You would need some way to hold yourself down," Yeomans said. "You'd launch yourself into space every time you took a step." Just being there could be extremely disorienting, said planetary scientist Tom Jones, co-chairman of the NASA task force on protecting Earth from dangerous objects. The rock would be so small that the sun would spin across the sky and the horizon would only be a few yards long. At 5 million miles away, the Earth would look like a mere BB in the sky. "It's going to be a strange alien environment being on an asteroid," Jones said. But Jones, a former astronaut, said that wouldn't stop astronauts from angling to be a part of such a mission: "You'll have plenty of people excited about exploring an ancient and alien world."

AT: Solvency- unilateralism

**Unilateralism in space development fails: lack of human resources**

Wiskerchen 10 (Michael Department of Mechanical & Aerospace Engineering, UC San Diego and Director, the California Space Grant Consortium. International Journal of Innovation Science Volume 2 Number 4 *The Emerging Organizational Framework for the Space Commerce Enterprise* December 1 2010. EBSCOhost) TS

The second foundational concept is that the endeavor to go to space and to accomplish some mission, program, and now commercial objective is absolutely filled with new challenges, with problems in engineering, science, and management that require dedicated and talented individuals to solve. Preparing to travel to and in space, to live in space, and to accomplish any sort of meaningful work in space is an intellectual challenge of the highest order. Further, there is no single organization anywhere in the world that has the necessary talent to solve all these challenges, or indeed to solve nearly any of them.

AT: solvency- timeframe

Asteroid Mining will take a few decades

Campbell 9’

(Michael D. Campbell et.al Educational Material Development Developing Industrial Minerals, Nuclear Minerals and Commodities of Interest via Off-World Exploration and Mining QJ)

**With many commodity prices at record highs today, and which are expected to stay high for decades, off-world exploration and mining are beginning to look attractive for development within the next 20 to 30 years.** At present, **mining company executives are essentially locked into meeting current needs but NASA and NASA‟s national laboratories and associated industrial contractors** such as Boeing, Lockheed, **and others, are beginning to take note that China, India, and other nations are expanding their economies at a rate higher than anticipated and are beginning to consider off-world resources to meet their future demand.** Goodyear (2006), a **corporate mining industry executive, reported a few years ago that the consumption of natural resources by China and India will place even greater stress on commodity prices, especially for copper, aluminum, nickel, iron ore and other metals and mined commodities, and that these resources will need to be replaced in the foreseeable future. Campbell**, et al., (2008 and 2009) **suggest that it is not unreasonable to assume that economic mineral deposits will be discovered elsewhere in the solar system, i.e., on other planets, moons, or asteroids.** Although the geological processes that form the younger types of uranium mineralization (of Tertiary age on Earth) and other deposits formed by hydrothermal processes require the presence of water, bacteria and associated enzymes, and may not be present on many of these distant bodies, water may be more pervasive than originally assumed. Geologically older types of uranium mineralization associated with igneous and metamorphic rocks similar to deposits that occur in Proterozoic gneisses and amphibolites (Christopher, 2007) and younger rocks in the U.S. (Armbrustmacher, et al., 1995), as well as the well-known, developed uranium deposits in Canada and northern Australia and those under development in Africa, would be analogues for the types of deposits that would be expected to occur elsewhere in the solar system. Speculations about uranium, thorium, and their associated geochemistry began a number of years ago (i.e., Surkov, et al., (1980); Zolotov, et al., (1993)). With the number of unmanned probes planned in the next few years, additional information should be available to begin looking actively for resources in our solar system, hopefully within the next 20 years, supported by solar and nuclear power (Campbell, et. al., 2009).

**Asteroid mining is too long of a goal to access**

GILSTER on MARCH 29, 2011 “PAUL Paul Gilster looks at peer-reviewed research on deep space exploration,  Asteroid Mining: A Marker for SETI?” <http://www.centauri-dreams.org/?p=17357> SH)

**Asteroid mining would be no easy catch. In fact, it’s best seen as part of a larger strategy, and may help us primarily in calling our attention to systems that demand further investigation**. Having analyzed the signature from the various mining activities, the authors add: The general trend is somewhat disappointing. For TAM to be detectable, it must be prolific and industrial-scale, producing a large amount of debris and disrupting the system significantly to be detected. However, instrumentation is continually improving, and sensitivity to such effects will only grow, reducing the constraints on detectability. What remains indefatigable with technological advance is the confusion of apparent TAM signals with natural phenomena. **A detection of any one of these TAM signals can be explained with a simpler natural model, but detection of many (or all) of these signals in tandem will prove more difficult to model, and hence TAM more difficult to discount as a possibility**. So targeted asteroid mining appears unlikely to provide us with a conclusive detection of an extraterrestrial civilization, but tentative signals seen in unusual dust size distributions or deficits in chemical composition could be markers that tell us to look at a system more closely. Usefully, the markers of asteroid mining would, unlike biomarkers in an atmosphere, indicate not just life but an intelligent, technology-driven culture. For that reason, the authors argue that searching for asteroid mining signatures is a useful addition to the multi-wavelength, multi-signal SETI strategy that is now evolving as we extend our hunt far beyond conventional methods. The paper is Forgan and Elvis, “Extrasolar Asteroid Mining as Forensic Evidence for Extraterrestrial Intelligence,” accepted for publication in the International Journal of Astrobiology ([preprint](http://arxiv.org/abs/1103.5369)). And if you’re not familiar with Iain Banks, do look into his novels about the Culture. His plots are ingenious, but I continue to marvel at his visual sense, and always take away images of places that are both astounding and inspiring. Oh to see technology used like this!

AT: solvency- Laundry list

No solvency- asteroid mining carries many more problems than they do resources

[**VinceSummers**](http://www.brighthub.com/members/vincesummers.aspx) Updated on Sep 7, 2010 “Vincent is a chemist with much experience in laboratory electroplating and electroforming state-of-the-art microwave electronic devices for use in radio telescopy (2,560 pts ****), Edited by [**George Adcock**](http://www.brighthub.com/members/wordman.aspx) “Asteroid Mining - Can it be Done?” [**http://www.brighthub.com/science/space/articles/58284.aspx**](http://www.brighthub.com/science/space/articles/58284.aspx) SH

 Is it merely science fiction, or could it become science fact that one day manufacturing resources could come from space, from within our own Solar System, by the process of asteroid mining? How plausible might it be? Can asteroid mining actually be accomplished? Is There a Need? For those who believe Earth's population will continue to increase, the fear is manufacturers will have to pay more-and-more for less-and-less available raw materials. Not just Earth's petroleum is used up. There is concern for metals and other resources as well. There are inner and outer asteroid belts in our Solar System. The inner belt is rich in metals. Is it possible space could be colonized and these inner asteroids could be "harvested" by workers in those colonies? Are Asteroids a Rich Resource? Asteroid Ida There are thousands—perhaps millions—of asteroids within our Solar System. Of those, perhaps 20 percent are rich in metals such as iron, nickel and magnesium. Asteroids, if available, could certainly augment Earth's supply of metals. According to John Lewis, author of Mining the Sky, an asteroid with a one kilometer diameter can contain 2 billion tons of mass, yielding more metal than has been mined in all human history. Would the opportunity to mine space rekindle the spirit of the Gold Rush? The promise of great wealth coupled with a desire to explore would certainly suggest so. Target Asteroids The asteroid belt lies between the orbits of Mars and Jupiter; it is here most asteroids are located. **The closest approach between Earth and Mars is about 35 million miles, which is more than 1,500 times the distance between Earth and Moon. So, traveling beyond the orbit of Mars for a mining expedition would seem unfeasible—at least at first. Asteroids nearest the Earth (and in the metal-rich inner belt) would seem the ideal candidates for Man’s asteroid-mining initiative**. Technically, closeby asteroids (those that come within 1.3 astronomical units of the Sun) are categorized as Near Earth Objects (NEOs). NASA has been cataloguing asteroids that fall into this category since 1980. The objective of the search is to identify asteroids that pose the greatest risk to Earth. Of the 6,500 that have been identified so far, about 2,300 of them have a diameter greater than 300 meters. 800 have a diameter of one kilometer or greater. On July 3, 2006 asteroid 2004 XP14, measuring 500 meters, came within 400,000 kilometers of our planet. Asteroids 2009DD45 and 2008TN166 approached Earth in 2009. The 30 meters wide 2009DD45 came within 70,000 kilometers of Earth. Asteroid Apophis, measuring 350 meters, is to approach Earth at a distance of about 36,000 kilometers in 2029**. Mining and Transportation Difficulties Asteroids are quite small, and so possess little gravity.** **They have generally irregular surfaces. This would make mining difficult. New technologies would have to be develooped. Transportation of mined material would require transportation—some kind of shuttle device.** How could craft used in asteroid mining be powered? Besides water, asteroids contain ice. The ice can be melted and electrolyzed into its component parts (oxygen and hydrogen) by using solar power. These gases can then be used as fuel to drive the craft. There is another difficulty: **to simplify mining, rockets well-positioned rockets may be needed to eliminate or control the spinning of asteroid rotation**. Mining an Earth-Approaching Asteroid Mining Methodologies As a logical extension of the mining methods used on Earth, strip mining and tunneling could be applied to asteroid mining. Strip mining is the scraping of minerals from an asteroid's surface; this technique would be best used in situations where the desired material is evenly distributed across a wide area. **Tunneling employs digging into one or more veins of desired deposits. Mining personnel would need to anchor themsel**ves. **Because of weightlessness, mined material could drift away. A large canopy would be needed to prevent that**. To ensure profitability, the yield of mined material would need to be refined on site. This would minimize impurities, improving the quality of the shipment. At some point, use of robots instead of human miners could further enhance cost effectiveness. For a large asteroid, mining could last a decade or longer. You Decide It's clear the mining of asteroids is not for the immediate future. Too much is involved. Yet, despite the idea's seeming fancifulness, this discussion should indicate it is not a feat lying in the realm of the impossible. It could happen. Will it?

AT: solvency- Laundry list

Asteroid mining is not effective - numerous warrants prove.

Coffee 02 (Thomas, MIT graduate Student Aeronautics and Astronautics, Reaching Beyond Mars: An Economic Assessment of Mineralogical Profitability from Minor Planets, <http://web.mit.edu/~tcoffee/www/docs/aca-16S26-rsp-AsteroidMiningEconomics-tcoffee-0c.pdf> , Google Scholar, NC)

Most discussions of asteroid exploitation fall into two general categories. In one approach, asteroids can be used as mineral resources to supply Earth-based needs; in the other (far more favorably), asteroids can provide mass already outside of Earth’s gravity well, effectively lowering launch costs to orbit.2, 3 Both these approaches face severe difficulties in economic terms. The first will never be profitable under any foreseeable circumstances: even for Near-Earth Objects (NEOs), launching spacecraft to go out, change their orbits, and bring them to the surface of the Earth will always cost huge amounts of money compared to ground-based mining. The second generally proceeds by calculating the “value” of metals in asteroids or mass in Earth orbit, and remarking upon the relatively low costs of transporting such mass from the asteroid belt rather than from the Earth’s surface4, 5, 6. However, in addition to ignoring the costs of infrastructure and the limitations of autonomous systems, this type of “economic” analysis has key weaknesses. First, we must consider the use of mass in orbit. If one desires useable building materials, one must break the asteroid into tiny pieces, through explosions or permanent mining colonies, requiring an enormous amount of energy, equipment, and labor. Second remains the issue of orbital processing construction, an incredibly complex process in itself compared to launching refined materials from Earth. Finally, such analyses typically ignore the costs of the men and machines that will perform these operations, casting nebulous references to robotic technologies, “highly reusable systems” and “longterm payback.” In order to make a real assessment of the “value” of asteroids, one must consider their role in the development of civilization. Contrary to O’Neill’s oft-quoted discussions of humanity’s prosperous future on artificial worlds in space,7 constructing settlements in space with or without materials provided will be horrendously expensive and almost certainly never profitable for its residents.8 In addition, building cities (or anything else) on asteroids poses the enormous difficulties of dealing with miniscule gravity levels—on typical asteroids, a firm jump could accelerate an astronaut to escape velocity. As worlds of their own, asteroids thus have little potential to attract human settlement. But though they cannot be profitably mined for Earth, perhaps they can be used to fuel development on humanity’s second world, Mars. Mars is separated from Earth by huge gravity wells; the asteroids may provide bulk materials lacking on Mars that would be much more expensive to launch from Earth. Though this might not constitute an “expansion” of human civilization, the pursuit of asteroids has significant potential to aid the growth of the Martian economy and motivate further human and robotic exploration within the Solar System, not to mention worthy research efforts on a fascinating class of objects with a rich cosmic history. It is this opportunity that we shall now investigate from an economic standpoint. We shall consider the process using relatively current technology, as might be available to Martian industry several decades from now, and ensure the consideration of hidden costs such as labor and infrastructure. In particular, we shall investigate the sensitivity of such an asteroid economy to propulsion capabilities in the near future.

AT: solvency- no transport/cost

NASA does not have the capacity to build a space shuttle to send a mission to an asteroid: Pricetag and Shuttle program show

Watson 10 (Traci, writer for USA Today, USA Today*, Landing on an asteroid: Not quite like in the movies*, June 28. 2010, http://www.Physorg /news196920110.html, AG)

 • ASTRONAUTS CAN'T HOP ON A SPACE SHUTTLE TO GET THERE. In "Armageddon," Willis' character and his crew blast off in two modified space shuttles to reach the killer asteroid. But NASA has long planned to retire the shuttles within the next year. And even if they weren't all headed to museums, they're useless as asteroid transporters. The shuttles were built only to circle Earth, said Dan Adamo, a former mission control engineer who has studied human missions to asteroids. They don't carry the fuel to jump into deep space, and their heat shields aren't designed to withstand the extra-high temperatures of returning from a destination other than the Earth's orbit. What's needed instead is a giant rocket on the scale of the monstrous Saturn V -- taller than Big Ben -- that propelled man to the moon in the 1960s and 1970s. Such a project is "a difficult challenge" that will cost in the multiple billions of dollars, said Ray Colladay, a member of NASA's advisory council. NASA spent more than $52 billion in 2010 dollars to develop and build the Saturn V. Building a 21st-century version can be done but will require a sharp increase in the NASA budget later this decade, some space experts say. "That's the issue everybody wants to duck right now, because it's uncomfortable to face that," Colladay said. NASA would also need to build a new spaceship where the astronauts can live and store all the oxygen, food and water needed for a long voyage. One option is to launch a small space pod carrying the crew, then, once safely in space, unleash an inflatable habitat, Leshin said. NASA has little practice with such a blow-up spacecraft.

AT: solvency- health

The long time needed to travel to NEOs would expose crews to major radiation and medical isolation

Watson 10 (Traci, writer for USA Today, USA Today*, Landing on an asteroid: Not quite like in the movies*, June 28. 2010, <http://www.physorg/news196920110.html>, AG)

 THE TRIP TAKES A LONG, LONG TIME. Willis and company arrive at their target asteroid in a few days, if not a few hours. Admittedly, it's streaking toward Earth at the time. NASA would prefer to go to one before it gets to that stage. Studies by Adamo, former astronaut Thomas Jones and others show that a round trip to a target asteroid would typically take five to six months. That assumes NASA shoots for one of the 40 or so asteroids that come closest to the Earth's path in the 2020s and 2030s and relies on spacecraft similar to those NASA had designed for Bush's moon mission. Another problem during the journey -- the crew would spend months "cooking" in space radiation, said NASA's Dave Korsmeyer, who has compiled a list of the most accessible asteroids. Shuttle passengers are somewhat screened from such radiation by Earth's magnetic field. Astronauts who leave Earth's orbit have no such protection. Space radiation raises the risk of cancer and in extreme cases causes nausea and vomiting, said Walter Schimmerling, former program scientist of NASA's space radiation program. The astronauts might need to take drugs to prevent the ill effects of radiation. Then there's the "prolonged isolation and confinement" that the crew will have to endure, said Jason Kring of Embry-Riddle Aeronautical University. "This crew will be more on their own than any other crew in history." If there's an emergency halfway into the trip, the astronauts would not be able to get home in a few days, as the Apollo 13 crew did. Instead it would take weeks, if not months.

Surface danger and the lack of gravity make manned missions exceedingly dangerous

Watson 10 (Traci, writer for USA Today, USA Today*, Landing on an asteroid: Not quite like in the movies*, June 28. 2010, <http://www.physorg/news196920110.html>, AG)

HUMANS CAN'T WALK OR DRIVE ON AN ASTEROID. Once they land on the asteroid "the size of Texas," the heroes of "Armageddon" run over the spiky terrain, except when they're steering two tank-like vehicles. In reality, even the biggest asteroids have practically no gravity. So anything in contact with the surface could easily drift away. "You don't land on an asteroid," said former Apollo astronaut Rusty Schweickart, a longtime advocate of asteroid studies. "You pull up to one and dock with it. And getting away from it, all you have to do is sneeze and you're gone." He envisions a spaceship hovering next to the asteroid and occasionally firing its thrusters to stay in place. Astronauts wouldn't walk on an asteroid. They would drift next to it, moving themselves along with their gloved hands. To keep from floating into space, crewmembers could anchor a network of safety ropes to the asteroid's surface, but "that has its own risks, because we don't understand how strong the surfaces of asteroids are and whether (they) would hold an astronaut in place," said Daniel Scheeres, a planetary scientist at the University of Colorado. The minimal gravity also means that any dust the astronauts stir up will hang in a suspended cloud for a long time. Because there's no weather on an asteroid, there's no erosion to smooth the dust particles. "It's all going to stay pretty razor-sharp. It's not the most friendly stuff in the universe," Korsmeyer said. Keeping humans safe as they explore an asteroid "is going to be really tricky."

AT: solvency- health

Space mining poses major health risk

ISU 10’

(International Space University, Astra, Asteroid Mining, Technologies Road Map, and applications, Final Report PG 21, Space studies program 2011 <http://www.isunet.edu> QJ)

**The mining industry produces negative environmental consequences. Platinum salts, when inhaled, cause severe respiratory dysfunction for mine workers, and extraction of alluvial deposits of platinum can cause water pollution** (Pepys, 1972). **Safety precautions are available for these issues, but are not frequently employed**. The sale of platinum, however, also has positive environmental consequences. In 2006, for example, 54% of all platinum sold was employed in control devices for automobile emissions, such as catalytic converters (George, 2006). The environmental benefits of platinum production, therefore, are far greater than the costs. Asteroid mining, being a possible means of decreasing the price of platinum, can enhance the efficiency of devices that now employ an inefficient mixture of platinum group (and other) metals. (NSLS, 2010). Platinum is also integral to the construction of hydrogen fuel cells, which can be of great benefit to the environment by enabling the use of hydrogen as a substitute for carbonaceous fuels (Vielstich, 2003). The environmental risks imposed by asteroid mining are less than those imposed by terrestrial mining, and are much more likely to be regulated by governments due to the high profile and international nature of asteroid mining activities.

**Occupational health and safety of miners on Earth is discussed in studies such as the one performed by R.S.** Roberts in 1989 (Roberts, 1989). This **study details the associated risk of respiratory and kidney cancer for the mining of nickel. The use of mercury for processing metals during the mining procedure is associated with cardiovascular disease** (Boffetta, 2001). **The ethics of exposing humans to unknown chemical mixtures in asteroids and possible microbiological organisms requires examination, and a human risk assessment is essential.**

There are problems with asteroid mining that NASA must plan for before a mission could take place

Science Clarified 11 (Science Clarified, How will humans mine asteroids and comets, <http://www.scienceclarified.com/scitech/Comets-and-Asteroids/How-Humans-Will-Mine-Asteroids-and-Comets.html> , 04-13-11, NC)

 These mining situations and techniques are not some flight of fancy that will take centuries to become reality. NASA, various groups of scientists, and some private companies have already begun drawing up plans for such space mining missions. They know that certain inherent difficulties and problems will have to be overcome, or at least planned for, to make this huge undertaking work. For example, even in the case of the NEAs, which will surely be the first targets for space miners, a typical round trip will be two to five years. This is a long time for a company of miners to be separated from family, friends, and society in general. Long periods of work in weightless conditions may also have a negative effect on the miners' health. Astronauts who have spent many months in weightless conditions in Earth's orbit have developed muscle weakness, loss of calcium and red blood cells, and other problems. And of course, such ventures will be extremely costly and require long-term financial and other commitments from governments, companies, and tens of thousands, if not millions, of individuals.

AT: exploration- propellants

Proclaimed Propellants that Promise Profits are Pitiful

 Coffee 02 (Thomas, MIT graduate Student Aeronautics and Astronautics, Reaching Beyond Mars: An Economic Assessment of Mineralogical Profitability from Minor Planets, <http://web.mit.edu/~tcoffee/www/docs/aca-16S26-rsp-AsteroidMiningEconomics-tcoffee-0c.pdf> , Google Scholar, NC)

Most of the plans for harnessing asteroid resources call for producing thrust from the materials of the asteroid itself, using the energy of the sun either to electrolyze surface water or to launch pieces of the asteroid in the opposite direction to form a “mass driver.” Though such schemes will surely save propellant mass and cost, it is difficult to see how they could be implemented. To cast away pieces of an asteroid, one must first separate those pieces, a complex and challenging task for a robotic probe in milligravity. Such an operation will probably require a human mining crew, which dramatically increases the scale of the mission and makes profitability a doubtful proposition. The presence of surface water on asteroids remains an open question. Though many have noted the possibility of a layer of water ice on the surface of Ceres, for example, this observation is far from clear.29 More generally, though general features of absorption spectra indicate the existence of water in surface materials, geologists believe that this water is in the form of hydrated minerals, perhaps having been mobilized by heating and embedded into the rock layers.30 Though some chemical schemes have been devised to extract this water, we again run into serious concerns about robotic capabilities and power consumption in the distant asteroid belt. Another potential source of water in the asteroid belt is comet nuclei, old comet cores (consisting largely of ice) that have lost their reflective properties and become part of the asteroid family.31 However, it will likely be a massive task to get at this water, since these nuclei become covered by lag deposits,32 and accretion from impacts tends to form thick regoliths (on the order of kilometers) on the surface of asteroid bodies.33 Though it is worthwhile to investigate in situ production as a means of reducing propellant costs for asteroid utilization, we will not assume that such methods can be used in this discussion.

AT: solvency- extraction and processing

Methods of extracting and processing resources from asteroids have already been conceptualized.

**Bonsor 2k** (Kevin, Bachelors degree in Journalism from Georgia Southern University writer for How Stuff Works and Discoverynews.com, “How Asteroid Mining Will Work”, accessed from [www.sps.aero](http://www.sps.aero), November 10th 2000, NB http://www.sps.aero/Key\_ComSpace\_Articles/LibTech/LIB-029\_How\_Asteroid\_Mining\_Will\_Work.pdf)

Extraction and Processing The drive to set up a mining operation on an asteroid is a matter of simple economics. While building an asteroid mine will cost billions of dollars, it will be far cheaper than carrying supplies from Earth to the moon or Mars. Spacecraft would have to carry food and supplies for the mining crew and the equipment for the mine. Newly developed spacecraft should make landing on an asteroid possible. After all, we have already landed on the moon, and some asteroids pass by closer than the moon. A spacecraft going to an asteroid would need less rocket power and fuel than one going to the moon. One problem will be how to keep the asteroid from rotating while it's being mined. Some experts suggest attaching rockets to the asteroid to take the spin out of it. But once miners land on the asteroid, just how do they plan to dig on it, process the materials extracted and transport it to a space colony or to Earth? No one knows for sure what the first asteroid mine will look like, but here are some good assumptions: • The machinery will likely be solar powered, to reduce the need for fuel that would have to be hauled to the asteroid by spacecraft. • The equipment will also have to be lightweight to transport it to the asteroid. • Some experts, including Lewis, have favored using robotic equipment to limit the personnel needed to carry out the mining project. This would reduce the amount of supplies, like food, required for a manned mission. • Miners on asteroids would use techniques similar to those used on Earth. The most likely method would be to scrape desired material off the asteroid, and tunnel into veins of specific substances. Scraping, or strip mining, will pull out valuable ore that will float off the asteroid. • Because much of the ore will fly off, a large canopy might be used to collect it. • Asteroids have nearly no gravity, so the mining equipment, and the astronaut-miners who operate it, will have to use grapples to anchor themselves to the ground. However, the lack of gravity is an advantage in moving mined material around without having to use much power. • Once a load of material is ready to be sent to either Earth or a space colony, rocket fuel for a ferrying spacecraft could be produced by breaking down water from the asteroid into hydrogen and oxygen. • After an asteroid's minerals and resources have been exhausted by the mining project, the equipment can then be transported to the next asteroid. Because of the lack of gravity and atmosphere, ferrying the newly mined materials to the moon will be easy. Once there, they can be refined and formed into structures!

AT: solvency- need more sudy

A simple program to mine asteroids can’t solve, it is necessary to study a number of asteroids in order to determine valuable composition

Welch et al 2010 (Dr. Chris, Resident Faculty member of the International Space University and chair of The 2010 Space Studies Program of the International Space University, “Final Report to The 2010 Space Studies Program of the International Space University, <http://webcache.googleusercontent.com/search?q=cache:0It3pOB-1OgJ:www.universetoday.com/85084/astronomy-without-a-telescope-alien-mining/+asteroid+mining+is+important+to+continued+economic+growth&cd=10&hl=en&ct=clnk&gl=us&source=www.google.com>, 2010, accessed 6/28/11)CNW

It is fundamental to future mining for us to determine asteroid composition, both qualitatively and quantitatively, the asteroid composition. We can determine physical features such as mass and bulk density to assist with the analysis of composition (Kowal, 1996). Using existing data from remote observations of asteroids, we can infer the mineralogical composition of similar classes. Errors associated with remote observation include incorrect reduction and characterization, potential modification of the observed spectrum caused by surface weathering, and instrument artifacts, affecting final reflectance spectra (Binzel, 2002). The foregoing errors create a challenge to obtaining reliable data on asteroid composition.

AT: solvency- tech

**Humans are not ready to mine asteroids—robots aren’t developed enough and not ready to send humans back into space**

Durda 06 (Daniel D, writer for Ad Astra, magazine of the National Space Society, Ad Nastra Volume 18, Number 2, Summer 2006, *Mining Near-Earth Asteroids*, Summer 2006, AG)

Once finally on an asteroid's debris-strewn surface, fine dust—easily motivated in the milli-g environment—will likely be a problem. Electrostatic charging now becomes a dominant force on dust particles, causing them to adhere to just about anything, the fine workings of mining equipment included. And once it is there you can't simply brush it away. Apollo 16 Commander John Young doesn't mince words when describing what he sees as one of the most serious concerns for future lunar explorers, and the same goes for asteroids as well: "When people talk about long-duration operations on the Moon, the thing they better worry about is the dust." Now, how do we actually go about mineral mining in such an environment? First, we have to get there! Today, we can obviously travel to and even "land" on asteroids, but real mining operations are going to require much more massive and expansive spacecraft operations than NASA's NEAR-Shoemaker mission or Japan's Hayabusa. Ion propulsion allowing for sustained and highly efficient operations will be essential if we decide we'd like to move a particularly attractive (or threatening) asteroid into a more accessible orbit. The nuclear electric propulsion technology that NASA was pursuing through the Prometheus program was a very promising move in the right direction, but, unfortunately, that program has been abandoned for now. Although certainly challenging, Prometheus required no extraordinary technological stretch. Revamping something like that program will simply require the political and financial will to do it. What about power to run the operation? No problem! Solar power is a practical and abundant option in near-Earth space. And of course, if you're moving about the Solar System in nuclear fission-powered spacecraft, you have a lot of power to spare coming along for the ride. Affixing or docking to the surface of a small asteroid in order to actually dig into its regolith or drill into its bedrock, may be easier said than done. And the methods that work for one object may not work at all for another. Harpoons or penetrators may be a tractable option for objects with porous but cohesive surfaces. Electromagnet pads might just work on the iron-rich asteroids. If we pick very small asteroids, our mining facility may not even "land" on the object at all—the rock could be swallowed whole by the spacecraft itself and mechanically and chemically digested for its resources. That, of course, is a technology yet to be demonstrated for large-scale, in situ operations. So, are we ready? Could we mine an asteroid today? Clearly the answer is "no." Our autonomous robotic capabilities are not yet developed enough to allow it (we don't even have the capabilities to do so in a fully autonomous manner here on Earth), and we're still at least a decade away from returning people to the Moon. But as soon as the scale of our operations in space reach a point where it becomes more economical to obtain and use mineral resources there rather than delivering them from deep in the Earth's gravity well, we'll be off and mining the most attractive resources out there—the asteroids.

The affirmative isn’t technically feasible -while methods of asteroid mining have been conceptualized there are still many critical areas requiring study

Sonter in 1998 (Mark J, Medical Physicist and scientific consultant providing advice on radiation protection and metallurgy to major mining companies and recipient of a large grant by the Foundation for International Non-government Development of Space (FINDS) to develop concepts for mining asteroids, “The Technical and Economic Feasibility of Mining the Near-Earth Asteroids”, accessed through nss.org, September 28th 1998, NB <http://www.nss.org/settlement/asteroids/sonter.html>**)**

Mining and processing methods can be readily conceptualised. However, there are many areas requiring study: anchoring into regolith on a body which has milli-g gravity; collection and handling material in milli-g gravity; minimum temperature and most rapid heat pulse for adequate volatiles release; system integration and minimum mass for required throughput. Control via teleoperation and trained machine intelligence will require successful developments in neural net and fuzzy logic machine learning and robotics.

AT: solvency- no qualified engineers

There is a huge deficit of qualified NASA engineers now

Fisher 05 (Anne, Fortune, How to Battle the coming Brain Drain, Academic Search Complete, NC)

Consider the chilling example of the National Aeronautics and Space Administration. Way back in the 1960s it spent $24 billion (in 1969 dollars)--and at one point employed 400,000 people--to send 12 astronauts to the moon. But in the 23 years since the Apollo program ended, the engineers who carried crucial know-how in their heads, without ever passing it on to colleagues, have retired or died (or both). At the same time, important blueprints were catalogued incorrectly or not at all, and the people who drew them are no longer around to draw them again. So to fulfill the Bush administration's promise to return to the moon in the next decade, NASA is essentially starting all over again. Estimated cost to taxpayers in current dollars: $100 billion.

AT: solvency- revisits

Asteroid mining isn’t currently feasible- cannot return

Wall in 2010(Mike, senior writer for space.com “Want to Mine the Solar System? Start With the Moon, October 30th 2010, NB http://www.space.com/9430-solar-system-start-moon.html)

Mining Asteroids: Years Away While the moon appears promising for off-world mining, reaching out to asteroids is a bit trickier, the experts said. Asteroids hold lots of iron, platinum and other valuable minerals — and, possibly, lots of water, too. But industrial extraction is not going to happen in the near future, several panel members argued. There are thousands of known near-Earth asteroids — which come much closer to us than do space rocks in the main asteroid belt between Mars and Jupiter. But even near-Earth objects are much farther away than the moon, and their eccentric orbits make them tough targets for multiple mining visits. "You can't get back to the same asteroid all that frequently," said Jeff Greason, president of XCOR Aerospace. "It is hard to go to one more than once," agreed Mike A'Hearn of the University of Maryland, principal investigator of NASA's EPOXI mission, which uses the Deep Impact spacecraft to study comets, extrasolar planets and other cosmic bodies. "That is a problem." Greason raised the prospect of dragging an entire asteroid close to Earth, to mine at our leisure. But that as well probably won't happen for quite some time. "We haven't even returned the first sample from any of these bodies yet," Greason said.

**Asteroid mining fails: revisit timeframe and lack of markets now**

Foust 10 (Jeff editor and publisher of The Space Review and Ph.D in [planetary sciences](http://en.wikipedia.org/wiki/Planetary_science) Space Review. *Where first for space resources?* November 22, 2010 ) TS

The biggest drawback of utilizing resources on NEOs, though, is accessing them. While many objects are small enough and come close enough to permit round trips with delta-V’s less than a landing on the Moon, repeated such opportunities to the same object are infrequent. That makes utilizing a NEO’s resources difficult unless you can extract them all in a single visit. “A lot of people in the space business don’t really believe this is possible. They don’t believe space resources and space resource extraction and utilization can be done,” Spudis said. “I have tried over the years to make a business case close for doing NEO resource exploitation. It is hard,” Greason said. “The reason it’s hard is the revisit time.” One solution, he said, is the “De Beers model”, where you extract all the resources you plan to take from a single object on one visit, and then parcel it out over an extended period of time. An extension of that would be to simply move the object itself back to Earth, or some other more readily accessible location. “Among other things, I think the legal regime is going to have an enormous amount of evolving to do before that’s a practical business proposition,” he said. “There is a steady-state asteroid mining market, at some point in the future,” Greason added later, once there’s greater knowledge about the composition of these objects and what is economically feasible to extract from them. “I see that happening some day, but some day is not any time very soon.”

**Asteroid mining fails because of revisits: De Beers model**

Foust 10 (Jeff editor and publisher of The Space Review and Ph.D in [planetary sciences](http://en.wikipedia.org/wiki/Planetary_science) Space Review. *Where first for space resources?* November 22, 2010 ) TS

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AT: Solvency- low gravity prevents mining

Lack of gravity on asteroids would pose a serious handicap problem for asteroid mining—Hayabusa mission proves

Durda 06 (Daniel D, writer for Ad Astra, magazine of the National Space Society, Ad Nastra Volume 18, Number 2, Summer 2006, *Mining Near-Earth Asteroids*, Summer 2006, AG)

The question before us here is: Could we mine a small NEA right now and actually make use of some of this mineral wealth? That is, assuming that the operational and economic infrastructure were now in place and required the in-space utilization of materials mined from small asteroids, do the techniques and technologies exist that would allow us to do so? If not, what do we still need to do and to learn in order to make asteroid mining a reality? The answers to these questions also bear directly on the closely related requirements for preventing the impact of a threatening asteroid. Let's first look at the environment that exists on and around small NEAs before considering the technological requirements for harvesting their mineral riches. Planetary scientists estimate that there are some 1,100 asteroids larger than a kilometer in diameter. Smaller, football-field-size objects are much more numerous—more than 100,000 of them orbit the Sun in near-Earth space (although at present we have catalogued only a few percent of them). Objects so small exert only a feeble gravitational pull befitting their diminutive stature. The surface gravity of even a modest-size kilometer-diameter rocky asteroid is only of order 1/30,000 of a g. It is in fact the negligible surface gravity of these objects that makes them such attractive targets for future mining activities; the materials mined from their surface need not be lifted back out of a deep gravity well in order to be delivered to the places where the resources are needed. But this low gravity can cause serious operational challenges as well. Simply moving around in the close vicinity of a lumpy and potentially rapidly rotating or tumbling NEA can be counterintuitive. Rather than orbiting the smallest asteroids, oilplatform-like equivalents of future mining factories may instead "station keep" in close proximity, rather like a Space Shuttle orbiter maneuvering around the International Space Station. Human and robotic mining engineers moving about along the surface will similarly need their own on-board and very capable navigation systems for the real-time trajectory calculations necessary in simply moving from point A to point B. The difficulties faced by the Hayabusa mission in trying to simply "drop" the tiny MINERVA rover onto the surface of the 500-meter-diameter asteroid Itokawa show that we still have some work to do in even this most basic area of mining operations.

**AT: Solvency- lack of infrastructure/cost**

**Space Mining unlikely – too many challenges with cost.**

SpaceDaily, 1999. (Space News. “The Challenge of Space Mining”. 9-14-1999. Available at: <http://www.spacedaily.com/news/asteroid-99i.html>, T.Q)

 The biggest impediment to space industrialisation is the cost involved getting raw materials back to Earth orbit. Unfortunately, at least five infrastructure challenges need to be met before we can move space mining from science fiction to economic fact. The first is debt servicing arrangements capable of handling projects where payoff periods are measured in decades (if not centuries) that will need to be put into place (which is why debt servicing will be a most interesting challenge for this potential space business; although large scale projects such as terrestrial mines & skyscrapers - as well as the illfated Iridium consortium - seem to suggest that this problem isn't completely insurmountable). Mind you: the payday from a large metal rich asteroid suddenly dropping a large load of processed material on terrestrial markets would certain put a new spin on the old traders' cry of optimism: When my boat comes in!.... (It is assumed here that debt servicing will be handled by futures sales of the processed raw material being mined... to avoid flooding the market, the ideal would be to have every gram of processed material presold before delivery; which could be incremental during near. Earth flybys - an especially attractive option if the final intent of the mining operation is to create some kind of spaceship/city/whatever - or dropping it en bulk from a final Earth orbit) The second & third challenges have (probably) almost been met even now; & with development incentives could be tested in space within a couple of years. Both are technological - the bulk of space mining operations are almost certainly going to be robotic rather than human - & involve the creation of spacerated automated materials processing technology for turning floating piles of rock into valuable raw material; & mobile mining technology which can make the raw material available for processing. Elements of these technologies are almost available now (with a few systems existing on the drawing board... or should i say CAD nowadays?); & some systems testing has already taken place... the main challenge here would be to spacerate designs which are capable of the years of work they'll be required to do.... (It's worth noting that the same basic technology could also be adapted as Earth-impacting asteroid mitigation strategy... something we're going to have to develop sooner or later. Roll on real space industrialisation)

No Asteroids to mine – long timeframe

**NASA reports show a lack of asteroids is pushing the mission to 2025-2030**

Kerr 11 (Richard A, senior writer for Science magazine, *Science Vol. 331, Nasa Weighs Asteroids: Cheaper than Moon, but Still Costly*, January 18, 2011, http://www.sciencemag.org/content/331/6019/841.full.pdf , AG)

Extending humans’ reach into deep space within 15 years is all well and good, NEA researchers say, but there are some costly and time-consuming hurdles to be cleared. First, someone needs to find a suitable asteroid. “There just aren’t very many targets out there,” says NEA researcher Alan Harris of the Space Science Institute in La Cañada, California. “Even though there are thousands and thousands of objects out there, there are only a few tens that will ever fit the bill.” Some NEAs are too small, little larger than the craft that would carry astronauts to them. Some spin so fast—with a “day” of minutes or an hour or two—that they couldn’t be approached and would fling away any astronaut touching down on them. The toughest requirement is finding an asteroid with an orbit enough like Earth’s that astronauts could catch up with it using a practical amount of fuel and get back to Earth in a reasonable amount of time—say, 6 months. A NASA study of possible asteroid targets conducted last fall came up empty-handed. “We’ve found only a handful of objects accessible in the 2025 to 2030 time frame,” says Lindley Johnson, NASA program executive for near-Earth object observations, “all of them quite small and not particularly attractive targets.” All were smaller than 50 meters in diameter; objects about the length of a football field or pitch are thought more desirable. So right now, Johnson says, there’s no steppingstone known on the way to Mars around the president’s target date. They’re out there, everyone agrees; it’s just a matter of looking harder. In a report in October on the threat of impacts on Earth, a National Research Council committee looked at two ways of searching for small NEAs. The cheaper way of fi nding 90% of objects 140 meters in diameter and larger passing near Earth is using a telescope on the ground, the committee concluded. But even for these larger objects, the survey would not be completed until late in the 2020s, far too late for Obama’s goal. A telescope with a better vantage point, one orbiting the sun inward of Earth’s orbit, would cost more than a ground-based telescope—perhaps half a billion dollars—and involve greater risk, but it could complete the survey faster, “perhaps as early as 2022.” Given the need for robotic scouting missions in the 20-teens and a likely requirement for backup targets, says Morrison, “we really need to get cracking. We all have 2025 looming.” Another challenge unique to the asteroidfi rst approach is tiny NEAs themselves. On a 100-meter NEA, an astronaut would weigh something like 10 grams, Harris notes, space suit included. Operating around such an object would be like a spacewalk around the international space station, says Morrison, but without the built-in handholds. And making handholds or installing instrumentation on the surface could be a dicey business, says planetary dynamicist Daniel Scheeres of the University of Colorado, Boulder. Hundred-meter NEAs could be “rubble piles” of boulders, cobbles, and pebbles held together, barely, by their own microgravity. Stepping onto the surface could be “like jumping into a pit of Styrofoam ‘peanuts,’ ” he says. Once kicked up, dust and pebbles could take hours or days to settle out. Even NEAs of equal size could have different reactions to the tread of astronauts because NEAs come in rocky, metallic, and crumbly carbonaceous versions.

**Status Quo Solves- Asteroid mission**

Nasa plans manned mission to asteroid by 2025

By DANIEL BATES 25th March 2011 writer for the dailymail newspaper <http://www.dailymail.co.uk/sciencetech/article-1370006/NASA-plans-manned-mission-asteroid-2025.html> “Nasa plans manned mission to asteroid in 2025”SH)

The moon has had its day and Mars is just, well, too far away. **Nasa plans to put a man on an asteroid by 2025 in a real-life  version of the film Armageddon. Astronauts will embark on a six-month mission to land on a lump of rock around the size of a building and take samples which could tell us about the origins of our solar system.** It would be the first manned mission into ‘deep space’ and at five million miles away, is 20 times further than a voyage to the moon. Such a venture could form the foundations for a journey to Mars, and recalls the 1998 blockbuster Armageddon, in which Bruce Willis blows up an asteroid on a collision course with Earth. Nasa’s mission to the asteroid has the full backing of President Barack Obama and would be regarded as an achievement akin to Neil Armstrong’s Apollo 11 mission to the moon in 1969. **The practicalities of getting to an asteroid, however, would be worthy of the Hollywood treatment themselves**.  A rocket similar to the huge Saturn V would be needed to do the job – the structure was taller than Big Ben and was used on missions to the moon in the 1970s. The crew would have to endure three months in space to get to an asteroid before spending five days there and coming back. During that time they would be ‘cooked’ by space radiation which could cause them to become sick and raise their risk of cancer**.  Upon arrival, the ship could land on the asteroid or, more likely, astronauts will spacewalk a short distance towards it and hover on a network of safety ropes while collecting samples**. During a recent Nasa forum, astronauts said such a voyage would be fraught with difficulty. ‘Long outbound and inbound trip times are going to be very challenging,’ said Andy Thomas, a veteran space shuttle astronaut. ‘These missions are going to be very, very risky. They are going to be as much risk as the Apollo missions were.’  Nasa has several asteroids in mind for the mission. The target asteroid would range in size from 20ft across to the size of a small office block. There are nearly 7,000 known near-Earth asteroids but of those only half a dozen will have orbits that could allow a space shuttle to reach them around 2025.  **The earliest Nasa could expect to reach an asteroid would be in 2020,** when ground-based telescopes will be able to spot the return of a 197ft-long rock known as 2009 OS5.

There are plans to explore and develop asteroids now, Squo solves the plan

LORI GARVER, NASA DEPUTY ADMINISTRATOR, master's degree in science, technology and public policy from George Washington University in 1989, Center for Strategic and International Studies , April 26, 2010, http://impact.arc.nasa.gov/news\_detail.cfm?ID=184, ES

Before we reach the surface of Mars with humans, we'll explore an asteroid, by 2025. The President announced that unprecedented goal in Florida. NASA engineers have been looking at candidates for a NEO mission that could launch in 2025. Because of orbital dynamics, launch date drives the specific destination. We are discovering new NEOs all the time, so our list of targets will certainly expand over the coming years. One intriguing candidate is asteroid 1999AO10, which we could reach with a 2025 launch on a 150 day round trip mission, spending about 2 weeks at the asteroid. But why would we want to visit an asteroid in the first place? Why are these space rocks such compelling destinations for humans? First, they provide an intermediate destination for human exploration, with round trip times significantly longer than the Moon but shorter than Mars. They also don't require a high gravity landing, perhaps making them even more accessible than the Moon from a hardware development standpoint. Next, asteroids are fascinating scientifically, as evidenced by the National Academy's endorsement of their exploration in Decadal Surveys and other reports. They are remnants of the birth of our solar system - they preserve the primitive materials from which our earth, and possibly even life, formed. Some asteroids are very rich in valuable metals, and may be important space resources. And finally, we know NEOs are important for life on Earth because they have affected our evolution through mass extinctions they have caused.

**Status Quo Solves- NASA asteroid mission**

**NASA plans to mine from asteroids – Status Quo solves.**

NASA. 2011. (NASA Government Agency. “NASA to Launch New Science Mission to Asteroid in 2016”. 5-25-11. <http://www.nasa.gov/topics/solarsystem/features/osiris-rex.html>. TQ)

NASA will launch a spacecraft to an asteroid in 2016 and use a robotic arm to pluck samples that could better explain our solar system's formation and how life began. The mission, called Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer, or OSIRIS-REx, will be the first U.S. mission to carry samples from an asteroid back to Earth. "This is a critical step in meeting the objectives outlined by President Obama to extend our reach beyond low-Earth orbit and explore into deep space," said NASA Administrator Charlie Bolden. "It’s robotic missions like these that will pave the way for future human space missions to an asteroid and other deep space destinations." NASA selected OSIRIS-REx after reviewing three concept study reports for new scientific missions, which also included a sample return mission from the far side of the Moon and a mission to the surface of Venus. Asteroids are leftovers formed from the cloud of gas and dust -- the solar nebula -- that collapsed to form our sun and the planets about 4.5 billion years ago. As such, they contain the original material from the solar nebula, which can tell us about the conditions of our solar system's birth. After traveling four years, OSIRIS-REx will approach the primitive, near Earth asteroid designated 1999 RQ36 in 2020. Once within three miles of the asteroid, the spacecraft will begin six months of comprehensive surface mapping. The science team then will pick a location from where the spacecraft's arm will take a sample. The spacecraft gradually will move closer to the site, and the arm will extend to collect more than two ounces of material for return to Earth in 2023. The mission, excluding the launch vehicle, is expected to cost approximately $800 million.

**Status Quo Solves – NASA plans to launch OSIRIS-Rex**

Poeter, 2011. (Damon Poeter. Reporter for PCMag. “NASA Preps Asteroid-Mining Spacecraft for 2014 Launch”. 5-26-11. [http://www.pcmag.com/article2/0,2817,2385949,00.asp](http://www.pcmag.com/article2/0%2C2817%2C2385949%2C00.asp). T.Q)

NASA will bring a beloved arcade game to life in 2014 when it deploys an unmanned spacecraft capable of busting up asteroids. Actually, the OSIRIS-REx spacecraft won't exactly be capable of blowing up the small, rocky leftovers from the solar system's birth—let alone possess an energy shield or the ability to jump into hyperspace. But the vessel will be equipped with a robotic arm built to pluck samples from a near-Earth asteroid designated 1999 RQ36 when it reaches its destination in 2020. NASA announced its first-ever mission to retrieve asteroid samples and bring them back to Earth on Thursday. "This is a critical step in meeting the objectives outlined by President Obama to extend our reach beyond low-Earth orbit and explore into deep space," NASA Administrator Charlie Bolden said in a statement. "It's robotic missions like these that will pave the way for future human space missions to an asteroid and other deep space destinations." Asteroids contain material left over from the cloud of gas and dust that cohered some 4.5 billion years ago to form the solar system we enjoy today—original material from the solar nebula that scientists believe contains important clues about the solar system's birth. NASA picked RQ36 for its relative closeness to Earth and primitive makeup. "This asteroid is a time capsule from the birth of our solar system and ushers in a new era of planetary exploration," said Jim Green, director of NASA's Planetary Science Division. "The knowledge from the mission also will help us to develop methods to better track the orbits of asteroids."

**Status Quo Solves- Other countries**

Russia already possessed detailed plans for asteroid mining for 13 years—Near programme reports prove

Guardian 98 (The Guardian (London), News agency, the world’s leading liberal voice, The Guardian Home Page November 9 1998, P. 11, *Global Sights on Hot Metal Fortune*, November 9, 1998, AG)

THERE is an asteroid called Clapton, and another called Zappafrank. There are asteroids named after each of the Beatles, as well as Mike Oldfield, Vangelis and Jean Michel-Jarre. Astronomers ran outof classical names long ago, there are so many asteroids in view, writes Tim Radford. The first asteroid, and the biggest, was identified in 1801 by a group of astronomers who called themselves the celestial police. They discovered Ceres. Thousands of asteroids wander across the solar system, and for humans they are treasure chests waiting to be opened. Charles Kowal, an engineer on the Near programme, calculated that a nickel-iron asteroid of just one cubic kilometre would contain 7 billion tons of iron, 1 billion tons of nickel and enough cobalt to supply the world for 3,000 years. At 1996 prices, he calculated, the value would be about pounds 3 million million. Asteroids have huge commercial potential. Even before Nasa had completed the Apollo moon landing US and Russian scientists were planning orbiting space colonies, which would capture asteroids and comets. They proposed mining them, and then building yet bigger space colonies, along with huge solar power stations to beam energy back to Earth. They had it all worked out - asteroids could be "bumped" into a safe, tidy orbit round the Earth through an electromagnetic system that would hurl lumps of rock off the asteroid; the thrust, like rocket exhaust, would push the asteroid in the opposite direction. Duncan Steel, the Australian astronomer, suggested that some asteroids might be the moribund nuclei of comets, so they could also be rich sources of methane, ethane, propane and butane as well as water.

China and Japan have already started planning for asteroid missions

XinHua 06 (XinHua News Agency, BBC Monitoring Asia Pacific, *Conference told China planning to send spacecraft to study* *asteroids*, September 18, 2006, <http://www.lexisnexis.com/hottopics/lnacademic/>, AG)

 Text of report in English by official Chinese news agency Xinhua (New China News Agency) Beijing, 18 September: China's space scientists plan to develop spacecraft to study asteroids in the near future, according to experts at the annual conference of the China Association for Science and Technology. The Beijing Morning Post on Monday [18 September] quoted an unnamed expert with the China Aerospace Science and Industry Corp. as saying the study of asteroids or comets had been listed on China's space programme. The Chinese spacecraft would probably land on the asteroids or crash into minor planets, similar to the Deep Impact mission of NASA, said the expert. On 4 July last year, the Deep Impact spacecraft arrived at Comet Temel 1, impacting with a mass of 370 kg. The study of asteroids was significant to the search for life outside the Earth, said experts. Japan has also sent spacecraft to probe asteroids. Asteroids are rock and metallic objects that orbit the Sun, but are too small to be considered planets. They are known as minor planets and range in size from Ceres, with a diameter of about 1,000 km, down to the size of pebbles. Sixteen asteroids have a diameter of at least 240 km. They have been found inside the Earth's orbit to beyond Saturn's orbit. Most, however, are contained within a main belt between the orbits of Mars and Jupiter. Some have orbits that cross the Earth's path and some have even hit the Earth in times past. Asteroids are material left over from the formation of the solar system. Much of mankind's understanding of asteroids comes from examining pieces of space debris that fall to the surface of Earth. Because asteroids are material from the very early solar system, scientists are interested in their composition. Before 1991 the only information obtained on asteroids was through Earth-based observations. Then in October 1991, asteroid 951 Gaspra was visited by the Galileo spacecraft and became the first asteroid subject to high-resolution images. Source: Xinhua news agency, Beijing, in English 0850 gmt 18 Sep 06

**AT: ADVs**

**AT: Resources ADV**

UQ for resources- substitutes and underwater mining solves

Synthetic substances and sea mining can solve for resources, space mining is unnecessary.

Bateman 61 (Alan M., bulletin of Atomic Scientists, Minerals: Supply and Demand, http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=9a33e850-7be2-4965-8a49-d5c61f09d25e%40sessionmgr4&vid=1&hid=19, Academic Search Premier, NC)

Most reserves of industrial minerals eventually will be exhausted, be it in decades or in scores of years. As exhaustion of any mineral approaches, lower grade ores (at much higher cost) will be utilized or synthetic substitutes will be developed. The inventiveness of man, particularly under the stress of necessity, can easily be shown. In the early nineteenth century there were cries of dismay that the world would soon be in darkness be- cause whales, whose oil supplied light, were rapidly being killed off. Then coal oil, kerosene, gas and electricity supplanted whale oil. Future power may be atomic or solar. Synthetic substitutes for exhausted resources (such as fiberglass for metal) may be developed. If electricity is still used, as it probably will be, it is difficult to imagine what substitutes could be developed to replace copper and other metal conductors. No one can be sure, however, that conductors made from abundant nonmetallic elements or from light metals may not be produced in the future. But if usable substitutes for seriously depleted supplies do not appear as exhaustion approaches, national and international restrictions may be placed on some minerals. Or man may “mine’, the seas for minerals deposited on the ocean’s floors and diluted in its waters.

AT: Resources Impacts

No impact- will find a way

As technology increases, we become able to find more resources.

Sagoff 97 (Mark, The Atlantic Monthly, Do We Consume Too Much, <http://www.theatlantic.com/past/docs/issues/97jun/consume.htm>, June 1997, NC)

First, with regard to subsoil resources, the world becomes ever more adept at discovering new reserves and exploiting old ones. Exploring for oil, for example, used to be a hit-or-miss proposition, resulting in a lot of dry holes. Today oil companies can use seismic waves to help them create precise computer images of the earth. New methods of extraction -- for example, using bacteria to leach metals from low-grade ores -- greatly increase resource recovery. Reserves of resources "are actually functions of technology," one analyst has written. "The more advanced the technology, the more reserves become known and recoverable."

The more we use materials, the better we get at making them last

Sagoff 97 (Mark, The Atlantic Monthly, Do We Consume Too Much, <http://www.theatlantic.com/past/docs/issues/97jun/consume.htm>, June 1997, NC)

Third, the more we learn about materials, the more efficiently we use them. The progress from candles to carbon-filament to tungsten incandescent lamps, for example, decreased the energy required for and the cost of a unit of household lighting by many times. Compact fluorescent lights are four times as efficient as today's incandescent bulbs and last ten to twenty times as long. Comparable energy savings are available in other appliances: for example, refrigerators sold in 1993 were 23 percent more efficient than those sold in 1990 and 65 percent more efficient than those sold in 1980, saving consumers billions in electric bills. Amory Lovins, the director of the Rocky Mountain Institute, has described in these pages a new generation of ultralight automobiles that could deliver the safety and muscle of today's cars but with far better mileage -- four times as much in prototypes and ten times as much in projected models (see "Reinventing the Wheels," January, 1995, Atlantic). Since in today's cars only 15 to 20 percent of the fuel's energy reaches the wheels (the rest is lost in the engine and the transmission), and since materials lighter and stronger than steel are available or on the way, no expert questions the feasibility of the high-mileage vehicles Lovins describes. Computers and cameras are examples of consumer goods getting lighter and smaller as they get better. The game-maker Sega is marketing a hand-held children's game, called Saturn, that has more computing power than the 1976 Cray supercomputer, which the United States tried to keep out of the hands of the Soviets. Improvements that extend the useful life of objects also save resources. Platinum spark plugs in today's cars last for 100,000 miles, as do "fill-for-life" transmission fluids. On average, cars bought in 1993 have a useful life more than 40 percent longer than those bought in 1970.

No impact- will find a way

As technology gets better, we get more mileage out of the resources we use without using more resources

Sagoff 97 (Mark, The Atlantic Monthly, Do We Consume Too Much, <http://www.theatlantic.com/past/docs/issues/97jun/consume.htm>, June 1997, NC)

As lighter materials replace heavier ones, the U.S. economy continues to shed weight. Our per capita consumption of raw materials such as forestry products and metals has, measured by weight, declined steadily over the past twenty years. A recent World Resources Institute study measured the "materials intensity" of our economy -- that is, "the total material input and the hidden or indirect material flows, including deliberate landscape alterations" required for each dollar's worth of economic output. "The result shows a clearly declining pattern of materials intensity, supporting the conclusion that economic activity is growing somewhat more rapidly than natural resource use." Of course, we should do better. The Organization for Economic Cooperation and Development, an association of the world's industrialized nations, has proposed that its members strive as a long-range goal to decrease their materials intensity by a factor of ten. Communications also illustrates the trend toward lighter, smaller, less materials-intensive technology. Just as telegraph cables replaced frigates in transmitting messages across the Atlantic and carried more information faster, glass fibers and microwaves have replaced cables -- each new technology using less materials but providing greater capacity for sending and receiving information. Areas not yet wired for telephones (in the former Soviet Union, for example) are expected to leapfrog directly into cellular communications. Robert Solow, a Nobel laureate in economics, says that if the future is like the past, "there will be prolonged and substantial reductions in natural-resource requirements per unit of real output." He asks, "Why shouldn't the productivity of most natural resources rise more or less steadily through time, like the productivity of labor?"

No resource wars

Resource shortages are not a major cause of war

Victor 2008 (David G., security correspondent for National Interest, “Smoke and Mirrors”, <http://nationalinterest.org/article/smoke-and-mirrors-1924>, Janduary 2, 2008, accessed 7/10/11)CNW

MY ARGUMENT is that classic resource wars-hot conflicts driven by a struggle to grab resources-are increasingly rare. Even where resources play a role, they are rarely the root cause of bloodshed. Rather, the root cause usually lies in various failures of governance. That argument-in both its classic form and in its more nuanced incarnation-is hardly a straw man, as Thomas Homer-Dixon asserts. Setting aside hyperbole, the punditry increasingly points to resources as a cause of war. And so do social scientists and policy analysts, even with their more nuanced views. I've triggered this debate because conventional wisdom puts too much emphasis on resources as a cause of conflict. Getting the story right has big implications for social scientists trying to unravel cause-and-effect and often even larger implications for public policy.

Michael Klare is right to underscore Saddam Hussein's invasion of Kuwait, the only classic resource conflict in recent memory. That episode highlights two of the reasons why classic resource wars are becoming rare-they're expensive and rarely work. (And even in Kuwait's case, many other forces also spurred the invasion. Notably, Iraq felt insecure with its only access to the sea a narrow strip of land sandwiched between Kuwait on one side and its archenemy Iran on the other.) In the end, Saddam lost resources on the order of $100 billion (plus his country and then his head) in his quest for Kuwait's 1.5 million barrels per day of combined oil and gas output. By contrast, Exxon paid $80 billion to get Mobil's 1.7 million barrels per day of oil and gas production-a merger that has held and flourished. As the bulging sovereign wealth funds are discovering, it is easier to get resources through the stock exchange than the gun barrel.

AT: Resouces shortages-resources cause conflict

An abundance of resources creates more conflict than a scarcity of resources.

Holden and Jacobson 07 (William N. Department of Geography/Program of Environmental Science, University of Calgary, R. Daniel, Department of Geography, University of Calgary, Canadian Geographer, Mining amid armed conflict: nonferrous metals mining in the Philippines, <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=5e31dac9-3d39-44e2-91ce-812dccc4a4bc%40sessionmgr11&vid=1&hid=21>, Winter 2007, Academic Search Premier, NC)

In addition, a new dimension to the resource curse thesis has emerged recently that posits that countries rich in mineral resources have an enhanced vulnerability to armed conflict (De Soysa 2000; Le Billon 2001, 2005; Auty 2004; Nevins 2004; Ross 2004a). Although some writers, such as Homer-Dixon (1999), postulate a view that a scarcity of resources creates conflict, a contrasting view has developed which says that an abundance of resources is much more likely to generate conflict (Collier 2000; De Soysa 2000; Hartmann 2001; Peluso and Watts 2001; Le Billon 2004). The reasons underlying this latter view relate to: greed, or the looting mechanism; the grievance mechanism; the lengthening of conflicts; the militarization of areas and the relationships between corruption and conflict. With respect to the looting mechanism, the locations of mining projects are dictated by ‘idiosyncratic natural endowments’(Collier 2000, 93). It can take several years, and hundreds of millions of dollars, for a mining company to find, develop, and begin to mine a major mineral deposit (Soussan 1988). Once a mining project is developed it cannot be relocated and a mining company has a substantial incentive to pay funds to armed groups in exchange for being allowed to operate (Le Billon 2001; Buhaug and Gates 2002; Ross 1999, 2004b). The vulnerability of mining companies to extortion raises some serious concerns about the viability of mining, as a method of achieving economic development, in an area subject to armed conflict. Buhaug and Gates (2002), Le Billon (2001) and Ross (1999, 2004b) argue that the vulnerability of a mining company to extortion, and its propensity to make payments to armed groups (given its high fixed costs and immobility), are factors that encourage an increase in the duration of the violence. Armed groups can extract money from mining project proponents to buy more, and better, weapons. With lucrative payments from mining companies, insurgents have a reduced incentive to stop their activities and the violence continues and, possibly, worsens. According to Ross (1999), the potential for extractive industries to worsen conflict is so serious it is referred to as a ‘violent form of the resource curse’. Ross (1999) suggests that the violence occasioned by the extortion of the mining companies makes it more difficult for firms engaged in other types of economic activity and the economic structure of the country becomes distorted and over reliant upon mining. The issue of payments by extractive companies in conflict zones has been addressed by a 2001 initiative sponsored by the American, British, Dutch and Norwegian governments (as well as a group of mining and oil companies) called the ‘Voluntary Principles on Security and Human Rights’(Global Witness 2005). This initiative is somewhat limited in its effectiveness because it only creates voluntary guidelines, which are not binding on the companies (Global Witness 2005). It is doubtful as to whether this voluntary initiative will have any effect in reducing the scope extractive industries pose for an aggravation of a conflict by locating in a conflict zone. In the words of Global Witness (2005, 33), ‘it seems that a company can endorse the Voluntary Principles, and draw the reputational benefits, without providing any information to the public about any payments that it makes to armed parties to a conflict’.

AT: Platinum Adv

No impact to platinum- replacements

No impact to platinum shortage, there are a number of viable replacements

Blair 2000 (Brad R., Bachelor's degree in Engineering Geology, and Master's degrees in Mining Engineering and Mineral Economics from the Colorado School of Mines and consultant with NASA, “The Role of Near Earth Asteroids in Long-Term Platinum Supply”, <http://www.nss.org/settlement/asteroids/RoleOfNearEarthAsteroidsInLongTermPlatinumSupply.pdf>, 5/5/00, accessed 6/27/11)CNW

Numerous substitutes exist for platinum. Their use depends on market and price behavior. Other platinum-group metals such as rhodium and palladium can substitute for specific catalytic reactions along with iron and cobalt. Gold is a common substitute for jewelry and investment-grade coins or bars. Palladium has been used as a substitute autocatalyst since 1995 due to low relative prices (Johnson Matthey, 1999). In general, the chemical similarity among PGMs governs the potential for substitution among many of the metallic members, with pricing trends typically dictating the exact substitution characteristics. However, it should be noted that specific platinum-group metals generate optimal chemical performance for a given reactor design, limiting substitution where manufacturing changes are difficult to implement in the short term.

AT: Hydrogen econ

Platinum Supply solves

We have enough platinum to fulfil the demand for fuel cells and stabilize prices

Platinum Today 04 (the world’s leading authority on platinum group metals, “Platinum supplies sufficient to meet fuel cell demand”, 1/28/04, http://www.platinum.matthey.com/news-archive/platinum-supplies-sufficient-to-meet-fuel-cell-demand/, accessed 7/11/11)CNW

A new study commissioned by the US Department of Environment has confirmed there are sufficient supplies and resources in the ground to meet the long-term demand for platinum from all applications, including fuel cells.

Conducted by TIAX, formerly Arthur D Little's Technology & Innovation business, to specifically examine the availability of platinum for use in fuel cells, the report concludes that platinum supplies will not be a barrier to fuel cell commercialisation.

The study also explained that the platinum industry is already expanding primary production at a rate required to meet platinum demand from fuel cell vehicles. 'We commend the US Department of Energy for commissioning an independent study on this very important technology development issue,' commented Marcus Nurdin, managing director of the International Platinum Association.

'Platinum provides the necessary catalyst for low-temperature fuel cells of the type being developed for transportation and other uses in the future. These fuel cells will help usher in the coming hydrogen economy with its environmental and energy security benefits.'

According to the TIAX study, increased demand for platinum will probably increase platinum prices in the short term, but as platinum supplies are sufficient to meet expected demand, prices should stabilise over the longer term.

Tech innovation solves for platinum shortages for hydrogen cells

Charles E. Thomas Company 09 (The Thomas Group is a diverse business operation made up of several different companies and divisions operating throughout the entire West Coast, “Will there be enough platinum?”, 10/27/09, http://www.cleancaroptions.com/Will\_there\_be\_enough\_platinum.pdf, accessed 7/11/11)CNW

With these assumptions, the US would consume approximately 35% of today’s known world platinum reserves by the end of the century. If we take into account FCEVs deployed in the rest of the world with these assumptions, then the platinum supply as we know it today might be stressed under these conditions. However, as with most minerals and fossil fuels, new mining technology always leads to new discoveries of reserves.

However, we have assumed that platinum loading stays at 16 g/FCEV after 2020, while experts are projecting values as low as 5.7 g/FCEV and there are many R&D programs around the world developing fuel cells without any precious metal catalysts. If only 5.7 g/FCEV was sufficient, then a mining industry growth rate of less than 1%/year would be required. In addition, even the mining industry production ramp rate of 2%/year assumed here could be doubled according to the UK Department of Transport, which should be sufficient to cover FCEV introduction to the rest of the world.

No solvency- public skepticism

Public Skepticism will prevent a hydrogen economy from being fully integrated.

Uhrig 04 (Robert E., professer of nuclear engineering, Engineering Challenges of the Hydrogen Economy, <http://www.roberteuhrig.com/articles/files/HydrogenEconomy-BENT.pdf>, Spring 2004, NC)

The concept of a hydrogen economy as a way to reduce the U.S. dependence on foreign oil has not stirred opposition by the public. They seem to like the hydrogen plus oxygen equals electricity plus clean water concept. However, the public has become uneasy with technological solutions, and many seem to be taking a wait-and-see view. In the three decades it may take to implement the hydrogen economy, there will be many unforeseen developments, and the public will be considering alternatives that look attractive at the time they secure a new or different vehicle, typically every four-to-five years. Indeed, the average life cycle is 10-12 years for automobiles and longer for heavy commercial vehicles. This long life cycle is one of the reasons that it will take so long to implement a hydrogen economy. The hydrogen economy would eventually affect every motorist personally. Many spend a substantial fraction of their income for automotive transportation. A large increase in the cost of what they consider a necessity will not be a welcome change. A significant decrease in performance or loss of comfort features (air conditioning, adequate room, power steering, power windows and locks, etc.) will not be viewed favorably. In the final analysis, the economics associated with the hydrogen economy and the benefits it provides will determine its acceptability by the public. It is not preordained that the hydrogen economy will be achieved, although it can probably be achieved at some cost. Whether that cost will be acceptable to the general public will depend upon many factors that cannot be foreseen, e.g., technological breakthroughs, geo-political situations, new discoveries of fuel reserves, and luck—that can be either good or bad.

Hydrogen economy doesn’t solve

Exclusive hydrogen economy can’t solve – other technologies can – and their authors are hacks

Behar, Popular Science, 5

(“Warning: The Hydrogen Economy May Be More Distant Than It Appears”, Popular Science, Jan. 2005, http://www.michaelbehar.com/popsci/warninghydrogen.html, accessed 6-21-11, AH)

The near-future prospects for a hydrogen economy are dim, concludes The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs, a major government-sponsored study published last February by the National Research Council. Representatives from ExxonMobil, Ford, DuPont, the Natural Resources Defense Council and other stakeholders contributed to the report, which urges lawmakers to legislate tougher tailpipe-emission standards and to earmark additional R&D funding for renewable energy and alternative fuels. It foresees “major hurdles on the path to achieving the vision of the hydrogen economy” and recommends that the Department of Energy “keep a balanced portfolio of R&D efforts and continue to explore supply-and-demand alternatives that do not depend on hydrogen.” Of course, for each instance where the study points out how hydrogen falls short, there are scores of advocates armed with data to show how it can succeed. Physicist Amory Lovins, who heads the Rocky Mountain Institute, a think tank in Colorado, fastidiously rebuts the most common critiques of hydrogen with an armada of facts and figures in his widely circulated white paper “Twenty Hydrogen Myths.” But although he’s a booster of hydrogen, Lovins is notably pragmatic. “A lot of silly things have been written both for and against hydrogen,” he says. “Some sense of reality is lacking on both sides.” He believes that whether the hydrogen economy arrives at the end of this decade or closer to midcentury, interim technologies will play a signal role in the transition. The most promising of these technologies is the gas-electric hybrid vehicle, which uses both an internal combustion engine and an electric motor, switching seamlessly between the two to optimize gas mileage and engine efficiency. U.S. sales of hybrid cars have been growing steadily, and the 2005 model year saw the arrival of the first hybrid SUVs—the Ford Escape, Toyota Highlander and Lexus RX400h. Researchers sponsored by the FreedomCAR program are also investigating ultralight materials—plastics, fiberglass, titanium, magnesium, carbon fiber—and developing lighter engines made from aluminum and ceramic materials. These new materials could help reduce vehicle power demands, bridging the cost gap between fossil fuels and fuel cells. Most experts agree that there is no silver bullet. Instead the key is developing a portfolio of energy- efficient technologies that can help liberate us from fossil fuels and ease global warming. “If we had a wider and more diverse set of energy sources, we’d be more robust, more stable,” says Jonathan Pershing, director of the Climate, Energy and Pollution Program at the World Resources Institute. “The more legs your chair rests on, the less likely it is to tip over.” Waiting for hydrogen to save us isn’t an option. “If we fail to act during this decade to reduce greenhouse gas emissions, historians will condemn us,” Romm writes in The Hype about Hydrogen. “And they will most likely be living in a world with a much hotter and harsher climate than ours, one that has undergone an irreversible change for the worse.”

Hyrdrogen econ uses resources

Hydrogen economy requires non-renewable energy and requires trillions of gallons of water

Behar, Popular Science, 5

(“Warning: The Hydrogen Economy May Be More Distant Than It Appears”, Popular Science, Jan. 2005, http://www.michaelbehar.com/popsci/warninghydrogen.html, accessed 6-21-11, AH)

Perform electrolysis with renewable energy, such as solar or wind power, and you eliminate the pollution issues associated with fossil fuels and nuclear power. Trouble is, renewable sources can provide only a small fraction of the energy that will be required for a full-fledged hydrogen economy. From 1998 to 2003, the generating capacity of wind power increased 28 percent in the U.S. to 6,374 megawatts, enough for roughly 1.6 million homes. The wind industry expects to meet 6 percent of the country’s electricity needs by 2020. But economist Andrew Oswald of the University of Warwick in England calculates that converting every vehicle in the U.S. to hydrogen power would require the electricity output of a million wind turbines—enough to cover half of California. Solar panels would likewise require huge swaths of land. Water is another limiting factor for hydrogen production, especially in the sunny regions most suitable for solar power. According to a study done by the World Resources Institute, a Washington, D.C.–based nonprofit organization, fueling a hydrogen economy with electrolysis would require 4.2 trillion gallons of water annually—roughly the amount that flows over Niagara Falls every three months. Overall, U.S. water consumption would increase by about 10 percent.

Hydro leaks cause warming

Hydrogen gas leaks are likely in a hydrogen economy and cause global warming

Behar, Popular Science, 5

(“Warning: The Hydrogen Economy May Be More Distant Than It Appears”, Popular Science, Jan. 2005, http://www.michaelbehar.com/popsci/warninghydrogen.html, accessed 6-21-11, AH)

Hydrogen gas is odorless and colorless, and it burns almost invisibly. A tiny fire may go undetected at a leaky fuel pump until your pant leg goes up in flames. And it doesn’t take much to set compressed hydrogen gas alight. “A cellphone or a lightning storm puts out enough static discharge to ignite hydrogen,” claims Joseph Romm, author of The Hype about Hydrogen: Fact and Fiction in the Race to Save the Climate and founder of the Center for Energy and Climate Solutions in Arlington, Virginia. A fender bender is unlikely to spark an explosion, because carbon-fiber-reinforced hydrogen tanks are virtually indestructible. But that doesn’t eliminate the danger of leaks elsewhere in what will eventually be a huge network of refineries, pipelines and fueling stations. “The obvious pitfall is that hydrogen is a gas, and most of our existing petrochemical sources are liquids,” says Robert Uhrig, professor emeritus of nuclear engineering at the University of Tennessee and former vice president of Florida Power & Light. “The infrastructure required to support high-pressure gas or cryogenic liquid hydrogen is much more complicated. Hydrogen is one of those things that people have great difficulty confining. It tends to go through the finest of holes.” To calculate the effects a leaky infrastructure might have on our atmosphere, a team of researchers from the California Institute of Technology and the Jet Propulsion Laboratory in Pasadena, California, looked at statistics for accidental industrial hydrogen and natural gas leakage—estimated at 10 to 20 percent of total volume—and then predicted how much leakage might occur in an economy in which everything runs on hydrogen. Result: The amount of hydrogen in the atmosphere would be four to eight times as high as it is today. The Caltech study “grossly overstated” hydrogen leakage, says Assistant Secretary David Garman of the Department of Energy’s Office of Energy Efficiency and Renewable Energy. But whatever its volume, hydrogen added to the atmosphere will combine with oxygen to form water vapor, creating noctilucent clouds—those high, wispy tendrils you see at dawn and dusk. The increased cloud cover could accelerate global warming.

**No solvency- warming not anthropegenic**

There are a number of reasons why global warming isn’t caused by humans

**Paterson 11**(norman r. Geoscience Canada, Global Warming: A Critique of the Anthropogenic Model and its consequences, <http://web.ebscohost.com/ehost/detail?sid=a2470082-1bd5-421c-ac2c-b20e1bc50407%40sessionmgr112&vid=1&hid=108&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d>, March 2011, NC)

The fact that the world has undergone cycles of warming and cooling has been known for a very long time, but the question as to man's influence on climate did not become a hot debate until after the mid-twentieth century, when Revelle and Seuss (1957) first drew attention to the possible effect of greenhouses gases (particularly CO2) on the earth's temperature. Subsequent studies pointed to the increase in atmospheric CO2 from roughly 0.025% to 0.037%, or 50%, over the past 100 years. Much was made of the apparent but crude covariance of atmospheric CO2 and global temperature, and the conclusion was drawn that man's escalating carbon emissions are responsible for the late 20th century temperature rise. Anxiety was rapidly raised among environmentalists, and also attracted many scientists who found ready funding for studies aimed at better understanding the problem. However, scientists soon encountered three important difficulties: i) To this date, no satisfactory explanation is forthcoming as to how CO2 at less than 0. 04% of atmospheric concentration can make a major contribution to the greenhouse effect, especially as the relationship between increasing CO2 and increasing temperature is a diminishing logarithmic one (Gerlich and Tscheuschner 2009); ii) Geological records show unequivocally that past temperature increases have always preceded, not followed, increases in CO2; i.e. the warming could potentially cause the CO2 increase, but not the reverse. Studies (e.g. Petit et al. 1999) have shown that over the past 400 000 years of cyclical variations, temperature rose from glacial values about 800 years before CO2 concentration increased. A probable explanation is that solar warming, over a long period of time, causes the oceans to outgas CO2, whereas cooling results in more CO2 entering solution, as discussed by Stott et al. (2007). Averaged over a still longer period of geological time, it has been shown (Shaviv and Veizer 2003) that there is no correlation between CO2 and temperature; for example, levels of CO2 were more than twice present day values at 180 Ma, at a time when temperature was several degrees cooler; iii) Other serious mistakes in analysis were made by some scientists over the years. Perhaps the worst of these (see Montford 2010 for a thorough discussion) was the publication of the 'Hockey Stick Curve' (Fig. 1), a 1000-year record of past temperature which purported to show that "The 20th century is likely the warmest century in the Northern Hemisphere, and the 1990s was the warmest decade, with 1998 as the warmest year in the last 1000 years" (Mann et al. 1999). This conclusion was adopted by the Intergovernmental Panel on Climate Change (IPCC) in its 2001 report and also by Al Gore in the movie An Inconvenient Truth. Subsequently, Mann et al.'s work has been challenged by several scientists (though to be fair, it is also supported by some). For example, McIntyre and McKitrick (2003) amended Mann's graph, using all available data and better quality control (Fig. 1), and showed that the 20th century is not exceptionally warm when compared with that of the 15th century. However, the IPCC has continued to report a steady increase in global temperature in the face of clear evidence that average temperature has remained roughly level globally, positive in the northern hemisphere and negative in the southern hemisphere, since about 2002 (Archibald 2006; Fig. 2).

No warming- studies wrong

Warming comes from false studies

Paterson 11 (norman r. Geoscience Canada, Global Warming: A Critique of the Anthropogenic Model and its consequences, <http://web.ebscohost.com/ehost/detail?sid=a2470082-1bd5-421c-ac2c-b20e1bc50407%40sessionmgr112&vid=1&hid=108&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d>, March 2011, NC)

It is likely that the cyclical warming and cooling of the earth results from a number of different causes, none of which, taken alone, is dominant enough to be entirely responsible. The more important ones are solar changes (including both irradiance and magnetic field effects), atmosphere-ocean interaction (including both multidecadal climatic oscillations and unforced internal variability), and greenhouse gases. All of these factors have been discussed by IPCC, but the first two have been dismissed as negligible in comparison with the greenhouse-gas effect and man's contribution to it through anthropogenic CO2. It is claimed (e.g. Revelle and Suess 1957) that the particular infrared absorption bands of CO2 provide it with a special ability to absorb and reradiate the sun's longer wavelength radiation, causing warming of the troposphere and an increase in high-altitude (cirrus) cloud, further amplifying the heating process. Detailed arguments against this conclusion can be found in Spencer et al. (2007) and Gerlich and Tscheuschner (2009). These scientists point out (among other arguments, which include the logarithmic decrease in absorptive power of CO2 at increasing concentrations), that clouds have poor ability to emit radiation and that the transfer of heat from the atmosphere to a warmer body (the earth) defies the Second Law of Thermodynamics. They argue that the Plank and Stefan-Boltzman equations used in calculations of radiative heat transfer cannot be applied to gases in the atmosphere because of the highly complex multi-body nature of the problem. Veizer (2005) explains that, to play a significant role, CO2 requires an amplifier, in this case water vapour. He concludes that water vapour plays the dominant role in global warming and that solar effects are the driver, rather than CO2. A comprehensive critique of the greenhouse gas theory is provided by Hutton (2009). It is firmly established that the sun is the primary heat source for the global climate system, and that the atmosphere and oceans modify and redirect the sun's heat. According to Veizer (2005), cosmic rays from outer space cause clouds to form in the troposphere; these clouds shield the earth and provide a cooling effect. Solar radiation, on the other hand, produces a thermal energy flux which, combined with the solar magnetic field, acts as a shield against cosmic rays and thereby leads to global warming. Figures 3 and 4 illustrate both the cooling by cosmic rays (cosmic ray flux, or CRF) and warming by solar irradiation (total solar irradiance, or TSI) in the long term (500 Ma) and short term (50 years), respectively. CRF shows an excellent negative correlation with temperature, apart from a short period around 250 Ma (Fig. 3). In contrast, the reconstructed, oxygen isotope-based temperature curve illustrates a lack of correlation with CO2 except for a period around 350 Ma.

AT: Asteroid Adv

**UQ- we have the knowledge**

NASA already has knowledge to protect itself from an asteroid crisis—NEAR mission proves

Newsweek 01 (Newsweek, American weekly news source based in New York City, Newsweek February 26, 2001, A*n Erotic Encounter: The NEAR spacecraft's landing on the asteroid Eros promises a wealth of astronomical information.*, February 26, 2001, [http://find.galegroup.com/ovrc/retrieve.do?subjectParam=Locale%2528e n%252C%252C%2529%253AFQE%253D%2528su%252CNone%252C8%2529asteroid%2524&contentSet=IAC-Documents&sort=DateDescend&tabID=T003&sgCurrentPosition=0&subjectAction=DISPLAY\_SUBJECTS&prodId=OVRC&searchId=R1&currentPosition=2&userGroupName=gonzagaufoley&resultListType=RESULT\_LIST&sgHitCountType=None&qrySerId=Locale%28en%2C%2C%29%3AFQE%3D%28SU%2CNone%2C8%29asteroid%24&inPS=true&searchType=BasicSearchForm&displaySubject=&docId=A70738141&docType=IAC](http://find.galegroup.com/ovrc/retrieve.do?subjectParam=Locale%2528en%252C%252C%2529%253AFQE%253D%2528su%252CNone%252C8%2529asteroid%2524&contentSet=IAC-Documents&sort=DateDescend&tabID=T003&sgCurrentPosition=0&subjectAction=DISPLAY_SUBJECTS&prodId=OVRC&searchId=R1&currentPosition=2&userGroupName=gonzagaufoley&resultListType=RESULT_LIST&sgHitCountType=None&qrySerId=Locale%28en%2C%2C%29%3AFQE%3D%28SU%2CNone%2C8%29asteroid%24&inPS=true&searchType=BasicSearchForm&displaySubject=&docId=A70738141&docType=IAC), AG)

NEAR's prospects weren't always so bright. In 1998, engineers lost contact with the craft when it malfunctioned during an engine burn. There was nothing to do but sit and wait for NEAR to right itself--or become a piece of pricey space junk. Luckily, NEAR followed its on-board instructions to the letter, shutting down, recharging and eventually beaming a signal back to Earth. The glitch threw NEAR off track, but it finally settled into orbit around Eros last Valentine's Day. Snapping pictures of craters, boulders and dust, NEAR's cameras uncovered intriguing features. Although space trash probably slams Eros all the time, the asteroid has surprisingly few small craters. And some of the larger craters have been filled in. That suggests that something is shifting dust around on Eros's surface. But what? The asteroid has no atmosphere, and certainly no water. Other instruments collected data on what Eros is made of. Scientists care about that because an asteroid's composition might tell us about the early days of the solar system: these rocks are thought to be made of the same stuff from which planets coalesced. Oh, and there's another reason composition matters: an asteroid rammed into Earth and wiped out the dinosaurs 65 million years ago. If one threatens us, "we'll need to know what it's made of before we send up a rocket to divert or detonate it," says NEAR project manager Thomas Coughlin. One day, then, NEAR may help save our puny planet from annihilation. Since NEAR cost just $223 million, that would be quite a bargain.

AT: Asteroid impacts- prefer faster timeframe

Their impacts are too far off to matter, prefer immediate impacts.

Williams 10 (Lynda, physics faculty member at Santa Rose Junior College, Peace Review, Irrational Dreams of Space Colonization, <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=588d444f-d6f9-46a1-927f-193750aefcd9%40sessionmgr11&vid=1&hid=19>, Academic Search Premier, NC)

According to scientific theory, the destruction of Earth is a certainty. About five billion years from now, when our sun exhausts its nuclear fuel, it will expand in size and envelope the inner planets, including Earth, and burn them into oblivion. So yes, we are doomed, but we have five billion years, plus or minus a few hundred million, to plan our extraterrestrial escape. The need to colonize the moon or Mars to guarantee our survival is not pressing. There are also real risks due to collisions with asteroids and comets, although none are of immediate threat and do not necessitate extraterrestrial colonization. There are many Earth-based technological strategies that can be developed in time to mediate such astronomical threats, such as gravitational tugboats that drag the objects out of range. The solar system could also potentially be exposed to galactic sources of high energy gamma ray bursts that could fry all life on Earth; any moon or Mars base would face a similar fate. Thus, human-based colonies on the moon or Mars would not protect us from any of these astronomical threats in the near future. Life on Earth is more urgently threatened by the destruction of the biosphere and its life-sustaining habitat due to environmental catastrophes such as climate change, ocean acidification, disruption of the food chain, bio-warfare, nuclear war, nuclear winter, and myriads of other manmade doomsday possibilities. If we accept these threats as inevitabilities on par with real astronomical dangers and divert our natural, intellectual, political, and technological resources from solving these problems into escaping them, will we be playing into a self-fulfilling prophesy of our own planetary doom? Seeking space based solutions to our earthly problems may actually exacerbate the planetary threats we face. This is the core of the ethical dilemma posed by space colonization: should we put our resources into developing human colonies on other worlds to survive natural and manmade catastrophes, or should we focus all of our energies on solving and mitigating the problems that create these threats on Earth?

Asteroids won’t hit us for at least 100 years

KATARINA FILIPE, Last updated 05:00 24/09/2010, Asteroid hitting earth ruled out any time soon, Alan Gilmore: Position Superintendent - Mt John University Observatory, Qualifications; B.Sc. (Wellington),

http://www.stuff.co.nz/timaru-herald/news/4162739/Asteroid-hitting-earth-ruled-out-any-time-soon, ES,

We will not be around then, but there is a chance – in the very distant future – of an asteroid hitting Earth with four times the energy of a magnitude 9 earthquake. Near-Earth object (NEO) Apophis was first discovered in mid-2004, and since then the possibility of it hitting Earth before 2036 has been ruled out, according to the University of Canterbury's Mt John Observatory. Instead, resident superintendent Alan Gilmore said all Kiwis would see was a star with a slightly lower level of brightness as the fifth star in the Southern Cross. Apophis was basically a pile of rubble, held loosely together by its own gravity. It orbited the sun in about 10 1/2 months and had a diameter of 300 metres. On Friday, April 13, 2029 it will pass about 30,000 kilometres from Earth. "It will be bright enough to see as a little star moving across the Northern sky," Mr Gilmore said. In New Zealand, however, it will be quite faint that evening, reaching its brightest point about 9.45am on April 14, 2029. Mr Gilmore said the aim of astronomers was "to find such an object before it finds us" and, if necessary, change its path to avoid a collision with Earth. "So far it's the only thing on the list that's a real concern [because] it's the closest. We know it won't hit us in 2029 and we've now established it won't hit us in 2036 ... but it's still in the neighbourhood." Mr Gilmore said astronomers could calculate orbits, with confidence, 100 years ahead "but beyond that uncertainty starts to grow".

**Asteroids unlikely**

**Even if asteroids cause extinction, the probability is very low**

Bucknam and Gold in 2008 (Mark and Robert. Bucknam is the Deputy Director for Plans in the Policy Planning Office of the Office of the US Secretary of Defense. Gold is the Chief Technologist for the Space Department at the Applied Physics Laboratory of Johns Hopkins University. Survival. *Asteroid Threat? The Problem of Planetary Defence Volume 50, Issue 5*  October 1, 2008) TS

On 13 April 2029, an asteroid the size of 50 US Navy supercarriers and weighing 200 times as much as the USS Enterprise will hurtle past the Earth at 45,000 kilometres per hour – missing by a mere 32,000km, closer to Earth than the 300 or so communications satellites in geosynchronous orbit. In astronomical terms it will be a very near miss. The asteroid, called 99942 Apophis, is named after an ancient Egyptian god of destruction: for several months after it was discovered in 2004, scientists were concerned that Apophis might strike the Earth. It still might, though not in 2029. If, on its close approach in 2029, Apophis passes through what is known as a ‘gravitational keyhole’, its orbit will be perturbed so as to cause it to hit the Earth in 2036 – striking with an energy equivalent to 400 megatonnes of TNT. Although the chances of a 2036 impact are judged to be just one in 45,000, it is unnerving to recall that until just a few years ago, Apophis was completely unknown to mankind, and that similarly sized asteroids have silently shot past Earth in recent years, only to be discovered after the fact. An asteroid like Apophis would cause considerable damage if it collided with Earth. If it hit on land, it would make a crater about 6km across and the shock wave, ejecta and superheated air would level buildings and trees and ignite fires over a wide area. 1 If it hit an ocean, it would cause a devastating cycle of gradually diminishing tsunamis. Scientists cannot yet predict the exact point Apophis might impact in 2036, but their current assessment predicts it would be somewhere along a long, lazy backward ‘S’ running from northeastern Kazakhstan through Siberia, north of Japan and across the Pacific Ocean before dipping south to converge with the west coast of North America; running eastward across Panama, Columbia and Venezuela, and finally terminating around the west coast of Africa near Senegal. The mid-point of this line lies several hundred kilometres west of Mexico’s Baja Peninsula, about midway between Honolulu and Los Angeles. The tsunami from an ocean impact would likely inflict horrific human and economic losses – damage from Apophis could certainly surpass the Indian Ocean tsunami of 26 December 2004, which claimed over 200,000 lives and inflicted damages on the order of $15 billion Small probability, huge impact Apophis is not the only massive and potentially threatening object crossing Earth’s orbit. Larger objects that could inflict even greater damage also circulate in Earth’s neighbourhood. Fortunately, larger objects are proportionally rarer. There are roughly 100 times as many objects onetenth the size of Apophis, and only one-hundredth as many objects ten times its size. At one-tenth the size of Apophis – approximately 23m across – an asteroid is big enough to make it through Earth’s atmosphere but unlikely to do widespread damage. As a point of comparison, some 50,000 years ago an asteroid roughly 46m in diameter is thought to have created Arizona’s impressive 1,200m-wide Meteor Crater. Scientists estimate impacts from asteroids of that size occur, on average, approximately once every 1,000 years. 2 At ten times the size of Apophis – roughly 2.3km across – an asteroid colliding with Earth would cause global effects and could kill tens of millions, if not billions, of people. Finally, the National Aeronautics and Space Administration (NASA) has categorised a strike from a 10km-wide asteroid as ‘an extinction-class event’. 3 An asteroid of that size is widely believed to have hit the continental shelf off Mexico’s Yucatán Peninsula some 65m years ago, near the present-day town of Chicxulub, wiping out an estimated 70% of all animal species, including the dinosaurs. 4 Fortunately, such catastrophes are estimated to occur only once every 100m years. 5 On average, a 1.5km asteroid will strike the Earth approximately every 500,000 years. The devastation from such an impact could kill up to 1.5 billion people. In one sense, that puts the risk of dying from an asteroid strike on a par with dying from a passenger-aircraft accident—around 1 in 20,000 averaged over a 65-year lifetime. But half a million years is so long compared to a human lifespan that it defies believable comparison. Twenty thousand generations will go unscathed for each generation that is decimated by a 1.5km asteroid. Aeroplanes have been around for little more than a century, and fatal aircraft accidents occur every year, so it is not difficult to convince people of the risks associated with flying and the need to spend money to improve flying safety standards The chances of Earth being hit by a comet are even smaller than for asteroids. Finally, the National Aeronautics and Space Administration (NASA) has categorised a strike from a 10km-wide asteroid as ‘an extinction-class event’. 3 An asteroid of that size is widely believed to have hit the continental shelf off Mexico’s Yucatán Peninsula some 65m years ago, near the present-day town of Chicxulub, wiping out an estimated 70% of all animal species, including the dinosaurs. 4

**Asteroid prevention->backlash**

US attempts to prevent an asteroid-related calamity would spark an international backlash.

Cowen 09 (Robert B., columnist for the Christian Science monitor, The Christian Science Monitor May 14, 2009, *Who is responsible for averting an asteroid strike?; Column: It's time to set aside political quibbles and form an international plan.*, May 14, 2009 AG)

Asteroid hunters have good news - and a challenge - for the rest of us.After an extensive search for asteroids a kilometer or more across, engineer Steve Chesley says that "we can now say with confidence that no asteroids large enough to cause such a global calamity [as killing off the dinosaurs] are headed our way." But if one of them - or even a smaller, city-destroying rock - were detected on a collision course, would the world community be prepared to handle it? A conference of legal experts that discussed this question at the University of Nebraska in Lincoln last month answered it with a resounding "No." Scientists and engineers who have studied the problem of deflecting a dangerous asteroid believe the technical issues are difficult but solvable. The challenge now is figuring out the legal issues of who takes action on behalf of humankind and of what their responsibilities and liabilities will be. Asteroid hunters believe they can give us plenty of warning. There is "a fair chance that the next Earth impactor will actually be identified with many decades and perhaps centuries of warning time," explains Mr. Chesley of the NASA Jet Propulsion Laboratory in Pasadena, Calif., in the March/April issue of the Planetary Report. That's plenty of time to develop a spacecraft whose gravitational attraction might nudge an asteroid aside - or a rocket or some application of nuclear explosives to do the job. However, if a single country - or small group of nations - tries to take the initiative on its own, the international reaction could stall any action at all. "The international political reactions to the US shooting down one of its own satellites a year ago to prevent presumably dangerous and toxic rocket fuel from reaching Earth only foreshadows what would happen if the US would detonate nukes claiming to destroy an incoming asteroid," said Frans von der Dunk, a University of Nebraska space law expert, at the Nebraska conference, according to Space News. Overlooking the hype about nuclear weapons, which engineers consider an unlikely, extreme measure, Professor von der Dunk has pointed out the main issue. Averting a regional or global asteroid threat may involve unforeseen collateral damage - such as splintered chunks making their way to Earth or worse. Therefore, the world community has to have a say in how that threat is handled.Right now, to use von der Dunk's word, that community is "underorganized" to meet this challenge. Getting organized for possible future action is less urgent than coping with global warming. But like any good insurance planning, it should not languish on the back burner of global politics. This need will come into sharper focus as the new Pan-STARRS 1 telescope in Hawaii goes into action this spring. Its mission to catalogue objects across the entire sky will pick out many more asteroids, large and small. Someday those facts may foretell a future impact. The world community should make sure that it has its response plan in order with the legal mechanism for assigning responsibilities in place.

Mining causes asteroid impact

An accident on a NEO could send it on a collision course to Earth, destroying it

Marks 10 (Joel, professor emeritus of philosophy at the University of New Haven and a former Focal Point contributor , Sky and Telescope, First, Do no Harm, December 2010, Academic Search Complete, NC)

A NEW ERA in humanity's relationship to asteroids has begun. Up until now we've been at their mercy, never knowing if and when one might strike Earth and devastate a city or even wipe out civilization. So it was reassuring that in the 1990s the U.S. Congress directed NASA to begin inventorying near-Earth objects (NEOs). This project has proceeded apace, although a more recent expansion of its purview has not yet been adequately funded. What prompts my writing, however, is a different sort of venture. In late 2009, Anatoly Perminov, head of the Russian Federal Space Agency, announced that his country is considering a robotic spacecraft mission to Apophis, a 270-meter-wide asteroid that, when discovered in 2004, was deemed a possible impactor. The threat has since subsided with improved tracking data. Nevertheless, a successful mission to Apophis could serve as a proof of concept for some sort of deflection technology (see page 22). Indeed, Apophis has been on the mind of many people for just this purpose, including folks at NASA. Russia's involvement confirms that technology now makes it feasible that sometime soon individual nations or even wealthy organizations could begin to play with asteroids. This is not a comforting thought. Immanuel Kant once wrote, "The prescriptions needed by a doctor in order to make his patient thoroughly healthy and by a poisoner in order to make sure of killing his victim are of equal value so far as each serves to bring about its purpose perfectly." Just so, the very device that could divert an asteroid from impacting Earth could also shift a harmless asteroid into an orbit that targets Earth. This would be analogous to the way passenger airliners were converted into lethal missiles on September 11, 2001. Furthermore, there need not be a deliberate intention but only incompetence or malfunction. So a James Bond villain is not required. Simply recall the Hubble Space Telescope, which was launched into orbit with a defective primary mirror due to human error. Apophis is the perfect case in point because its now-predicted near misses of Earth in 2029 and 2036 could, with an artificial nudge, conceivably put our planet back in the bull's-eye. Since near-Earth asteroids are attractive for various commercial ventures, such as mining, it's clear that humans and machines will be visiting them with increasing frequency. For all these reasons, it's imperative to monitor NEOs and the traffic to them. Fortunately, Perminov spoke of inviting a cooperative effort with NASA and other space agencies. But it seems to me that the risks of miscalculation and the reality of human renegades, not to mention the numerous inherent uncertainties that bedevil various intervention strategies, now call for a more formal approach to human-asteroid relations. While the level of research to reduce the uncertainties should certainly be ratcheted up, so too should the oversight of all missions to NEOs. As with the development of nuclear weapons, both a race among competing nations and unchecked proliferation would be the worst sort of models for efforts to avert the very real NEO danger.

**No Impact- Asteroid Painting**

We can deflect any asteroid by changing the speed of its orbit

KATARINA FILIPE, Last updated 05:00 24/09/2010, Asteroid hitting earth ruled out any time soon, Alan Gilmore: Position Superintendent - Mt John University Observatory, Qualifications; B.Sc. (Wellington),

http://www.stuff.co.nz/timaru-herald/news/4162739/Asteroid-hitting-earth-ruled-out-any-time-soon, ES,

Mr Gilmore said astronomers could calculate orbits, with confidence, 100 years ahead "but beyond that uncertainty starts to grow". If Apophis was to hit, Mr Gilmore said the effect would be "considerable". "Its kinetic energy is about four times the energy of a magnitude 9 earthquake. Most of that energy would be turned into heat so it would cook the ground below it ... A lot of the rocks would hit the ground, a lot of dust would be thrown into the atmosphere. "The main problem with these things is dying of starvation. It would be locally devastating but the real worry is the global impact of the dust being left in the atmosphere .... [for] weeks probably." If an NEO looked likely to hit Earth, there were several steps that could be taken, Mr Gilmore said. "The idea is ... to very, very slightly speed the object up or slow it down." A solar-powered rocket could be landed on the object, a spacecraft could be parked beside it or it could be painted a different colour so the sun would affect its speed. In the meantime, the only date New Zealanders need to remember is Friday the 13th in 19 years.

Painting .5% of the surface of an asteroid will change its trajectory

D.C. Hyland 11 , Optimized Spacecraft Hovering Positioning for Painting an Asteroid, Professor of Aerospace Engineering S. Ge, N. Satak Graduate Students, Texas A&M University March 1, 2011, http://www.mendedreality.com/docs/apophis/sunlit.pdf, ES

An effective way of modifying an asteroid’s trajectory is altering the force due to the Yarkovsky effect, a secular force driven by differential thermal emission of a small rotating body. This is achievable through painting its surface so as to change its albedo, which will in turn change the temperature distribution and hence the emission of photonic momentum. Since only a relatively small portion of the asteroid must be painted ( .5% of the surface area), one important concern is to determine the optimal location to paint to generate the greatest torque. This can be achieved through dividing the asteroid into grids and calculating the torques from solar radiation emission in each grid and comparing different collections of grids corresponding to .5% of the surface area. This torque among other factors also depends on the angle between the normal to the surface and the sun. This is different for different regions due to the tilt in the asteroid spin axis relative to its orbit plane around the sun. Once these maximum-torque locations have been determined, these areas can be further narrowed down through determining areas of minimum spacecraft inertial hovering fuel consumption given a certain hovering altitude. To calculate the fuel consumption a decent knowledge of the gravity field of the asteroid is required. A polyhedron approximation of the shape of the asteroid can be used to calculate the gravity field around it. Using the above tools, this paper addresses an algorithm for determining such optimal hovering points and the optimal area to paint.

**No impact to asteroids**

NEO’s are currently unable to bring about Armageddon – NASA report proves

Robin 10 (Lloyd, writer for Scientific American, Scientific American Vol. 302 Issue 6, *Asteroid Collision*, June 2010, <http://web.ebscohost.com/ehost/detail?vid=3&hid=19&sid=b72dc9ab-5029-44a3-b990-dd>6fcfdcd98 6%40sessionmgr14&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d, AG)

On June 13 an asteroid called 2007 XB10 with a diameter of 1.1 kilometers--and the potential to cause major global damage--will zip past Earth. As far as near-Earth objects go, it will pass, fortunately, pretty far, at 10.6 million kilometers, or 27.6 times the Earth-moon distance. Indeed, no giant asteroids appear poised to rewrite history any time soon. The bad news is that we can expect in the next 200 years a small space rock to burst in the atmosphere with enough force to devastate a small city. A near-Earth object (NEO) is an asteroid or comet that comes within 195 million kilometers of the planet. In 2009 NASA tallied 90 as approaching within five lunar distances and 21 within one lunar distance or less. NEO hunters typically detect them as specks on images, and such momentary glimpses can make their orbits hard to calculate. So researchers can only lay odds of an impact as they await more data. NASA has spotted 940 NEOs one kilometer or more in diameter (about 85 percent of the estimated total of that size), and none will collide with Earth. (The NEO that wiped out the dinosaurs was about 10 kilometers wide.) The bigger threat now, however, involves the smaller rocks, according to a National Research Council (NRC) report released earlier this year. These asteroids and comets--100,000 or so of them span 140 meters or more--are too small to bring about an Armageddon, but even those at the lowest end of that range could deliver an impact energy of 300 megatons of TNT. And these events occur on average far more frequently (every 30,000 years or so for a 140-meter object) than, say, a one-kilometer impact (every 700,000 years). Given the possible danger, Congress mandated in 2005 that NASA find 90 percent of such NEOs by 2020. But budget shortfalls will make it impossible for scientists to meet that deadline, the NRC has found. NEO hunters get about $4 million in federal funding annually

AT: Econ Adv

AT: Econ- **Plan kills Chinese economy**

Mining space puts Chinese out of work collapse there econ

[Newitz](http://io9.com/people/Annalee/) Feb 19, 2010 — Annalee editor for the IO9 article Will Asteroid Mining Destroy The Chinese Economy” <http://io9.com/5475304/will-asteroid-mining-destroy-the-chinese-economy>

Instead of sending people to the Moon, the US space program is[sending robots to the Asteroid Belt](http://www.space.com/missionlaunches/090218-dawn-asteroid-mars.html). When these robots discover metals in the Belt, how will it affect the economy of Earth? Discovery's Robert Lamb reports on a lecture given by Vatican astronomer Guy J. Consolmagno, which was in part about the ethics of asteroid mining. Lamb writes: Can you put a price tag on an asteroid? Sure you can. We know of roughly 750 S-class asteroids with a diameter of at least 1 kilometer. Many of these pass as near to the Earth as our own moon — close enough to reach via spacecraft. As a typical asteroid is 10 percent metal, Brother Consolmango estimates that such an asteroid would contain 1 billion metric tons of iron. That's as much as we mine out of the globe every year, a supply worth trillions and trillions of dollars. Subtract the tens of billions it would cost to exploit such a rock, and you still have a serious profit on your hands. But is this ethical? Brother Consolmango asked us to ponder whether such an asteroid harvest would drastically disrupt the economies of resource-exporting nations. What would happen to most of Africa? What would it do to the cost of iron ore? And what about refining and manufacturing? If we spend the money to harvest iron in space, why not outsource the other related processes as well? Imagine a future in which solar-powered robots toil in lunar or orbital factories. "On the one hand, it's great," Brother Consolmango said. "You've now taken all of this dirty industry off the surface of the Earth. On the other hand, you've put a whole lot of people out of work. If you've got a robot doing the mining, why not another robot doing the manufacturing? And now you've just put all of China out of work. What are the ethical implications of this kind of major shift?" It seems to me that the economies of Earth might have undergone some shifts by the time we've got robot armies mining the Asteroid Belt. Still, the question is interesting. A number of authors, including Ken MacLeod and Paul McAuley, have suggested that Earth's future economy may become rigidly environmentalist to preserve the planet's habitability. Development planetside will grind to a halt, but old-fashioned dirty industry will thrive in space. So you could wind up with two human economies: A controlled, stable-state one on Earth, and a crazily free market one offworld.

AT: Econ- **Mining hurts econ**

Unmanned asteroid Mining disrupts the economy and breaks ethics—puts millions out of work and ruins resource-exporting nations

Lamb 10 (Robert, writer at DiscoveryNews, Discovery News, *The Ethics of Planetary Exploration and Colonization*, February 17. 10, <http://news.discovery.com/space/the-ethics-of-planetary-exploration-and-colonization.html>, AG)

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Turn: Instead of helping, asteroid mining actually hurts industries worldwide – Africa proves

Newitz 10 (Annalee, editor, io9.com, Will Asteroid Mining Destroy the Chinese Ecomony, <http://io9.com/5475304/will-asteroid-mining-destroy-the-chinese-economy>, February 19, 2010, NC)

Instead of sending people to the Moon, the US space program is sending robots to the Asteroid Belt. When these robots discover metals in the Belt, how will it affect the economy of Earth? Discovery's Robert Lamb reports on a lecture given by Vatican astronomer Guy J. Consolmagno, which was in part about the ethics of asteroid mining. Lamb writes: Can you put a price tag on an asteroid? Sure you can. We know of roughly 750 S-class asteroids with a diameter of at least 1 kilometer. Many of these pass as near to the Earth as our own moon — close enough to reach via spacecraft. As a typical asteroid is 10 percent metal, Brother Consolmango estimates that such an asteroid would contain 1 billion metric tons of iron. That's as much as we mine out of the globe every year, a supply worth trillions and trillions of dollars. Subtract the tens of billions it would cost to exploit such a rock, and you still have a serious profit on your hands. But is this ethical? Brother Consolmango asked us to ponder whether such an asteroid harvest would drastically disrupt the economies of resource-exporting nations. What would happen to most of Africa? What would it do to the cost of iron ore? And what about refining and manufacturing? If we spend the money to harvest iron in space, why not outsource the other related processes as well? Imagine a future in which solar-powered robots toil in lunar or orbital factories. "On the one hand, it's great," Brother Consolmango said. "You've now taken all of this dirty industry off the surface of the Earth. On the other hand, you've put a whole lot of people out of work. If you've got a robot doing the mining, why not another robot doing the manufacturing? And now you've just put all of China out of work. What are the ethical implications of this kind of major shift?" It seems to me that the economies of Earth might have undergone some shifts by the time we've got robot armies mining the Asteroid Belt. Still, the question is interesting. A number of authors, including Ken MacLeod and Paul McAuley, have suggested that Earth's future economy may become rigidly environmentalist to preserve the planet's habitability. Development planetside will grind to a halt, but old-fashioned dirty industry will thrive in space. So you could wind up with two human economies: A controlled, stable-state one on Earth, and a crazily free market one offworld

AT: Econ- **Mining hurts econ**

**Asteroid mining will create world-wide unemployment: mining and manufacturing**

Lamb 10 (Robert. science writer for HowStuffWorks.com. Discovery *THE ETHICS OF PLANETARY EXPLORATION AND COLONIZATION* Feb 17, 2010. Lexis) TS

Humans are no strangers to ravaging the land, but the stars have proven a good deal more elusive. So far, our ethical concerns have remained limited to the contamination of extraterrestrial environments, but what will the future bring? Last night I attended a lecture by Jesuit Brother Guy J. Consolmagno, a U.S. research astronomer and planetary scientist at the Vatican Observatory. He gave a very engaging talk about the ethics of exploration and planetary astronomy, touching on two particularly noteworthy items: Asteroid Mining Can you put a price tag on an asteroid? Sure you can. We know of roughly 750 S-class asteroids with a diameter of at least 1 kilometer. Many of these pass as near to the Earth as our own moon -- close enough to reach via spacecraft. As a typical asteroid is 10 percent metal, Brother Consolmango estimates that such an asteroid would contain 1 billion metric tons of iron. That's as much as we mine out of the globe every year, a supply worth trillions and trillions of dollars. Subtract the tens of billions it would cost to exploit such a rock, and you still have a serious profit on your hands. But is this ethical? Brother Consolmango asked us to ponder whether such an asteroid harvest would drastically disrupt the economies of resource-exporting nations. What would happen to most of Africa? What would it do to the cost of iron ore? And what about refining and manufacturing? If we spend the money to harvest iron in space, why not outsource the other related processes as well? Imagine a future in which solar-powered robots toil in lunar or orbital factories. "On the one hand, it's great," Brother Consolmango said. "You've now taken all of this dirty industry off the surface of the Earth. On the other hand, you've put a whole lot of people out of work. If you've got a robot doing the mining, why not another robot doing the manufacturing? And now you've just put all of China out of work. What are the ethical implications of this kind of major shift?" Brother Consolmango also stressed that we have the technology to begin such a shift today; we'd just need the economic and political will to do it. Will our priorities change as Earth-bound resources become more and more scarce? Most of our planetary colonization dreams revolve around changing the environments of other worlds to cater to our own astronomically particular needs. Seriously, imagine if the Smoking Gun posted humanity's tour rider for visiting other worlds. What utter divas we are!

AT: econ- no markets

Space mining markets are non-existent: nobody would fund it and it wouldn’t help the economy

Gerlach 05 (Charles L. founder and CEO of Gerlach Space Systems LLC 2005 INTERNATIONAL SPACE DEVELOPMENT CONFERENCE National Space Society *Profitably Exploiting Near-Earth Object Resources* May 19–22, 2005. Google Scholar) TS

When exploring the potential commercial viability of various space resources opportunities, the ideal candidates are those where an actual market exists today for the product. Obviously, to make money a product and a market are required. Markets are based on need. There is no market if no one wants to buy the product. Would-be space entrepreneurs have identified many products over the years, but most of the markets are non-existent, hypothetical or government dependent. No independent commercial demand exists today for space habitats and astrocrete or orbital water, oxygen, and metals or helium-3 on Earth except to supply government-sponsored activities. This requirement for existing markets is the reason space tourism is attracting so much attention in general discussions of commercial space development. Several market studies32 suggest that there is a readily identifiable group of customers who are willing to spend a specific amount of money today for the opportunity to travel into space. Most space resources development schemes, such as proposals to mine lunar helium-3 and return it to Earth for use in fusion power plants,33 are dependent not only on investment in the infrastructure to mine and return lunar helium-3 but also on the massive investment in time and capital required to actually build a working helium-3 fusion reactor (if that is possible at all in the foreseeable future).

**There is no volatile or ice deposit market or infrastructure**

Gerlach 05 (Charles L. founder and CEO of Gerlach Space Systems LLC 2005 INTERNATIONAL SPACE DEVELOPMENT CONFERENCE National Space Society *Profitably Exploiting Near-Earth Object Resources* May 19–22, 2005. Google Scholar) TS

Even smaller-scale activities, such as proposals to extract volatiles from comets or potential ice deposits at the lunar South Pole to produce oxygen, water, and fuel for use in space, require not only the investment in the mining and processing of the products but also in the development of a costly space-based infrastructure for actually utilizing those products. Decades of investment and detailed research have gone into studies of building blocks for a potential market on orbit for volatiles produced in space (e.g., orbital maneuvering vehicles,34 orbital refluiding,35 orbital fuel depots36) but no such infrastructure yet exists. Without that infrastructure in place, no viable market exists.

AT: Colonization Adv

Colonization fails- sterilization

Colonization will fail- space radiation causes sterilization

Jerome Taylor, Monday, 14 February 2011, Why infertility will stop humans colonising space, The Independent,

http://www.independent.co.uk/news/science/why-infertility-will-stop-humans-colonising-space-2213861.html, ES

The prospect of long-term space travel has led scientists to consider, increasingly seriously, the following conundrum: if travelling to a new home might take thousands of years, would humans be able to successfully procreate along the way? The early indications from Nasa are not encouraging. Space, it seems, is simply not a good place to have sex. According to a review by three scientists looking into the feasibility of colonising Mars, astronauts would be well advised to avoid getting pregnant along the way because of the high levels of radiation that would bombard their bodies as they travelled through space. Without effective shielding on spaceships, high-energy proton particles would probably sterilise any female fetus conceived in deep space and could have a profound effect on male fertility. "The present shielding capabilities would probably preclude having a pregnancy transited to Mars," said radiation biophysicist Tore Straume of Nasa's Ames Research Center in an essay for the Journal of Cosmology. The DNA which guides the development of all the cells in the body is easily damaged by the kind of radiation that would assail astronauts as they journeyed through space. Studies on non-human primates have shown that exposure to ionising radiation kills egg cells in a female fetus during the second half of pregnancy. "One would have to be very protective of those cells during gestation, during pregnancy, to make sure that the female didn't become sterile so they could continue the colony," Dr Straume said. Radiation in space comes from numerous sources but the two types that have Nasa scientists most concerned are solar flares and galactic cosmic rays. Flares are the result of huge explosions in the Sun's atmosphere that catapult highly charged protons across space. The Earth's atmosphere and magnetic field absorbs much of this harmful radiation – but in space astronauts are much more vulnerable. Galactic cosmic rays pose an even greater threat. They are made up of even heavier charged particles. Although Nasa's shields can protect astronauts against most flare radiation, it is unlikely they could do the same against cosmic rays. Until recently, sex had been a taboo subject for Nasa, which has a strict code of conduct stating that "relationships of trust" among astronauts are to be maintained at all times. Only once has a husband and wife been on the same mission – Jan Davis and Mark Lee – and they have remained tight-lipped over whether they joined the 62-mile high club.

Colonization Inevitbale

Space colonization is inevitable in the status quo

Dr. Ruth Globus, Last Updated: April 29, 2011, NASA, Astrobiology Life in the Universe, Scientist at Ames Research Center, http://settlement.arc.nasa.gov/Basics/wwwwh.html, ES

Presently, with few exceptions, only highly trained and carefully selected astronauts go to space. Space settlement needs inexpensive, safe launch systems to deliver thousands, perhaps millions, of people into orbit. If this seems unrealistic, note that a hundred and fifty years ago nobody had ever flown in an airplane, but today nearly 500 million people fly each year. Some special groups might find space settlement particularly attractive: The handicapped could keep a settlement at zero-g to make wheelchairs and walkers unnecessary. Some religious groups might prefer to live away from "non-believers". Penal colonies might be created in orbit as they should be fairly escape proof. People who wish to experiment with very different social and political forms could get away from restrictive social norms. Although some colonies may follow this model, it's reasonable to expect that the vast majority of space colonists will be ordinary people. Indeed, eventually most people in space settlements will be born there, and some day they may vastly exceed Earth's population. Based on the materials available, the human population in orbit could one day exceed ten trillion living in millions of space colonies with a combined living space hundreds of times the surface of the Earth.

Colonization is inevitable- tech proves

Sean Gallacher, Ttk Ohtk Tks and MKS, H3, 2010, IT at Raytheon Intelligence and Information Systems

Provo, Utah Area, Defense & Space http://books.google.com/books?hl=en&lr=&id=PTlK3WE0tEEC&oi=fnd&pg=PA11&dq=asteroid+mining+%22not+vital%22+to+colonization&ots=ZgVYNOA02R&sig=yFbHZPuj3hqq63cWq0E3O-Y79mM#v=onepage&q&f=false, ES

By the time we reach the 2030s we will have two massive orbiting space stations, each with over 100,000 cubic metres of space inside, an equivalent presence on The Moon, a town the size of lnverell on Mars with a weekly shuttle service (even when Mars is on the other side of The Sun), and the following spacecraft: Six or more Orbital Shuttles, two Lunar Class tks Vessels, four Mars Class tks Vessels, and six Centauri Class tks Vessels. The tks designation stands for the method of propulsion and it is obvious what the other vessel designations indicate. By the time we reach the 2030s we will have our orbital Gateway Stations, and the beginnings of our massive cities on Mars, and oh so many massive spacecraft, but lets not call anything Enterprise and let's not name our new cities "New" something; let's also exercise a little creativity here shall we. It comes up again later but think about it now: What do we call the first city on Mars? And isn't that a fun thing to think about now that it is just around the corner. Now as if I haven't mentioned enough already in this introduction, add to all of this that by the 2030s the nextgen of propulsion (the propulsion that will replace tks Propulsion) should at least have a prototype: The MISS-VAPS (Magnetic Induction Slide System, Very Advanced Propulsion System) has been conceptualized to the extent that I can see it will work one day, and there are three or four others on which I have done some preliminary work and they look promising also. Just like everything in this book (with only one or two exceptions in about thirty), we haven't seen MISS or any of the others anywhere else before (not even in sci-fi). With the additional creativity that this knowledge, and the concepts when I unveil them, and this book, and the entirety of the H3 operation will encourage, we may have the next generation to replace tks Propulsion in the twenties, but we will absolutely have the next generation before we get to the second half of this century. Because I have already conceived of half a dozen othe1's that have not been seen anywhere else, and worked through three or four of them sufficiently to see that they are likely, and with the release of this book I will not be the only one dealing in real world ideas of this magnitude in this field, there is nothing more certain in this world than that we will have the second generation light speed propulsion before 2050, and that it will be based on completely different principles to the first generation, and that it will be far more advanced.

Colonization fails to ensure survival

Space colonization doesn’t solve disasters the whole galaxy would be affected from disaster that the Earth Faces

Williams 10’

(Lynda Williams Peace Review Physics Instructor, Santa Rosa Junior College, Irrational Dreams of Space Colonization, a Journal of Social Justice The New Arms Race in Outer Space, 22.1, Spring 2010 QJ)

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

DA links

Politics- Obama Good

Plan unpopular- spending

Political motives get in the way of the asteroid mission—electoral promises make its future uncertain

Watson 10 (Traci, writer for USA Today, USA Today*, Landing on an asteroid: Not quite like in the movies*, June 28. 2010, <http://www.physorg/news196920110.html>, AG)

HUMANITY DOESN'T HANG IN THE BALANCE. In "Armageddon," NASA must send a crew to an asteroid or life on Earth will be wiped out. "Even the bacteria," said the NASA chief, played by Billy Bob Thornton. In the real world, that irrefutable motivation is absent. By 2025, Obama's target date, there will have been four presidential elections. Any could result in the mission's cancellation, just as Obama canceled Bush's moon plan. "The politics of this is far more challenging than the engineering," Colladay said. The Obama administration has promised to increase NASA's budget by $6 billion over the next five years, but priorities may change. The Bush administration, for example, in 2007 cut long-term funding for its own moon program by $1.2 billion. As the deficit looms larger, "especially as the November elections come along I would just not be surprised if enthusiasm for some big human spaceflight mission ends," said Marcia Smith, founder of spacepolicyonline.com. As it is, the extra $6 billion Obama has promised NASA is inadequate for all the tasks the agency is supposed to tackle, Jones said. "The declaration that we're going to deep space is not matched by budget reality," he said. Leshin, the NASA official, responds that the agency is embarking on a research program that will lead to new, less costly technologies. The agency will build new spacecraft over a period of many years, so the costs don't pile up all at once, she said. "If we're making progress toward goals that are exciting and important to the American people, then it should be a sustainable program," Leshin said. She is optimistic that relatively soon, NASA astronauts will speed toward a rendezvous with an asteroid, and that it will be better than in the movies. "The first time we send humans beyond the cradle of the Earth-moon system, it's going to be extraordinary," Leshin said. "We will have gone further with humans in space than ever before. It will be an incredible first."

**Long term and pure exploration fail: economic and political support**

Elvis et al. 11 (Martin PhD Senior Astrophysicist @ Harvard Smithsonian Center for Astrophysics Space Wealth *Is Profitable Asteroid Mining A Pragmatic Goal?* 23 February 2011. Google Scholar) TS

To reach such ambitious goals, space agencies must be economically as well as politically sustainable.9 Space agencies need to deliver substantive, tangible, near-term benefits. If they do not, it is unlikely that they will generate the support, the knowledge, and the technologies that are required to realize our “ultimate goals” in space. Viable space programs must satisfy “fundamental” as well as “self-actualization” needs, as Abraham Maslow defined these in his Hierarchy of Needs.10 With competing claims on increasingly limited funds, programs that argue “It’s our nature to explore!”11 may not long survive.

**Plan unpopular- public**

**Voters are against new space exploration: economic crisis**

Elvis et al. 11 (Martin PhD Senior Astrophysicist @ Harvard Smithsonian Center for Astrophysics Space Wealth *Is Profitable Asteroid Mining A Pragmatic Goal?* 23 February 2011. Google Scholar) TS

As we emerge from the “Great Recession”12 and enter the long “Lean Years”13 under the darkening cloud of a growing fiscal crisis,14 taxpayers and their representatives will make choices. When asked, voters choose to sacrifice civil space programs rather than cut funding to fundamental social programs, such as “national defense, law enforcement, environmental protection, or other more basic needs.”15 In 2010, Rasmussen found that “Fifty percent (50%) of Americans say the U.S. should cut back on space exploration given the current state of the economy.”16 Our primate ancestors did not stand up on their hind legs in order to inspire younger generations to study the rarified art of balancing on two feet. They did it to get food and to avoid becoming food.

The general populace does not see fulfillment in space at an economic and survival level

Vedda 09 (Vedda, James A, Ph. D in science, Xlibris. 2009. p. 161-163 *Choice, Not Fate: Shaping a Sustainable Future in the Space Age,* 2009, http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf,\_AG)

Active members of the space community today will have a different perception than the rest of society regarding where the rationales fall in the Hierarchy. To the people who live this stuff on a daily basis, the exploration and development of space is their financial security and medical coverage at the safety-needs level, their professional and social networks at the social-needs level, and their recognition and sense of accomplishment at the esteem-needs level. Many have reached the self-actualization level where they seek the truth about life elsewhere in the universe.... “The rest of the populace outside the space community needs to see how space contributes to need fulfillment at the levels of the Hierarchy where they live and work ... economic and survival.

Plan Unpopular – Public doesn’t support NASAs vision

Crandal 09. (William BC. Crandal. MBA, President and Founder of Abundant Planet. Organization. A letter exchange to .Norman R. Augustine. “Why Space, Recommendations to the Review of United States Human Space Flight Plans Committee” 8-3-09. <http://www.nasa.gov/pdf/383154main_53%20-%2020090803.7.toAugustineCommittee-2009-08-03.pdf> TQ. )

Drenched in gigabytes of high-definition space-opera video, today’s youth find NASA less inspiring than the software companies that enable video virtual realties. 15 They realize that computing and communications firms offer real technological frontiers. 16 Today’s undergraduates are more concerned about the environment than with space. 17 When asked to prioritize space development spending, today’s net-literate public feels that our civil space programs should (1) Study climate change; (2) Stimulate commerce; (3) Drive science and engineering development; and (4) Enable space colonization. 18 Only one of these involves human space flight; it is their last priority, not the first. For years, NASA has bemoaned the loss of public support and tried various marketing ploys to convince taxpayers that their programs are worthwhile. These efforts have failed, because the core value proposition is lacking. Rather than trying to force preconceived notions onto the public, our nation’s civil space agency needs to listen. Two Twitter polls are instructive. 19 Both asked the same question. One poll offered only NASA approved responses. The other added two “non official” responses. The question: “What NASA project would you most like to see accomplished?” In the first poll, building a colony on the moon, or Mars, take the lead (29% and 27%). But the second poll showed that the two non -NASA -approved options are more strongly favored: (1) “Provide and/or purchase basic in -space infrastructure to enable private sector development of space” (33%); and, somewhat hyperbolically, (2) “Figure out how [NASA] can obsolete itself by creating a spacefaring society where everyone is capable of being their own NASA” (32%). Today’s netizens want space, but they want it on their own terms, not NASA’s.

Plan unpopular- human space flight

Human Spaceflight unpopular in congress and public

Watson 09 (Traci, Reporter for USA Today, USA Today, 17 July, 2009, *What’s our Next Step?* July 17, 2009, [**http://abcnews.go.com/Technology/story?id=8105921&page=3**](http://abcnews.go.com/Technology/story?id=8105921&page=3), AG)

Human space exploration also has run into trouble in Congress. In its spending bill for 2008, lawmakers ordered NASA not to spend any money to study sending humans to Mars. "Manned [SIC] space travel adds far more cost than is justified in terms of scientific return," says Rep. Barney Frank, D-Mass. Frank says he doesn't want to end the astronaut program but doesn't want to send humans to Mars or the moon. He'd restrict astronauts to tasks robots can't handle, such as the recent upgrade of the Hubble Space Telescope by a seven-astronaut team. Opposition to NASA's astronaut program stretches across the political spectrum. Republican Newt Gingrich, former speaker of the House, wrote in Aviation Week & Space Technology last year that NASA should get out of the business of sending humans to space to make way for private space entrepreneurs. For NASA, the most opposition may be from the people who pay the bills: the public. In a 2005 USA TODAY poll, 58% opposed spending money on a human mission to Mars. Americans may support human spaceflight, but they don't make it a high priority, says historian Roger Launius of the Smithsonian Institution's National Air and Space Museum. Nor do political leaders, he says. "That leaves us in low-Earth orbit for the foreseeable future," Launius says "I hope it doesn't come to that, but I'm afraid it might."

NASA policies are controversial

NASA action creates a huge political ripple

Wiskerchen 10 (Michael Department of Mechanical & Aerospace Engineering, UC San Diego and Director, the California Space Grant Consortium. International Journal of Innovation Science Volume 2 Number 4 *The Emerging Organizational Framework for the Space Commerce Enterprise* December 1 2010. EBSCOhost) TS

In the transition from Apollo to Shuttle, the overall mission was therefore diverted from building a world-class space infrastructure for science, space exploration, and military purposes, to one focused primarily keeping Congressional appropriations at a consistent and manageable level. In this political arena, you enter a never-ending cycle in which mission budgets and plans are up for discussion, and for politically motivated changes, on an annual basis. I believe that this scenario, which emerged in early 1980s, was the start of the Congressional ‘earmark’ problem that continues to plague NASA. As a result, NASA’s earmark problem has grown to 3% of its annual budget. Why does it matter? Because major NASA decisions are made according to how many jobs will be created or lost in a particular geographic area, making NASA a pawn in a political battle between the White House and the political parties in Congress. Alas, you cannot effectively manage a highly technical program with 3% of your annual budget being manipulated by the winds of political whim.

Politics- Obama Bad

Plan popular- congress/ AT: spending link

NASA’s current mission, global warming research, is more expensive than space exploration. Congressman are in full support in the continuation of space exploration missions.

Horn 11 (Art, independent meteorologist, pajamasmedia.com, Congress to NASA: Study Space!, <http://pajamasmedia.com/blog/congress-to-nasa-study-space-not-climate-thats-not-space/?singlepage=tr-ue>, 02-18-11, Google News, NC)

Members of Congress are asking something novel of NASA: to actually study space, not global -warming. Representatives Bill Posey (R-FL), Sandy Adams (R-FL), Rob Bishop (R-UT) and others have sent a letter to House Appropriations Committee Chairman Harold Rogers (R-KY) and Commerce, Justice, and Science Subcommittee Chairman Frank Wolf (R-VA) asking for NASA to launch their efforts in a new direction — the old one. For many years, NASA has been spending vast sums of money to study global warming, despite the efforts already undertaken at other federal agencies where such research is more appropriate. The letter asks that NASA refocus on what it was created to do, which is to maintain and develop our space program. The amount of money being spent to study global warming, as a percentage of NASA’s budget, is startling — especially when one considers this is not part of NASA’s original mission. In budget year 2010, NASA spent 7.5% of its funding — over $1B — to study global warming. On top of that — the vast majority of federal stimulus money given to NASA in 2010 was spent on studying global warming. As a whole, the U.S. federal government has spent $8.7 billion dollars on global warming studies — just in the past year! Many of the sixteen separate agencies doing this work were performing redundant research. In a time of federal spending cuts that are sure to come, much of this redundancy certainly can and must be eliminated, saving taxpayers billions. Certainly NASA should be one of the first to see funding drastically cut, or eliminated entirely, in this area. The principal arm of global warming research for NASA is the Goddard Institute for Space Studies (GISS). That’s “Space” Studies, not climate. The Institute is located in New York City on the campus of Columbia University. The homepage of GISS states: Research at the NASA Goddard Institute for Space Studies (GISS) emphasizes a broad study of global change. No mention of anything to do with space exploration. How odd. The overview continues: … which is an interdisciplinary initiative addressing natural and man-made changes in our environment that occur on various time scales — from one-time forcings such as volcanic explosions, to seasonal and annual effects such as El Niño, and on up to the millennia of ice ages — and that affect the habitability of our planet. Under the section titled “More Research News & Features,” there are seven different news items, all dealing with global warming. Nothing about space or manned space missions or anything at all up there. It’s as if GISS has launched itself into an entirely different orbit, unrelated to its founding documents. The Goddard Institute for Climate Studies would be a much more accurate representation, though I think Dr. Robert Goddard would be surprised to learn how much influence he must have had in the field of climate research, rather than in developing liquid fueled rockets. The shift of the GISS research effort is mysterious, but so is the trend of their long-term temperature records. In the late 1990s, GISS published a graph of the United States yearly average temperature from 1880 to 1998. From the graph it is clear that 1934 is nearly 1 degree Fahrenheit warmer than 1998, a very substantial amount. In fact, the graph ranked the four warmest years in order as: 1934, 1921, 1931, and 1998. But by 2009, an updated version of the graph shows some dramatic and remarkable changes: 1934, 1921, and 1931 are all now cooler than 1998!

Plan popular- bipartisan

NASA provides governmental inspiration across party lines

Weaver 10 (David, Nasa.gov, NASA Administrator Thanks Congress for 2010 Authorization Act Support, <http://www.nasa.gov/home/hqnews/2010/sep/HQ_10-238_Bolden_Auth_Statement.html>, 09-29-10, google news, NC)

The following is a statement from NASA Administrator Charles Bolden regarding Wednesday's action by the House of Representatives on the National Aeronautics and Space Administration Authorization Act of 2010. "We thank the Congress for their thoughtful deliberations about NASA's future over the past months. Both the House and the Senate provided insight, ideas and direction that were truly exemplary of the democratic process. It is clear that our space program inspires passion and dedication across party lines, and for that we are truly thankful. "This important vote today in the House of Representatives on a comprehensive NASA authorization charts a vital new future for the course of human space exploration. We are grateful that the National Aeronautics and Space Administration Authorization Act of 2010 received strong support in the House after its clearance in the Senate, and can now be sent on to the President for his signature. "The President has laid out an ambitious new plan for NASA that pioneers new frontiers of innovation and discovery. The plan invests more in NASA; extends the life of the International Space Station; launches a commercial space transportation industry; fosters the development of path-breaking technologies; and helps create thousands of new jobs. Passage of this bill represents an important step forward towards helping us achieve the key goals set by the President. "This important change in direction will not only help us chart a new path in space, but can help us retool for the industries and jobs of the future that will be vital for long term economic growth. "NASA appreciates all of the hard work and effort that has gone into advancing this legislation."

Asteroid development is a bipartisan effort

ROBERT CABANA, FLORIDA VOICES, June 12, 2011 12:05 AM, NASA is creating the future now, tenth director of NASA's John F. Kennedy Space Center in Florida

http://www.news-journalonline.com/opinion/editorials/guest-columns/2011/06/12/nasa-is-creating-the-future-now.html, ES

The News-Journal's June 6 editorial asserts that NASA is uncertain of its future direction. We are not. There is a plan, directed by President Barack Obama, supported by Congress, and in the process of being implemented by NASA. The nation's commitment to human exploration and big, inspiring missions remains as strong as ever. The strongly bipartisan NASA Authorization Act of 2010, signed by the president last fall, outlines our plans to live and work on the International Space Station (ISS) until at least 2020. We will fully utilize its unique capabilities to learn more about human health in space and demonstrate technologies to take us farther into the solar system; develop a heavy-lift rocket and multipurpose crew vehicle to reach destinations beyond low Earth orbit (LEO); facilitate a dynamic commercial sector's transportation services to LEO; pursue a huge range of science missions to enlarge our understanding of the cosmos and make breakthroughs in aeronautics that will benefit everyone. That's a tall order, but NASA has always done big. We are developing an evolvable, heavy-lift architecture that will enable us to reach multiple destinations beyond our home planet. NASA made the first step on those journeys last month when we decided to base that next crew vehicle on the Orion module already in development. We're continuing to examine all of our options for the heavy-lift rocket and soon will announce the direction we intend to pursue. These are complex projects that will serve America for a generation, and we are working to develop the most cost-effective, innovative solutions. This approach to human space exploration will allow us to reach a range of destinations that includes near-Earth asteroids, the Moon, Lagrange points, the moons of Mars, and eventually Mars itself.

Plan popular- public

The public supports specific exploration missions like asteroid mining

Christian Science Monitor 10 (Christian Science Monitor, The Monitor’s Editorial Board, *Nasa and Obama’s budget: the politics and ideals of human space exploration;Negative reaction to the presidents’ intial plan for NASA has forced him to backpedal a bit and offer human spaceflights to Mars and an asteroid. Now he needs to work more closely with Congress to set long-term, deep-space missions,* April 16, 2010 http://www.lexisne xis.com/hott opics/l nacademic/, AG)

Human travel to Mars is now back on America's space agenda. It is just one of many course-corrections that President Obama will likely be forced to make to his January proposals for big changes at NASA. Too many Americans and lawmakers reacted negatively to the initial White House plan for the National Aeronautics and Space Administration. They still see human exploration to specific destinations in space as a compelling frontier - not just for the nation but humanity, too. They weren't ready to live only vague promises of deep-space missions, as Mr. Obama Enhanced Coverage Linking Obama made. Nor do they want the space agency more focused on earthly tasks such as climate-change monitoring, as Obama would prefer, over scientific discovery in outer space. The public reaction pushed the president on Thursday to set a timetable for the first Mars trip - by the mid-2030s - as well as a schedule to land on an asteroid (near 2025). He also had to set 2015 for starting construction of a heavy-lift launcher based on new innovative technology. But Obama only partially backed down on his proposal to cancel a Bush-era program called Constellation. That project, now over budget, would return Americans to the moon to do more research and to tap that body's frozen water for making fuel for lunar launches to Mars and beyond. While he still wants to stop production of the Ares rockets for the moon mission, Obama did backpedal a bit by offering to keep the planned Orion crew-ship - but only as an emergency vehicle to escape the International Space Station. Even Neil Armstrong, the first human on the moon, opposes an end to the moon project, partly because other nations, especially China, are gearing up to land there in the years ahead. America's leadership in space would be in jeopardy. The political battle over funding the moon project will play out in Congress over coming months. Some compromise may be possible. This debate will likely have little of the polarizing partisan tones of other issues on Capitol Hill. Rather, it pits key political states with many space-related jobs - Florida, Texas, California, and Colorado - against other states. To his credit, the president would raise NASA's overall budget by about $6 billion over five years - despite his call for cuts during his 2008 campaign. And he wants to support the fledgling private space agency to take over many of the government's goals for low-orbit projects, such as reaching the space station. He also would extend the space station's life by four years. Finding a political middle that can support NASA's program through many presidencies would be Obama's biggest legacy in space. The agency and the private contractors can keep suffering financial whiplash every few years, as they did once again when Obama laid out his goals last January. One of those potential middle positions was articulated well by Obama on Thursday: "Our goal is the capacity for people to work and learn, operate and live safely beyond the Earth for extended periods of time." The president erred by not working more closely with Congress before setting forth his budget plan for NASA. He also may be counting too much on the commercial space-launch industry to mature soon enough to take over key NASA functions and fill the gap - to be temporarily filled by Russian rockets - caused by the end of the space shuttle program this fall. He's on course, however, when he clearly lines himself up with America's strong tradition in spaceflight, as he did Thursday in speaking at the Kennedy Space Center: "Space exploration is not a luxury, not an afterthought in America's brighter future, [but] an essential part of that quest.... For pennies on the dollar, the space program has improved our lives, advanced our society, strengthened our economy, and inspired generations."

Plan popular- public

**Asteroid mission K2 mars, deflection and is popular: scientists, defense, and public**

Berger 10 (ERIC Science Reporter for HOUSTON CHRONICLE *Next giant leap: With support growing, NASA takes a small step toward walking on an asteroid* Sept. 5, 2010) TS

Hollywood fancies that when an asteroid threatens Earth, NASA will respond by rounding up a crew and nuking the space rock. Before doing this, though, it would be nice to know exactly what we'd be nuking, and the fact is scientists just don't know. But that may soon change. There's growing support for the idea that NASA's next human flight beyond low-Earth orbit should target a near-Earth asteroid, rather than our already visited celestial neighbor, the moon. "It's a concept that I think a lot of people can relate to," said Laurie Leshin, deputy administrator for NASA's Exploration Program. As a destination, an asteroid appeals to NASA because it's a challenging but doable mission that will test much of the technology that would be needed for a flight to Mars. Innumerable small asteroids, remnants from the formation of the solar system that weren't swept up by planets, glide around the sun on orbits bringing them close to Earth. About the size of a house or a small building, they could at a minimum destroy a large city on impact. NASA has several asteroids in mind that will come within 8 million miles or so of Earth, and the space agency would like to find more. That's considerably closer than Mars, but still a few dozen times farther than the Apollo flights to the moon. NASA could test a new generation of space capsules and rockets to ensure they can protect astronauts from space radiation and a host of other concerns that would accompany a mission, which once launched couldn't return to Earth for months. Such a mission also appeals to scientists, Leshin said, who know little about the interior of asteroids and would like to study large samples that could be returned. And there's the planetary defense community, which is interested to know the interior composition of asteroids, in case one needs to be deflected. Finally, the mission has the potential to capture the public's attention, which already has been primed to fear killer asteroids by Hollywood. "I think this would be incredibly exciting," said Phil Plait, an astronomer who writes the popular Bad Astronomy blog. "There is inherent danger in that, of course, and any such trip would take the astronauts well past the moon. It's been decades since we've seen any long journey away from Earth. "And the destination itself is exotic and amazing; human eyes have never seen an asteroid up close. Moreover, there's the ultimate goal of such a mission: learn more about potentially threatening objects that could one day impact the Earth and do real and serious harm to us." At a workshop last month in Washington, D.C., NASA canvassed the scientific, human spaceflight and planetary defense communities about their priorities for a mission to a near-Earth asteroid. Leshin said these communities concluded that such a mission had great value but that more asteroid targets needed to be identified.

Existing plan for exploration of asteroids is popular now

LORI GARVER, NASA DEPUTY ADMINISTRATOR, master's degree in science, technology and public policy from George Washington University in 1989, Center for Strategic and International Studies , April 26, 2010, http://impact.arc.nasa.gov/news\_detail.cfm?ID=184, ES

These are truly tangible reasons for making a NEO, one of our first destinations for humans in deep space. And I have to add, it is incredible how well Hollywood taps in to the psyche and true desires of the public, so having something appear in a movie is not necessarily a bad thing. The public is fascinated by NEOs, and I am sure they are also a little afraid, to be honest. A recent poll just completed by the Everett Group found that sixty-three percent of those who said exploring space was at least somewhat important cited protecting the Earth from collisions with comets and asteroids as a major reason for continuing that exploration. NASA has been working, and in the new budget ramps up, the activity of cataloging and characterizing NEOS. If one is going to pose a danger to Earth, we need to know about it, and by visiting one, we'll have that much better of an understanding of what it might take to mitigate potential future collisions.  A mission to a NEO will also test our deep space propulsion systems, since we're talking about 5 million miles of travel as opposed to around 239,000 to reach the Moon. They'll test our ability to orient ourselves and explore on an alien world. They'll test the habitat, radiation protection and life support systems we'll be developing for human beings in deep space. All in all, they're a tough destination. And Mars will be even tougher.

New missions are key to NASA popularity

NASA needs to re – imagine itself to regain public support

Stern 08 (Alan, planetary scientist at the Southwest Research Institute, Aviation Week and Space Technology, Making NASA relevant again, <http://web.ebscohost.com/ehost/detail?sid=2b427833-e550-42f8-b94d-6b2e2fc85b53%40sessionmgr4&vid=1&hid=10&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d>, 06-23-08, Academic Search Premier, NC)

The U.S. space program leads the world. It has produced more firsts, delivered more discoveries and still possesses more capability than any of its competitors. Yet NASA does not enjoy the strong public support it once did. Why is this so? In part, because NASA's current efforts are too disconnected from everyday life and U.S. society. It's no wonder that few Americans can say when they last heard the space program developed something which demonstrably touched their life. Yet it need not be this way. The early NASA program combined pioneering explorations with an impressive array of fundamental societal benefits. Its efforts of the 1960s, '70s and '80s catalyzed the communications satellite and electronics miniaturization revolutions, unleashed environmental awareness via the first color pictures of our fragile home planet, perched satellites on high to transform weather forecasting and helped enable GPS satellite navigation. More subtle but equally important were the foreign policy benefits of America's early space efforts. One was the ability to provide land use, pollution, flood and storm warnings to nations across the world. Another is the unabashedly positive image of America that our explorations of the Earth, Solar System and larger universe communicate to students across the globe. And perhaps most importantly, NASA benefited society by inspiring an army of technical workers and entrepreneurs to careers in engineering and science, fueling many of the industries our economy now depends on. With the coming of a new administration to Washington in 2009, there will naturally be a re-examination of our policy interests and direction in space. How might that re-examination make NASA more relevant? One possibility would be to retreat from NASA's current exploration and scientific research efforts, turning down the pace of renewed human exploration or scientific studies, for example. This might yield precious dollars toward more practical benefits. This would be a huge mistake, because it would signal to friends and foes alike that 21st century America has exhausted the ideas or capital to ignite the fundamental transformations that space has yielded. Instead, we could and should augment NASA's world-pacesetter scientific and exploration programs with innovative new efforts that directly encourage the economic and societal benefits that space exploration and applications can yield. Such new NASA initiatives should include dramatically amplifying the agency's capability to monitor the changing Earth in every form-from climate change to land use to the mitigation of natural disasters. So too, NASA should take greater responsibility for determining how to mitigate the hazards associated with solar storms and asteroid impacts, such as by expanding space weather research and planning human missions to nearby asteroids to better understand them. NASA also should accelerate much needed innovation in aircraft and airspace system technologies to save fuel, save travelers time and regain American leadership in the commercial aerospace sector. And a more relevant NASA should be charged to ignite the entrepreneurial human suborbital and orbital spaceflight industry. This nascent commercial enterprise promises to fundamentally revolutionize how the public perceives spaceflight. A more responsive and relevant NASA would serve a deeper purpose: inspiring students to explore and to serve their nation's future. Rather than NASA purely working its own agenda, with specific direction to become more relevant and responsive in the new administration, the agency-to the great advantage of itself and America-would be working to accomplish the nation's agenda. An effort like this need not be expensive. It could be implemented by redirecting just a fraction of NASA's budget to new initiatives. It could be financed without sacrificing existing efforts in either exploration or science. All it would take is a strong and consistent emphasis on cost control that imposes stiff consequences when projects grow past their proposed levels. Imagine this different, stronger, more efficient NASA, as historic an explorer as it has always been, but also newly responsive to how space can better connect to our nation, society, economy and home planet. Imagine a NASA that both inspires and serves. Imagine a NASA that both explores and protects. It isn't hard to do.

Spending DA

Econ link- metal prices/AT: solvency- dangers of return

Asteroid mining has a high chance of failure—shown in price collapse and difficulty in sifting thorugh metals

Ingebresten 01 (Mark, Contributing Writer for The Journal for the Institution of Electrical and Engineering Engineers, IEEE Journal*,,* Mining Asteroids, August 2001, http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=& arnumber=938712 AG)

But why bother ferrying water around instead of mining metals and returning them to Earth’s surface—especially since trillions of dollars worth of high-valued metals are ripe for the taking? The fact is that transporting materials back to Earth changes the economics of the equation. For starters, the logistical problems greatly increase. “One of the things that we’re discovering is just how fragile atmospheric physics is,” said Richard Gertsch, an assistant professor in the mining and materials engineering department at Michigan Technological University, Houghton. Thus, any miscalculation could turn an ore-bearing shuttle into a hailstorm of molten metal. Disasters aside, developing a craft that transports materials back to Earth as efficiently as ships and rail cars now transport ores from terrestrial mines is a tall order. An even bigger problem from an economic standpoint is that asteroidal supplies of iron may easily exceed demand, depressing prices. A huge influx of space metals—or even the expectation that they might come onto the market—would result in a price collapse. Also, any venture aimed at returning these materials from space has to compete with the highly efficient terrestrial mining techniques already in use. Still, given that asteroids contain platinum metals worth trillions, why isn’t it possible to profitably return these to earth? “The whole idea of space resources is that the resources are huge. How you use them has been the real problem,” Gertsch laments. “Everyone goes back to high-value metals, the pgms.” Vexed by the problem, Gertsch co-wrote a study with his wife Leslie, another assistant professor at Michigan Technological University with a special interest in asteroid mining. They envisioned a project equivalent in scale to the Anglo- French Channel Tunnel. It would cost at least $5 billion and take up to 12 years to finish. The study assumed that the asteroid mined would be made up of 150 parts per million of pgms, a concentration thought to occur in about one in 10 platinum-bearing asteroids. Finding a suitable asteroid and mounting a mission would consume up to four years of the project, the Gertsches reasoned. On arrival, miners would need to sift through 500 million metric tons of material in order to extract enough platinum—some 68 thousand metric tons, at an assumed price of about $13 per gram—to generate a return of 100 percent on the project. However, even a 100 percent return rate would not attract the needed billions in risk capital, given the 12-year timetable and the high probability of failure, the Gertsches concluded.

**Spending link/**AT: solvency- cost

Plan difficult to maintain – Spending risks too high.

Gertsch & Gertsch 05. [Richard Gertsch (research associate professor of mining engineering at Michigan Technological University) and Leslie E. Gertsch (Mining Engineering Dept. and Center for Space Mining, Colorado School of Mines). “Economic analysis tools for mineral projects in space”. <http://www.kemcom.net/EconAnal.pdf>. 2005. TQ.)

The risk involved in exploiting space resources is very high, from risky to wildcatting (Table 2). Terrestrial investors would like a very high ROI and a very short payback period for this level of risk. However, high ROIs makes the project technologically more difficult. In the example project, 100% ROI is basically prohibited by the very high ore tonnage needed, 500 million tonnes. However, lesser ROIs are feasible (Tables3 and 4). The payback period for the example project also is very long for a commercial venture. However, 11 years before any income is long even for a low risk venture. Perhaps it is in the 6 nature of space projects to have long payback periods. Asteroids, in particular, have a long trip time. The very high cost of space transportation alone (both for Earth to LEO and in space itself) is a significant barrier to commercial success. Lowering transportation costs is one key to furthering successful commercial space ventures. When planning long space missions, costs should be delayed as long as possible, and revenues captured as soon as possible. For example, an asteroid mining project could delay building processing plants and miners until the exploration phase is complete. Sellable material from the asteroid should be returned with minimum delay.

**Plan not Feasible – Costs too much.**

Sonter, NO DATE. , ( Mark Sonter. scientific consultant working in the Australian mining and metallurgical industries. Department of Civil and Mining Engineering in University of Wollongong,. "Mining Economics and Risk-Control in the Development of Near-Earth-Asteroid Resources", http://www.spacefuture.com/archive/mining economics and risk control in the development of near earth asteriod resources.shtml. TQ)

Project conceptual planning and prefeasibility studies: At this stage, the design team will begin to consider possible mining and processing methods. The concepts will be subjected to initial review. In the terrestrial case, there is generally need for further drilling to delineate orebody shape and reserves. Bulk samples may be required to provide feed for metallurgical testwork. Conceptual project design work - the PreFeasibility Study - commences. This Study must consider the RESOURCE size, percent RECOVERY, and desired production RATE, to come up with a Mining Plan, and a Metallurgical Process Flowsheet, which minimizes Capital Expenditure, minimizes Payback Time, and maximizes the Expected Net Present Value. The Feasibility Study will consider the various mining and process options, identify the one or two best mining and processing choices, and estimate capital and operating costs (+/- 50%) for the chosen production rate, based on industry rules of thumb. Many projects fail at this stage because the costs do not come in low enough. My thesis completed a couple of years ago showed how to carry out a generic scoping and prefeasibility study for hypothetical asteroid mining projects for water recovery and delivery to a near-future market in low earth orbit including how to calculate net present value for these ventures. An asteroid mining project must be able to deliver a positive NPV or it will not fly!!

**Econ link-short term spending**

Space exploration is not a good short term investment

Fogan and Elvis 11 ( Duncan H. Scottish Universities Physics Alliance (SUPA), Institute for Astronomy, University of Edinburgh, ,Martin, Harvard Smithsonian Center for Astrophysics, Extrasolar Asteroid Mining as Forensic Evidence for Extraterrestrial Intelligence, <http://arxiv.org/PS_cache/arxiv/pdf/1103/1103.5369v1.pdf>, NC)

Humans have not begun asteroid mining primarily for reasons of political economy. While the resources still exist in affordable quantities on Earth, governments lack a good short-term economic case to attempt dangerous missions at high cost to bring back what would initially be modest quantities of raw materials. As Hickman (1999) observes, asteroid miners should not expect immediate investment from private investors either. While the potential return from successful, properly matured asteroid mining missions is very large, the level of capital required up front for any large-scale space project is also very large - Schmitt (1997) optimistically estimates a sum of around $15bn for general commercial space enterprise (assuming fusion technologies based on lunar 3He become profitable, and not considering the problems presented by the current financial landscape). Further to this, the maturation time period (before profits can be generated) is too long, i.e. greater than 5 years. Other large-scale space projects (such as Martian colonization) are equally unappealing for investors looking for returns on their investments within a decade - Hickman (1999) gives a simplified example which shows that if Mars can be terraformed in less than a thousand years, even a modest rate of interest on an initial loan requires Martian real estate to be extremely expensive.

Spending link/AT: solvency- cost

Plan triggers link – Plan is expensive.

Gertsch & Gertsch 05. [Richard Gertsch (research associate professor of mining engineering at Michigan Technological University) and Leslie E. Gertsch (Mining Engineering Dept. and Center for Space Mining, Colorado School of Mines). “Economic analysis tools for mineral projects in space”. <http://www.kemcom.net/EconAnal.pdf>. 2005. TQ.)

Here lies firmer ground. Many organizations can make reasonable estimates and calculate project costs. Regardless of whether the project is commercial or governmental, costs are generally costs. But because governments are not profit-driven, they generally experience higher costs than commercial ventures. This is due to the luxury to be able to spend more on such items as enhanced safety and reliability. It is useful to review the factors that contribute to costs. While the following discussion is general, some examples are specific to the mineral industry: Research & Development. When a new machine or device is needed to accomplish a venture, costs are incurred during its inventing, designing, constructing and testing. Governments tend to conduct R&D over longer lead times, while commercial ventures tend to develop what is needed now. Examples would be governments providing basic research 3 into rock fragmentation (open-ended with no clear path), and equipment manufacturers building autonomous mining machines (difficult, but with a clear pay-off). Exploration & Delineation. In the mining industry, this means finding out with reasonable certainty what is there to be mined, and then building a mathematical model of precisely where it is and how it will be attacked. Part of the exercise is called a feasibility study, but it must be based on reliable ground truth which can only be supplied by drilling into the ground many times. Construction & Development. After the project is a go, the physical plant must be built and the ore must be accessed by drilling, blasting, and hauling. Transportation to and from the site is needed, power must be supplied, processing plants built, and materials handling equipment provided. Operations. The costs incurred by production: salaries, consumables, fuel, maintenance, safety, depreciation, taxes, etc. Engineering. The cost to monitor, model, control, and thereby improve the economy of operations: surveying, analyzing, inventorying, record keeping, computing, etc. Environmental. The cost of mitigating environmental impacts. General and Administrative. The cost of management and sales. Costs of air, stowage, housekeeping, health and safety, and extra training would be added for space projects.Mineral projects tend to have long lead times, because exploration & delineation and construction & development are simply time consuming. Recently, environmental permitting has added to the required lead times. This is a real cost. Space projects by necessity also will have long lead times. When a $100M mining machine spends two years in orbit to reach an asteroid, it has consumed a large amount of money before operations even start.

**COUNTERPLANS**

**Mine Moon CP**

**Mine moon CP- solvency- Rare Earth**

**The moon contains deposits of rare earth elements**

David 2010 (Leonard, Space.com columnist, “Is Mining Rare Minerals on the Moon Vital to National Security?”, <http://www.space.com/9250-mining-rare-minerals-moon-vital-national-security.html>, 10/4/10, accessed 6/30/11)CNW

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.

Mine Moon CP: solves

**Lunar mining is better than asteroid mining: YOUR AUTHORS AGREE**

Foust 10 (Jeff editor and publisher of The Space Review and Ph.D in [planetary sciences](http://en.wikipedia.org/wiki/Planetary_science) Space Review. *Where first for space resources?* November 22, 2010 ) TS

The access issue has even advocates of asteroid resource utilization suggesting that lunar resources may be a better near-term prospect. “Net present value and the time cost of money is crucial, and that’s one of the things that has me swinging back away from asteroids and towards the Moon,” said Mark Sonter, an Australian mining consultant who has studied asteroid mining. John Lewis, professor emeritus of planetary sciences at the University of Arizona and a long-time advocate for the study and utilization of asteroids, also acknowledged that lunar resources might be more viable in the near term. “You have to respond to any opportunity that opens up,” he said. “Historically I’m identified with asteroid resources, but if we had a manned, federally-sponsored program for going back to the Moon right now, I’d be right at the head of the line saying that we should go after lunar resources.”

Mine Moon CP- resources

**The moon has superior resources**

Foust 10 (Jeff editor and publisher of The Space Review and Ph.D in [planetary sciences](http://en.wikipedia.org/wiki/Planetary_science) Space Review. *Where first for space resources?* November 22, 2010 ) TS

The question of where to go first in the solar system from a resource perspective was the central topic of a panel session that kicked off the Space Studies Institute’s Space Manufacturing 14 conference October 29 in Sunnyvale, California. While the session’s title was “Moon, Mars, Asteroids: Where to Go First for Resources?”, the debate among the panelists was between the Moon and near Earth objects (NEOs)—no one advocated for going to Mars first, and the Red Planet went virtually unmentioned in the discussion. And in that debate, advocates of lunar missions made a strong case of going there first. Among the biggest backers of lunar exploration and utilization was Paul Spudis, a senior staff scientist at the Lunar and Planetary Institute. “There’s three reasons to go to the Moon: it’s close, it’s interesting, and it’s useful,” he said. “Of those, the first and the third—close and useful—I think are most relevant in terms of resource utilization.” While the Moon has potentially a wide range of useful resources, including platinum group metals left behind from asteroid impacts and the oft-discussed helium-3 for as-yet-nonexistent fusion reactors, Spudis argued the best initial resource on the Moon is water ice, concentrated in permanently-shadowed craters at the lunar poles. That belief is buoyed by research from NASA’s Lunar Reconnaissance Orbiter (LRO) and Lunar CRater Observation and Sensing Satellite (LCROSS) spacecraft, released a week before the panel, which not only confirmed the presence of water ice but also found that in some locations it may be in the form of nearly pure crystals. “We know now that the water there is free water; it is unbound,” he said. “Fundamentally all you have to do is to scoop it up and heat it to 100°C and it vaporizes.” That makes it much easier to extract, he said, than if the ice crystals were chemically bound to the lunar regolith. “Mining water on the Moon is going to be a lot easier than we thought.” That mining need not involve humans present on the Moon. Greg Baiden, chairman and CTO of Penguin Automated Systems Inc., a company that develops technology for automated mining on the Earth, said such systems could also find use on the Moon. He said he’s been working with the Canadian Space Agency for the last four years on a strategic plan for mining the Moon. “We’re at a point now with teleoperation of mining equipment that I think it’s feasible to mine the Moon,” he said. “Mining the Moon is not going to be an easy thing to do,” he admitted, but added, “I could easily make a business case for going to the Moon” given his experience mining in remote locations on the Earth. “Once we start extracting and using anything, from anywhere, for any purpose, the incremental cost of adding one more kind of resource that we extract and use is next to nothing compared to the cost of getting there in the first place,” Greason said. But what do you do with the water you mine on the Moon? One use, of course, would be to support any human settlements there. Spudis, though, argued that a bigger market for lunar water is for a “cislunar transportation system”, using that water (or, more likely, its elemental composition, hydrogen and oxygen) as propellant. “If you can do that, if you can build a system with, for example, reusable landers and propellant depots that can routinely access the lunar surface, you can access any other point in cislunar space,” he said. “That’s where virtually all of our satellites reside.” The government would be the obvious initial customer for such a system, he said, but others would make use of it once it’s available. Another advocate of first utilizing lunar resources was Jeff Greason, president of XCOR Aerospace and a member of last year’s Augustine Committee. “I think if you ask the question of what’s going to happen first, especially in light of all that’s come out in the last 10 to 15 years about the Moon,” he said, “I think the Moon is clearly the answer.” Greason also sees water ice as the first resource to access on the Moon, with governments as likely initial customers. “The probability is great that one or more governments around the planet are going to maintain a human space exploration program,” he said. “And if you’re planning on doing human space exploration, you’ve got to have a lot of propellant.” Even something on the scale of Apollo, he said, would generate demand for several hundred tons a year of propellant. Mining water on the Moon, he added, could open the door for accessing other lunar resources. “Once we start extracting and using anything, from anywhere, for any purpose, the incremental cost of adding one more kind of resource that we extract and use is next to nothing compared to the cost of getting there in the first place,” he said. “It really is an irreversible tipping point. Once we figure out how to make it make money for anything, we can start figuring out how to make it make money for everything.”

**Privatization CP**

Privatization CP- private solves

The private sector can execute asteroid and Mars missions much more easily than NASA

Spudis and Zubrin 10 (Paul D. and Robert Zubrin, Founder of the Mars Society, The Washington Times, *NASA’s mission to nowhere; Big, fat , pointless and expensive describes plan to twiddle our fingers*, June 1, 2010, AG)

The new plan proposes to contract with private companies to design and develop vehicles for human flights to low Earth orbit (LEO) and the International Space Station. The agency will research advanced technologies in the coming five years before picking a heavy-lift rocket design. Human missions are next - to an asteroid in 15 years and to orbit Mars in 25 years. A human Mars landing supposedly will occur afterward - sometime. The idea of contracting with the private sector for launch and transport to LEO is not new. This capability was encouraged and started under Vision. The difference under the new direction is the termination of any capability by the federal government of the United States to send people into space.For 50 years, America has maintained this ability through an infrastructure of cutting-edge industrial hardware, specialized facilities and a skilled work force. By adopting the new program, we will lose - probably irretrievably - this space-faring infrastructure and, most certainly, our highly trained, motivated and experienced work force. It will be prohibitively expensive and difficult to restart our manned program after five to 10 years of agency navel-gazing, effectively signaling the end of America's manned space program and our leadership in space. NASA falters without specific direction or a stated destination. The history of the agency is replete with research projects disconnected from flight missions that produced no real hardware or technology. Taking five years (or even one year) to "study" the technologies of a heavy-lift rocket is not only pointless - it is destructive. We currently possess all the knowledge, technology and infrastructure necessary to build a heavy-lift launch vehicle. In a logical and effective space program, a mission is chosen, a plan for accomplishing the mission is developed, the flight hardware needed to accomplish the plan is identified, and technology is developed as needed to enable the flight hardware. The administration claims it is setting daring goals - the asteroids and Mars - but has posited them so far in the future that no real, focused work needs to be done toward their achievement during this or the next presidential term. Under Vision, we were working on the development of real capabilities, including launch systems, spacecraft and destinations with specific activities and capabilities at these places. If the new path is adopted, we will have exchanged a mission-driven program for a costly stagnation that will take us nowhere. That is the choice before us.

Privatization CP solvency--- commercial companies can solve all impacts

Major James L. Hyatt, III et al 10 SPACE POWER 2010 A Research Paper Presented To The Directorate of Research Air Command and Staff College<http://www.fas.org/spp/eprint/95-010e.pdf>

How Do We Get There? In order to achieve genuine space power the **US must act to encourage the commercialization of space and then exploit the resulting technological advances and economic advantages. This requires striking a delicate balance between stirring the industrial pot and staying out of the way. Specifically, this entails encouraging commercial space activities by removing impediments to the competitiveness of US firms**. For instance, **commercial spacelift companies should be allowed greater access to, and perhaps control of, government launch and satellite processing facilities**. **Finally, the US should stimulate new commercial space business through increased use of commercial space systems and services to fulfill military space requirements.** These initiatives should be combined with aggressive government-led development of the few uniquely military space technologies, doctrinal innovation and organizational adaptation. This would put the nation on course to be the top military space power in the year 2010.

Privatization CP- private solves

Private business would mine asteroids USFG not needed

Ian O'Neil June 29th, 2009 “in Mining Asteroids: Not At Those Overheads” <http://www.astroengine.com/2009/06/mining-asteroids-not-at-those-overheads/> SH

In The Future™, when mankind is Sufficiently Advanced®, nations, companies and entrepreneurs will be shuttling huge cargo spaceships to and from the asteroid belt. Asteroid mining is going to be the first REAL gold rush, “thars gold in them thar rocks!” But not only gold, we’ll be able to consume asteroids of all their constituents; platinum, iridium and silicon (silicon?). Global economies will be flooded with a new-found wealth being fed by the new Solar System’s bounty. Times will be good, after all, this is The Future™. Although asteroid mining looks good on paper, once you do a little bit of adding up, you suddenly realize it’s actually one hell of an undertaking. Looking at the economics of asteroid mining is especially daunting, and believe me, my co-author Greg Fish has done the number crunching. When Greg and I started out researching our book, Astroeconomics: Making Money from the Vacuum of Space, we initially made the assumption that the key way to make vast wads of cash in space is from asteroid mining. This assumption was purely based on… well, an assumption. A quick glance on the various space advocacy websites will demonstrate just how accepted asteroid mining is as a future industry. After all, science fiction has been telling us this for years. Given a sufficiently advanced technology, we’ll be able to build a spaceship, with a mining platform, send it to the asteroid belt (obviously a very short distance), fill up the cargo hold with ore (or, if we are that advanced, refined precious metals) and be back on Earth by a week next Friday. However, when we looked at the situation, we decided to focus on the economics of the beast (in all honesty, Greg did the calculations, I can barely balance my own books, let alone the books of an entire space-faring industry). 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. 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.

**The private sector should incite space commerce, not the federal government.**

Benaroya et al in 2001 (Haym - Professor of Mechanical & Aerospace Engineering and director of the Center for Structures in Extreme Environments @ Rutgers, Thomas Taylor - head of Global Outpost inc., Werner Grandl - architect, Martina Pinni -Space Habitation Architect and assistant professor at the University of Venice, “Space Colony from a Commercial Asteroid Mining Company Town”, accessed through ebsco, NB

http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=6be9f71a-3b39-4cab-aef2-c9298089781c%40sessionmgr13&vid=12&hid=19)

To those who say the commercial development of space should come after NASA and other space faring nations government are finished with their space exploration, let us say commerce is actually the way the rest of world works and will likely be the way near space works. “Space Commerce” in many forms brings increased markets, investment money from another source other than taxes, lower costs, and multiple innovation paths that the government does not have to fund with tax dollars, until they purchase services and enjoy the competitive market savings, (Fletcher, 1988). Some of these little startups in the emerging space commerce industry actually become companies that pay taxes rather than require governments to support their entire cost with tax budgets. The benefits of cooperation with and stimulation of space commerce organizations are many fold and can start with simple partnership agreements that realistically address market and budget needs of both parties, (Taylor, Kistler, Citron, 2007).

Privatization CP- Government bad for space

Government destroys private ownership of space missions

Walker 05 (Bill, , Alaska Politician, Freeman-New Series Foundation, *Thirty-Six Years After Neil Armstrong*,July/August 2005, <http://www.fee.org/pdf/the-freeman/walker0705.pdf>, AG)

Thirty-six years ago men could walk on the moon. Today they can’t; the only moon rockets on this planet are serving as lawn decorations in Huntsville and Houston. Is this because 21st-century technology is less advanced than that of 1969? Obviously not. America’s failure in space is due to our re-enslavement to medieval economics;we believe that government owns everything outside the earth’s atmosphere. Without private property, there will be no markets, no profitable commerce, and no permanent progress in space.How can I be so sure? Because it has all happened before, both on Earth’s seas and in space. China is well known for inventing gunpowder, paper, silk, the compass, the rocket, and more centuries before Europeans could even copy them. But it is less well known that the Chinese actually had an Age of Exploration long before Columbus. From 1405 to 1420, Chinese fleets under the eunuch admiral Zheng He visited India, Sri Lanka, Saudi Arabia, and Africa’s east coast.The ships were gargantuan for the time, some with more than ten masts and with displacements up to 500 tons. The fleets made seven long voyages, carrying Ming vases and other treasures to impress the distant civilizations they visited. They brought a giraffe (and an insufficiently impressed Sri Lankan ruler) back to the emperor. Then the winds of imperial fashion changed, and the voyages stopped. Not only did the “treasure fleets” never again set sail, but the shipyards were destroyed along with the ship’s blueprints and most of the records of the voyages. Later emperors implemented actively anti-maritime policies. By 1520, when Europeans had already been exploring the Americas for three decades, it was illegal for a private Chinese subject to own a ship with more than two masts.The future belonged to the Europeans, with their smaller ships and their vastly greater level of private ownership and economic freedom. In an exact parallel with Imperial Chinese sea exploration, seven moon-landing voyages were launched (though Apollo 13 had to abort; remember, it’s bad luck to be superstitious).Then they stopped.Three years after Neil Armstrong’s landing, the first and last NASA moon field geologist (Harrison Schmidt) walked back into a LEM (lunar excursion module) ascent stage and returned to earth to take off his helmet and become a U.S. senator. No one has been to the moon since. No one can go to the moon today. Just like the mandarins, NASA destroyed the rockets. Those Saturn Vs and Saturn Is we visit in the museums today were real, operational rockets . . . tossed away and left to collect dust.

Privatization CP- private best for mining

Private sector asteroid mining solves best: ensures a new market and incentivizes future space exploration

Geere 10 (Duncan. Senior Staff Writer at Wired.co.uk Wired.co.uk *Making space exploration pay with asteroid mining.* 15 July 10. Lexis) TS

It's not confined just to epic space MMO [Eve Online](http://www.eveonline.com/) and [Mass Effect 2](http://www.wired.co.uk/news/archive/2010-02/08/mass-effect-2-review?page=all) -- [asteroid mining](http://chview.nova.org/station/ast-mine.htm) exists as a topic of study in the real world too. At the [TEDGlobal 2010](http://www.wired.co.uk/news/archive/2010-05/13/space-tourism-price-halved-by-space-adventures) conference in Oxford, Professor Eric Anderson of [Space Adventures](http://www.wired.co.uk/news/archive/2010-05/13/space-tourism-price-halved-by-space-adventures) talked a little about how space travel could eventually prove profitable -- by mining asteroids. Asteroids happen to be particularly rich in platinum group metals -- ruthenium, rhodium, palladium, osmium, iridium, and platinum. These elements are extremely rare on Earth, and most of the world's known deposits come from sites of asteroid impact. They're so rare that [prices for a few grams](http://www.kitco.com/charts/livepalladium.html) can be in the thousands of pounds. However, they're also crucial ingredients for electronics. They're very stable, resistant to chemical attack, and cope with high temperatures, making them perfect for use in circuitry. Asteroids that have already been [surveyed](http://www.wired.co.uk/news/archive/2010-07/9/rosetta-probe-asteroid-lutetia) have been shown to contain vast amounts of these metals. One average 500-metre-wide asteroid contains hundreds of billions of pounds-worth of metal -- more than has ever been mined in the course of human history. [Near-Earth asteroids](http://www.wired.co.uk/news/archive/2010-01/13/just-spotted-asteroid-to-narrowly-miss-earth-today) are likely first targets for mining, due to the ease of getting to them, and getting the materials back to earth. 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.

CP solvency-space treaty sovles

Space treaty key to space cooperation

Imburgia 2011(, Joseph S., author in Vanderbilt Journal of Transnational Law; “Space Debris and Its Threat to National Security: A Proposal for a Binding International Agreement to Clean Up the Junk.” May 2011 <http://web.ebscohost.com/ehost/detail?sid=6e7410a9-26b2-454c-a808-c656e99bad12%40sessionmgr15&vid=2&hid=15&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d> SH)

**Finally, any treaty must have teeth in the form of sound enforcement mechanisms. Because the law of the sea, like the law of space, is concerned with a province of all mankind, the dispute resolution and enforcement mechanisms in any space debris treaty** ought to be similar to the provisions contained in the 1982 UN Convention on the Law of the Sea.354 Accordingly, any space debris treaty should require state parties to settle disputes peacefully in accordance with Article 2, paragraph 3, of the UN Charter and to seek a solution by the means indicated in Article 33, paragraph 1, of the UN Charter.355 **Moreover, the treaty should establish an International Tribunal for the Law of Outer Space to hear disputes that may arise.356 In enforcing treaty violations, states need to be free to choose among various dispute settlement forums, including the proposed International Tribunal for the Law of Outer Space**, the International Court of Justice, or an appropriate arbitral tribunal constituted in accordance with the treaty.357 Moreover, in accordance with Article 33, paragraph 2, of the UN Charter, the Security Council shall always have the power to call upon the parties to settle their dispute by any means or to enforce, through binding resolutions or sanctions, the treaty’s provisions.**358**