Asteroid Mining Affirmative

Asteroid Mining Affirmative 1

1AC Inherency (1/1) 3

1AC Plan Text 4

1AC Resources Adv (1/3) 5

1AC Resources Adv (2/3) 6

1AC Resources Adv (3/3) 7

1AC Platinum Adv (1/6) 8

1AC Platinum Adv (2/6) 9

1AC Platinum Adv (3/6) 10

1AC Platinum Adv (4/6) 11

1AC Platinum Adv (5/6) 12

1AC Platinum Adv (6/6) 13

1AC Colonization Adv (1/3) 14

1AC Colonization Adv (2/3) 15

1AC Colonization Adv (3/3) 16

AFF 17

Inherency 17

Inherency 18

Solvency 19

Solvency- better than mars or moon 19

Solvency- better than alternatives 20

Solvency- tech 21

Solvency- complies with OST 22

Solvency- laundry list 23

Solvency- return feasible 24

Solvency- return feasible 25

Solvency- asteroids nearby 26

Solvency- best for environment 27

Solvency- better than earth mining 28

Solvency- sustainable 29

Solvency- private interest 30

Solvency- private interest 31

Solvency- Robots best 32

Solvency- full commitment 33

Solvency- program improvement 34

Solvency- launch systems sufficient 35

Terrestrial mining bad-causes terrorism 36

Terrestrial mining bad- environment 37

Terrestrial mining bad- environment 38

Now is key- limited resources 39

Now is key- short term resource shortages 40

Now is key- Orion spacecraft 41

Advantages 42

SETI Advantage 42

Asteroid mining key to SETI 43

Asteroid mining key to SETI 44

Asteroid mining key to economy/SETI 45

Resources Advantage 46

Resources- General 46

General- UQ 46

UQ- Resources running out/ asteroids solve 47

General- Links 48

Mining solves resource shortages/environmental destruction 48

Mining solves resource shortages/Economy 49

Mining solves resource shortages/Economy 50

General- impacts 51

Resources key to econ 52

Resources key to econ 53

Resources key to econ 54

Resources key to econ 55

Resource shortages- war 56

Resource shortages- cycle of war 57

Resource wars increasingly likely now 58

Resource wars- magnitude 59

Asteroid mining solves resource wars 60

Resource shortages- sustainability 61

Water shortage- war/ short timeframe 62

Resources- platinum 63

Platinum- UQ 63

UQ for platinum- demand high 63

UQ for platinum- prices high 64

Platinum- Links 65

Asteroids key to platinum supply 66

Platinum- Impacts 67

Platinum shortage kills fuel cells 68

Platinum has a market 69

Platinum key to oil dependence 70

Platinum boosts economy 71

Oil dependency causes warming 72

Oil Dependency Kills economy and heg 73

Oil Dependency causes wars 74

Oil Dependency causes war with China and tanks foreign relations 75

Global Warming- extinction 76

Warming- biodiversity 77

AT: substitutes 78

Asteroid Advantage 79

Asteroids- UQ 79

UQ for asteroids/mining solves 79

No Asteroid protection now 80

No Asteroid protection now 81

AT: Asteroid Painting 82

Asteroids- Links 83

Mining solves asteroid impact- gravity tractor 83

Mining solves asteroid impact 84

Asteroids- Impacts 85

Asteroids impact- extinction 85

Colonization Advantage 86

Colonization Links 86

Mining key to mars- tech, fuel, and research 87

Mining key to colonization- Mars 88

Mining key to colonization- resources 89

Mining key to colonization- propellants 90

Mining key to colonization- volatiles 91

Mining key to colonization- water 92

Mining key to colonization- water 93

Colonization- AT: Mars and moon solve 94

Colonization- Asteroids best 95

Space power advantage 96

Space Power- UQ 96

UQ- US space power declining 97

UQ- US space power declining 98

Space Power- Links 99

Space leadership key to hege 99

Asteroid mining is key to space power 100

Space Power- Impacts 101

Space power- laundry list impacts 101

Space power- laundry list impacts 102

Economy- Adv 103

Mining key to economy and environment 103

Space mining solves space tourism/exploration 104

Mining boosts econ- new industries/space economy 105

Mining boosts econ- new industries/space economy 106

Space commerce key to hege 107

AT: Mine moon CP 108

AT: Mine moon CP- asteroid mission saves resources 108

AT: Mine moon CP- asteroids have more resources 109

AT: Mine moon CP- asteroids better- more resources 110

AT: Privatization 111

AT: privatization CP- perm solvency 111

AT: privatization CP- perm solvency 112

AT: privatization CP- can’t solve/no markets 113

AT: privatization CP- still expensive 114

AT: privatization CP- government key- no markets 115

AT: privatization CP- government key to space economy 116

AT: privatization CP- no investors 117

AT: privatization CP- government key- colonization 118

AT: privatization CP- government key- capital 119

AT: privatization CP- companies fail- capital 120

AT: privatization CP- companies fail- capital 121

AT: spending 122

AT: spending 123

AT: Obama good- link turn- tangible benefits 124

AT: robots CP 125

Random Cards 126

Mining key to ecological sustainability 126

UQ for rare earth- low access 127

UQ for rare earth- US has supplies 128

UQ for rare earth- underwater mining solves 129

Key to further exploration- multiple warrants 130

Moral obligation for space expansion 131

Asteroid mining key to exploration- sparks interest 132

1AC Inherency (1/1)

Obama has no intention of mining asteroids – he wants to use it “pit stop” on the way to mars.

Space.com 11( space.com, Obama: NASA Needs a Technological Breakthrough, <http://www.space.com/12192-obama-nasa-technological-breakthrough-twitter-town-hall.html>, 07-06-11, google news, NC)

Answering a question in a Twitter town hall meeting today, President Obama suggested spaceflight is stuck in Apollo-era mode and said NASA needs a technological breakthrough to allow faster, longer spaceflight with a goal of getting astronauts to Mars. "Frankly I have been pushing NASA to revamp its vision," Obama said. "The Shuttle did some extraordinary work in low orbit: experiments, the International Space Station, moving cargo. It was an extraordinary accomplishment and we're very proud of the work that it did. But now what we need is that next technological breakthrough. [Video: See Obama's Full Comments] "We’re still using the same models for space travel that we used with the Apollo program, thirty, forty years ago. And so what we've said is: rather than keep on doing the same thing, let's invest in basic research around new technologies that can get his places faster, allow human spaceflight to last longer. And what is your seeing now is NASA, I think, redefining its mission. We've set a goal: let's ultimately get to Mars," the president said while fielding questions from Twitter users about the economy and other subjects. "A good pit stop is an asteroid." He joked that a specific asteroid has not been chosen. Obama was clear in alluding to what some critics have said: NASA's human spaceflight program has been stuck flying circles around Earth for decades. "Let's start stretching the boundaries so we’re not doing the same thing over and over again," he said. "Rather, let’s start thinking about what’s the next horizon? What’s the next frontier out there? But in order to do that, we’re actually going to need some technological breakthroughs that we don't have yet." The president did not dismiss low-Earth orbit efforts, but put that responsibility on the shoulders of private enterprise. Let the private sector handle routine tasks of sending vehicles into Earth orbit, he said. And he mentioned how that could, in time, lead to space tourism: "We may be able to achieve a point in time where — those of you who are just dying to go into space – you can buy a ticket and a private carrier can potentially take you up there while the government focuses on the big breakthroughs that require much more larger investments and involve much greater risk."

1AC Plan Text

Thus the plan:

The United States Federal Government should mine asteroids.

1AC Resources Adv (1/3)

**Terrestrial resources will be depleted in decades - only asteroid mining can provide the critical metals to prevent industry collapse once this happens.**

**Crandall et al in 2011(William, MBA at California Polytechnic Institute and President of AbundantPlanet.org,Larry Gorman Professor of finance @ Cal Poly, Peter Howard, Senior Scientist @ Exelixis inc ., “**Is profitable asteroid mining a pragmatic goal?”, February 23rd 2011, NB

[http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf))

In its 1985 revision of the 1958 Space Act, Congress defined NASA’s #1 Priority: “Seek and encourage, to the maximum extent possible, the fullest commercial use of space.”23 Given such direction, one might assume that today, 25 years latter, NASA’s top activity would be developing economically promising space resources: energy from the sun and metals from asteroids. Instead, most funds go to programs to put humans in space.24 Some of these resources have outstanding value. Space agencies intent on addressing fundamental economic needs should focus on these materials. Platinum, for example, has sold at over $1,700/oz since January.25 Platinum group metals (PGMs) are great catalysts. Used in automotive catalytic converters, which are required by national governments worldwide,26 PGM supplies are quite limited. Some models point to terrestrial depletion within decades.27 Platinum group metals are also critical as catalysts in hydrogen fuel cells, which are key to a possible post-carbon, “hydrogen economy.”28 In 2008, The National Research Council identified PGMs as the “most critical” metals for U.S. industrial development.29 Platinum group metals are abundant in certain types of near-Earth asteroids (NEAs). NEAs that are mineralogically similar to one of the most common types of “observed fall” meteorites (H-type, ordinary chondrites) offer PGM concentrations (4.5 ppm)30 that are comparable to those found in profitable terrestrial mines (3-6 ppm).31 Other meteorites suggest that some asteroids may contain much more valuable metal.32 The PGM value of a 200 m asteroid can exceed $1 billion, or possibly $25 billion.33 Over 7,500 NEAs have been detected.

Asteroid mining avoids resource scarcity on earth

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)

 The discussion of the monetary worth of asteroids and comets must not divert attention from the other major reason to pursue the dream of mining these objects. Namely, the metals, minerals, and volatiles acquired in such operations would help conserve supplies of these materials on Earth. At present, these supplies are marginally sufficient to sustain the planet's present population. But that population will inevitably grow and supplies of a number of metals and other commodities will begin to run out. Also, processing metals and minerals (separating them from the rocky mixtures in which most are trapped) pollutes Earth's air, soil, and water. This problem will be eliminated entirely in space mining since all of the processing will take place far from Earth. At first glance, it would seem that such operations would simply shift the pollution problem from Earth to outer space. But this need not be the case. William Hartmann explains: Some writers have raised the specter of humanity despoiling the solar system, in the same manner that over-industrialization is beginning to despoil Earth's environment. But . . . with a careful balance of research and exploitation, we could learn from and process materials in space in a [clean] way that would [also] begin to take the pressure off Earth's ecosystem. A transition from Earth-based manufacturing to interplanetary manufacturing could eventually reduce pollution and ravaging of Earth by an Earth-based society bent on ripping the last dwindling resources from the land. 43 There is another dimension to human acquisition and consumption of cosmic resources, however. Nearly all the experts agree that by the time space mining becomes widespread, only a small percentage of the materials mined will end up on Earth. Instead, a major portion of these resources will be used to construct and sustain human colonies and cities floating in space. Space, they say, will become a vast new frontier that will attract many people born on Earth, helping to stabilize or at least slow the growth of the planet's population. (And of course, over time even more people will be born in space.)

1AC Resources Adv (2/3)

Resource Scarcity is the biggest threat to global security - if exacerbated it will culminate in global war

Trainer 2 (Ted, Senior Lecturer @ University of New South Wales “If you want affluence, prepare for War,” Democracy & Nature: The International Journal of Inclusive Democracy; July 2002, Vol. 8 Issue 2, p281-299)

‘President Carter last week issued a clear warning that any attempt to gain control of the Persian Gulf would lead to war.’ It would ‘… be regarded as an assault on the vital interests of the United States’.65 ‘The US is ready to take military action if Russia threatens vital American interests in the Persian Gulf, the US Secretary of Defence, Mr Brown, said yesterday.’66 Klare’s recent book *Resource Wars* discusses this theme in detail, stressing the coming significance of water as a source of international conflict. ‘Global demand for many key materials is growing at an unsustainable rate. … the incidence of conflict over vital materials is sure to grow. … The wars of the future will largely be fought over the possession and control of vital economic goods. … resource wars will become, in the years ahead, the most distinctive feature of the global security environment.’67 Much of the rich world’s participation in the conflicts taking place throughout the world is driven by the determination to back a faction that will then look favourably on Western interests. In a report entitled, ‘The rich prize that is Shaba’, Breeze begins, ‘Increasing rivalry over a share-out between France and Belgium of the mineral riches of Shaba Province lies behind the joint Franco– Belgian paratroop airlift to Zaire. … These mineral riches make the province a valuable prize and help explain the West’s extended diplomatic courtship …’68 Then there is potential conflict between the rich nations who are after all the ones most dependent on securing large quantities of resources**.** ‘The resource and energy intensive modes of production employed in nearly all industries necessitate continuing armed coercion and competition to secure raw materials.’69 ‘Struggles are taking place, or are in the offing, between rich and poor nations over their share of the world product, within the industrial world over their share of industrial resources and markets …’70

Resource wars will increase in frequency and have a large magnitude

Klare No Date (Michael, Professor at Hampshire Collage, Resource Conflict, <http://pawss.hampshire.edu/topics/resource/index.html>, Google Scholar, NC)

Historically, many wars have been fought over the possession or control of vital resources: water, arable land, gold and silver, diamonds, copper, petroleum, and so on. Conflict over resources figured prominently in the inter-imperial wars of the 16th, 17th, 18th, and 19th centuries, and laid the groundwork for World War I. Resource conflict was less prominent during the Cold War period, when ideological disputes prevailed, but has become more prominent in the Post-Cold War era. Indeed, many of the conflicts of the 1990’s—including those in Angola, Chechnya, Chiapas, Congo, Indonesia, Liberia, Sierra Leone, Somalia and Sudan—were driven largely or in part by competition over the control of critical sources of vital materials. As was true in the past, conflict over resources remains a significant feature of the world security environment. One can of course that the current resurgence of conflict over resources is nothing more than a return to past practice, when such disputes were a common feature of the international landscape. To some degree, this is true. But it is also evident that resource conflict is becoming more frequent and more pronounced in some areas as the demand for certain materials comes to exceed the available supply. For example, an acute shortage of arable land and fresh water seems to have been a significant factor in several conflicts, including those in Chiapas, Rwanda, and Zimbabwe. The same conditions appear to be developing in other areas of scarcity.

1AC Resources Adv (3/3)

**Only Asteroids solve – any other means don’t have sufficient resources and cost more.**

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. )

The moon is unattractive, not just because Apollo astronauts say that the “current Vision [is] a glorified rehash of what we did 40 years ago,” 58 and that “setting up a [moon] base is absolutely ridiculous.” 59 The moon is unattractive because it is mineralogically poor and gravitationally problematic. Consisting of post-impact slag, 60 with only a light dusting of mineralogically rich asteroids, the moon is obviously not the best celestial source of industrially useful metals. Lunar gravity is strong enough to require the use of expensive and dangerous rockets for every arrival and departure. Simultaneously, at only one-third Earth-normal gravity, the moon may be unhealthy, perhaps debilitating, for sustained human habitation. 61 Some have suggested that the moon can offer economically significant quantities of Helium-3, a possible fuel for fusion reactors. There is, however, no current demand for this exotic isotope, which may be equally plentiful in asteroid regolith. Even optimistic promoters of fusion energy technology continue to put its possible deployment billions of dollars and decades in the future, even after billions and decades have already been devoted to its attempted realization. 62 Asteroids: Accessible wealth Asteroids, on the other hand, offer rich deposits of metals that are currently in demand. They generate only very small gravitational effects, so expensive, high-powered rockets are not required. Asteroids also offer structural materials (e.g., iron, nickel, and silicon), volatiles (which can be used for in-space propulsion), and semiconductors. These can be used to build a wide range of evolving infrastructure, including, in the fullness of time, spinning habitats that can precisely simulate biologically benign, Earth-normal gravity. 63 Thanks to several Hollywood blockbusters, the potential dangers of an asteroid impact are widely known. 64 But the fact that asteroids contain high value minerals that are critical for industrially development is less widely known.

**Mining is feasible – our knowledge of asteroids increased drastically.**

Sonter 06- ( Mark Sonter. scientific consultant working in the Australian mining and metallurgical industries. Department of Civil and Mining Engineering in University of Wollongong,. “Asteroid Mining: Key to the Space Economy,”, February 2006, http://www.nss.org/settlement/asteroids/key.html/. TQ)

 Return of resources from some of these NEAs to low or high earth orbit may therefore be competitive versus earth-sourced supplies. Our knowledge of asteroids and comets has expanded dramatically in the last ten years, with images and spectra of asteroids and comets from flybys, rendezvous, and impacts (for example asteroids Gaspra, Ida, Mathilde, the vast image collection from Eros, Itokawa, and others; comets Halley, Borrelly, Tempel-1, and Wild-2. And radar images of asteroids Toutatis, Castalia, Geographos, Kleopatra, Golevka and other... These images show extraordinary variations in structure, strength, porosity, surface features. The total number of identified NEAs has increased from about 300 to more than 3,000 in the period 1995 to 2005. The most accessible group of NEAs for resource recovery is a subset of the Potentially Hazardous Asteroids (PHAs). These are bodies (about 770 now discovered) which approach to within 7.5 million km of earth orbit. The smaller subset of those with orbits which are earth-orbit-grazing give intermittently very low delta-v return opportunities (that is it is easy velocity wise to return to Earth). These are also the bodies which humanity should want to learn about in terms of surface properties and strength so as to plan deflection missions, in case we should ever find one on a collision course with us. Professor John Lewis has pointed out (in Mining the Sky) that the resources of the solar system (the most accessible of which being those in the NEAs) can permanently support in first-world comfort some quadrillion people. In other words, the resources of the solar system are essentially infinite… And they are there for us to use, to invest consciousness into the universe, no less. It's time for humankind to come out of its shell, and begin to grow!! So both for species protection and for the expansion of humanity into the solar system, we need to characterize these objects and learn how to mine and manage them. Once we learn how to work on, handle, and modify the orbits of small near-earth objects, we will have achieved, as a species, both the capability to access the vast resources of the asteroids, and also the capability to protect our planet from identified collision threats.

1AC Platinum Adv (1/6)

Scenario 1: Economy

Platinum prices are expected to rise in the near future

Assis 2010 (Claudia, reporter for Marketwatch.com, “ Platinum, palladium prices expected to rise: Industrial demand higher as recovery gains momentum, refiner says”, <http://www.marketwatch.com/story/platinum-palladium-prices-expected-to-rise-2010-11-16>, 11/16/10, accseed 6/28/11)CNW

SAN FRANCISCO (MarketWatch) — Industrial demand for platinum and palladium is expected to grow and prices are expected to rise as high as $1,900 and $850, respectively, in the next six months, a platinum-group refiner said Tuesday.

 Palladium is expected to see both increased industrial and investor demand, London-based Johnson Matthey said. The increase in demand comes from a rise in sales of consumer electronics and from auto-parts makers, with the latter expected to rise 27%. Demand from exchange-traded funds backed by palladium is likely to remain strong, Johnson Matthey said.

Asteroid Mining is the way to go key to lowering marketing prices on PGMs and increase pursuit of Knowledge allowing all kinds of exploration in space

Geere July 10(Duncan is senior staff writer at wired.co.uk “Making space exploration pay with asteroid mining” 15 July 10 http://www.wired.co.uk/news/archive/2010-07/15/asteroid-mining SH)

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**.**

1AC Platinum Adv (2/6)

**Platinum metals are a critical component of the United States techno-economic system and consumption is growing annually at an extreme rate**

Blair in 2000 (Brad R., professor of metal economics @ Colorado School of Mines, “The Role of Near Earth Asteroids In Long Term Platinum Supply”, May 25th 2000, pg. 5, NB

http://www.nss.org/settlement/asteroids/RoleOfNearEarthAsteroidsInLongTermPlatinumSupply.pdf)

Current high-technology manufactured products that depend on platinum include fuel cells, chemical reactors, refractory metal components, glassmaking equipment, medical devices, electronics, hard disks, and many others. Each of these uses could easily expand to fill a void left by lower prices and increased supply. Other uses of platinum are possible, especially with increased supply. Technological Factors: The link between platinum and high technology is strong. The metal has made its way into a variety of industrial uses, forming a strategic cornerstone of our modern technical economy. A high melting point combined with its ductility and mechanical strength gives platinum an advantage over many refractory metals (Yamabe-Mitarai, 1998). PGM chemical inertness can be useful in caustic or other extreme environments requiring high reliability equipment. It is an excellent conductor with good thermal stability. Like gold, platinum will not oxidize in the atmosphere. The metal finds use in automobiles and petroleum refining due to its powerful catalytic properties in the reforming of hydrocarbons. Many platinum-based products form critical links in the U.S. techno-economic system. Examples include gasoline production, modern plastics and chemical processes, emissions reduction, as well as special aerospace and defense industry uses. The strategic importance of platinum has prompted the Defense Logistics Agency to stockpile over 200,000oz of the metal to assure U.S. industrial productivity in case of an interruption in supply (Christian, 1997). Note that North America imported 970,000 ounces to meet 1999 demand, underscoring U.S. dependence on foreign supply (Johnson Matthey, 1999). Platinum Demand Projections: Industrial demand for platinum stems from its special physical and chemical properties. Many additional industrial uses of platinum are waiting should prices drop and quantity expand, given the quality and properties of the metal. Autocatalyst consumption is currently on the rise (projected at 5% annual growth – Christian, 1999) and has significant potential for long-term growth as developing nations adopt emissions standards similar to the U.S. and Europe.

US key to the world economy

Wang 5/21 (Joy, Columnist Shanghai Daily, 2011, p. Shanghai daily, http://www.shanghaidaily.com/ nsp/Business, OST)

But there are still many uncertainties, such as debt crises in the European Union, political riots in North Africa and the earthquake in Japan. The situation in the United States was also crucial for recovery, participants said. "The US has passed the most difficult times with better employment and better finance," said Lawrence Summers, a professor at Harvard University and former director of the US National Economic Council.  "Now the world has the framework of the G20, which works pretty well, especially in dealing with the crisis. The emerging markets, or to some extent emerged markets, will have a profound influence on the rise of Asia." Li Lihui, president of the Bank of China, said the world's economy had recouped territory lost in the global financial crisis, and there were signs of the growing power of emerging markets. But the global economic order remained the same as before the crisis - dominated by the US. "What the US will do is crucial for the rest of the world," Li said. Quantitative easing policies in the US, due to end in June, led to floods of speculative money flowing into emerging markets. Ronald McKinnon, an economics professor at Stanford University, said it partly explained why inflation was so high in China.

Economic crisis will cause war – multiple reasons. Their take-outs are wrong

Strauss-Kahn 9 (Dominique, Manging Director of the IMF, International Monetary Fund, http://www.imf.org/external/np/speeches/2009/102309.htm)JFS

Let me stress that the crisis is by no means over, and many risks remain. Economic activity is still dependent on policy support, and a premature withdrawal of this support could kill the recovery. And even as growth recovers, it will take some time for jobs to follow suit. This economic instability will continue to threaten social stability. The stakes are particularly high in the low-income countries. Our colleagues at the United Nations and World Bank think that up to 90 million people might be pushed into extreme poverty as a result of this crisis. In many areas of the world, what is at stake is not only higher

1AC Platinum Adv (3/6)

unemployment or lower purchasing power, but life and death itself. Economic marginalization and destitution could lead to social unrest, political instability, a breakdown of democracy, or war. In a sense, our collective efforts to fight the crisis cannot be separated from our efforts guard social stability and to secure peace. This is particularly important in low-income countries. War might justifiably be called “development in reverse”. War leads to death, disability, disease, and displacement of population. War increases poverty. War reduces growth potential by destroying infrastructure as well as financial and human capital. War diverts resources toward violence, rent-seeking, and corruption. War weakens institutions. War in one country harms neighboring countries, including through an influx of refugees. Most wars since the 1970s have been wars within states. It is hard to estimate the true cost of a civil war. Recent research suggests that one year of conflict can knock 2-2½ percentage points off a country’s growth rate. And since the average civil war lasts 7 years, that means an economy that is 15 percent smaller than it would have been with peace. Of course, no cost can be put on the loss of life or the great human suffering that always accompanies war. The causality also runs the other way. Just as wars devastate the economy, a weak economy makes a country more prone to war. The evidence is quite clear on this point—low income or slow economic growth increases the risk of a country falling into civil conflict. Poverty and economic stagnation lead people to become marginalized, without a stake in the productive economy. With little hope of employment or a decent standard of living, they might turn instead to violent activities. Dependence on natural resources is also a risk factor—competition for control over these resources can trigger conflict and income from natural resources can finance war. And so we can see a vicious circle—war makes economic conditions and prospects worse, and weakens institutions, and this in turn increases the likelihood of war. Once a war has started, it’s hard to stop. And even if it stops, it’s easy to slip back into conflict. During the first decade after a war, there is a 50 percent chance of returning to violence, partly because of weakened institutions.

Scenario 2: Hydrogen Economy

We don’t have enough platinum to enable full scale production of hydrogen fuel cells

Yang 09 (CJ, energy policy, An impending platinum crisis and its implications for the future of the automobile, <http://www.duke.edu/~cy42/Pt.pdf>, google scholar, NC)

The US Department of Energy (DOE) hired the consulting firm Arthur D. Little Inc., 2001 to assess the cost of large-scale Production of fuel-cell stacks. They estimated that the cost of Making a 50Kw fuel-cell unit could be reduced to$15,000 if it Were produced at a scale of 500,000 units per year. Their Assumptions followed the status quo technical specifications in 2001,which required 200g of platinum in a fuel-cell unit. When They estimated the material cost of platinum, they used the Market price of $15/g in 2001.Thanks to economy of scale, they Believed that the per-unit fabrication cost would be significantly Lower in large-scale production while the material cost would Remain the same. The Arthur D. Little assessment overlooked an important point: with 200g per unit and 500,000 units per year, this hypothetical factory would be expected to consume 100Mg of platinum annually. In 2001, the world wide supply of platinum was 182.3Mg and the demand was 193.8Mg. This means not only Was all the platinum mined and recycled in that year entirely consumed, but also an additional 11.5Mg were removed from inventories and used up. The large-scale fuel-cell factory envisioned by Arthur D. Little would dramatically exacerbate the imbalance by adding 100Mg of demand. The extent of shortage (over50%) would be unprecedented. It is not reasonable to expect A stable platinum price with such demand jump. Furthermore ,a Hydrogen economy certainly cannot be built with only one factory. If a hydrogen economy actually emerges, the demand for platinum Must necessarily out grow supply by several folds. The dramatic Increase in demand will definitely raise the platinum price by Such a magnitude that makes the widespread adoption of fuel-cell Vehicles impossible. In 2003,TIAX LLC(also with a DOE contract) assessed the long- Term availability and price stability of platinum given anticipated Demand from fuel-cell vehicles(Carlsonetal.,2003). It suggested that the long-term real price of platinum will stabilize at around $300 per troy ounce ($10/g).The report justified its optimistic projection: ‘‘Historic price behavior indicates that as long as supply and demand remain in balance, the long-term real price of platinum will remain stable.’’ The reality is that supply and demand have not been in balance ,and prices have continued to be volatile. Most existing assessments have underestimated the platinum shortage issue and have concluded that platinum supply will not be a barrier to the officially touted hydrogen economy (Carlson et al.,2003; Department for Transport(UK),2006). However, researchers indeed recognize the problems with high platinum price. Intensive R&D has been devoted tor educing platinum loading, and it has achieved significant success. The platinum loading for a vehicular fuel-cell has been reportedly reduced to 60 gin 2006.However, potential platinum price hikes can easily outpace the reduction of

1AC Platinum Adv (4/6)

platinum loading. With low-hanging fruits already picked, further reductions will become increasingly difficult. Even if the most optimistic target (about15–20gper vehicle) were met, a fuel-cell car would still require ten times more platinum than a gasoline-powered car. Some scholars do recognize the inadequacy of platinum. Geologist R. B. Gordon and his colleagues compared the earth’s platinum resources with the potential requirement of a global hydrogen economy (Gordonetal.,2006). They assume that most of the platinum catalysts will be recycled. Because there will inevitably be losses in recycling, a constant flow of new platinum material is required to maintain a fleet of fuel-cell vehicles. According to their estimate, a fleet of 500 million fuel-cell vehicles would exhaust the entire platinum resources in earth’s lithosphere within 15 years. Direct methanol fuel-cell(DMFC) for mobile electronic devices is another promising application of fuel-cell technology. Platinum is irreplaceable in DMFC. DMFC offers several advantages over lithium batteries, the dominant power source for mobile electronic devices. DMFC has very long battery life and can be quickly recharged by refilling methanol. Consumers of high-end mobile electronics might be willing to accept a high price for DMFC because of its superior features. The profit margin of high-end mobile electronics is significantly higher than that of automobiles. It is conceivable that DMFC mobile electronics may be commercialized earlier than hydrogen fuel-cell vehicles. If DMFC technology indeed commercializes, it would add further stress to the platinum supply/demand imbalance and make the commercialization of hydrogen fuel-cell vehicle even less likely.

Lack of Platinum is the primary obstacle to a hydrogen economy

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

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

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

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

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

Schwartz, partner in the Monitor Group and chair of Global Business Network, and Randall, senior practitioner at GBN, 3 (Schwartz and Randall Peter, Doug, *Wired*, “How Hydrogen Can Save America”, April 2003, http://www.wired.com/wired/archive/11.04/hydrogen.html, AH)

The cost of oil dependence has never been so clear. What had long been largely an environmental issue has suddenly become a deadly serious strategic concern. Oil is an indulgence we can no longer afford, not just because it will run out or turn the planet into a sauna, but because it inexorably leads to global conflict. Enough. What we need is a massive, Apollo-scale effort to unlock the potential of hydrogen, a virtually unlimited source of power. The technology is at a tipping point. Terrorism provides political urgency. Consumers are ready for an alternative. From Detroit to Dallas, even the oil establishment is primed for change. We put a man on the moon in a decade; we can achieve energy independence just as fast. Here's how. Four decades ago, the United States faced a creeping menace to national security. The Soviet Union had lobbed the first satellite into space in 1957. Then, on April 12, 1961, Russian cosmonaut Yuri Gagarin blasted off in Vostok 1 and became the first human in orbit. President Kennedy understood that dominating space could mean the difference between a country able to defend itself and one at the mercy of its rivals. In a May 1961 address to Congress, he unveiled Apollo - a 10-year program of federal subsidies aimed at "landing a man on the moon and returning him safely to the Earth." The president announced the goal, Congress appropriated the funds, scientists and engineers put their noses to the launchpad, and - lo and behold - Neil Armstrong stepped on the lunar surface eight years later. The country now faces a similarly dire threat: reliance on foreign oil. Just as President Kennedy responded to Soviet space superiority with a bold commitment, President Bush must respond to the clout of foreign oil by making energy independence a national priority. The president acknowledged as much by touting hydrogen fuel cells in January's State of the Union address. But the $1.2 billion he proposed is a pittance compared to what's needed. Only an Apollo-style effort to replace hydrocarbons with hydrogen can liberate the US to act as a world leader rather than a slave to its appetite for petroleum. Once upon a time, America's oil addiction was primarily an environmental issue. Hydrocarbons are dirty - befouling the air and water, possibly shifting the climate, and causing losses of biodiversity and precious coastal real estate. In those terms, the argument is largely political, one of environmental cleanliness against economic godliness. The horror of 9/11 changed that forever. Buried in the rubble of the World Trade Center was the myth that America can afford the dire

1AC Platinum Adv (5/6)

costs of international oil politics. The price of the nation's reliance on crude has included '70s-style economic shocks, Desert Storm-like military adventures, strained relationships with less energy-hungry allies, and now terror on our shores. George W. Bush arrived in Washington, DC, as a Texan with deep roots in the oil business. In the days following September 11, however, he transformed himself into the National Security President. Today, his ambition to protect the United States from emerging threats overshadows his industry ties. By throwing his power behind hydrogen, Bush would be gambling that, rather than harming Big Oil, he could revitalize the moribund industry. At the same time, he might win support among environmentalists, a group that has felt abandoned by this White House. According to conventional wisdom, there are two ways for the US to reduce dependence on foreign oil: increase domestic production or decrease demand. Either way, though, the country would remain hostage to overseas producers. Consider the administration's ill-fated plan to drill in the Arctic National Wildlife Refuge. For all the political wrangling and backlash, that area's productivity isn't likely to offset declining output from larger US oil fields, let alone increase the total supply from domestic sources. As for reducing demand, the levers available are small and ineffectual. The average car on the road is nine years old, so even dramatic increases in fuel efficiency today won't head off dire consequences tomorrow. Moreover, the dynamism at the heart of the US economy depends on energy. Growth and consumption are inextricably intertwined. There's only one way to insulate the US from the corrosive power of oil, and that's to develop an alternative energy resource that's readily available domestically. Looking at the options - coal, natural gas, wind, water, solar, and nuclear - there's only one thing that can provide a wholesale substitute for foreign oil within a decade: hydrogen. Hydrogen stores energy more effectively than current batteries, burns twice as efficiently in a fuel cell as gasoline does in an internal combustion engine (more than making up for the energy required to produce it), and leaves only water behind. It's plentiful, clean, and - critically - capable of powering cars. Like manned space flight in 1961, hydrogen power is proven but primitive, a technology ripe for acceleration and then deployment. (For that, thank the Apollo program itself, which spurred the development of early fuel cells.) Many observers view as inevitable the transition from an economy powered by fossil fuels to one based on hydrogen. But that view presupposes market forces that are only beginning to stir. Today, power from a fuel cell car engine costs 100 times more than power from its internal combustion counterpart; it'll take a lot of R&D to reduce that ratio. More daunting, the notion of fuel cell cars raises a chicken-and-egg question: How will a nationwide fueling infrastructure materialize to serve a fleet of vehicles that doesn't yet exist and will take decades to reach critical mass? Even hydrogen's boosters look forward to widespread adoption no sooner than 30 to 50 years from now. That's three to five times too long. Adopting Kennedy's 10-year time frame may sound absurdly optimistic, but it's exactly the kick in the pants needed to jolt the US out of its crippling complacency when it comes to energy. A decade is long enough to make a serious difference but short enough that most Americans will see results within their lifetimes. The good news is that the technical challenges are issues of engineering rather than science. That means money can solve them. How much money? How about the amount spent to put a man on the moon: $100 billion in today's dollars. With that investment, the nation could shift the balance of power from foreign oil producers to US energy consumers within a decade. By 2013, a third of all new cars sold could be hydrogen-powered, 15 percent of the nation's gas stations could pump hydrogen, and the US could get more than half its energy from domestic sources, putting independence within reach. All that's missing is a national commitment to make it happen. It'd be easy - too easy - to misspend $100 billion. So the White House needs a plan. The strategy must take advantage of existing infrastructure and strengthen forces propelling the nation toward hydrogen while simultaneously removing obstacles. There are five objectives: 1. Solve the hydrogen fuel-tank problem. 2. Encourage mass production of fuel cell vehicles. 3. Convert the nation's fueling infrastructure to hydrogen. 4. Ramp up hydrogen production. 5. Mount a public campaign to sell the hydrogen economy. By pursuing all five at once, the government can create a self-sustaining cycle of supply and demand that gains momentum over the coming decade and supplants the existing energy market in the decades that follow. Rather than waiting to build a hydrogen infrastructure from scratch, the US can start building the new fuel economy immediately by piggybacking on existing petroleum-based industries. Once customers are demanding and producers are supplying, there will be time to create a cleaner, more efficient hydrogen-centric infrastructure that runs on market forces alone.

Global warming causes extinction

Tickell 8 **(Oliver, Cliamte researcher at The Guardian, “On a planet 4C hotter, we can all prepare for its extinction”,** <http://www.guardian.co.uk/commentisfree/2008/aug/11/climatechange>, August 11, 2008, accessed 7/28/11)CNW

We need to get prepared for four degrees of global warming, Bob Watson told the Guardian last week. At first sight this looks like wise counsel from the climate science adviser to Defra. But the idea that we could adapt to a 4C rise is absurd and dangerous. Global warming on this scale would be a catastrophe that would mean, in the immortal words that Chief Seattle probably never spoke, "the end of living and the beginning of survival" for humankind. Or perhaps the beginning of our extinction. The collapse of the polar ice caps would become inevitable, bringing long-term sea level rises of 70-80 metres. All the world's coastal plains would be lost, complete with ports,

1AC Platinum Adv (6/6)

cities, transport and industrial infrastructure, and much of the world's most productive farmland. The world's geography would be transformed much as it was at the end of the last ice age, when sea levels rose by about 120 metres to create the Channel, the North Sea and Cardigan Bay out of dry land. Weather would become extreme and unpredictable, with more frequent and severe droughts, floods and hurricanes. The Earth's carrying capacity would be hugely reduced. Billions would undoubtedly die. Watson's call was supported by the government's former chief scientific adviser, Sir David King, who warned that "if we get to a four-degree rise it is quite possible that we would begin to see a runaway increase". This is a remarkable understatement. The climate system is already experiencing significant feedbacks, notably the summer melting of the Arctic sea ice. The more the ice melts, the more sunshine is absorbed by the sea, and the more the Arctic warms. And as the Arctic warms, the release of billions of tonnes of methane – a greenhouse gas 70 times stronger than carbon dioxide over 20 years – captured under melting permafrost is already under way. To see how far this process could go, look 55.5m years to the Palaeocene-Eocene Thermal Maximum, when a global temperature increase of 6C coincided with the release of about 5,000 gigatonnes of carbon into the atmosphere, both as CO2 and as methane from bogs and seabed sediments. Lush subtropical forests grew in polar regions, and sea levels rose to 100m higher than today. It appears that an initial warming pulse triggered other warming processes. Many scientists warn that this historical event may be analogous to the present: the warming caused by human emissions could propel us towards a similar hothouse Earth.

1AC Colonization Adv (1/3)

Extinction is inevitable on earth, colonization is key to prevent it and allow for sustainable living

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

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

Obtaining resources from space is key to establish settlements.

Collins & Autino 10 (Patrick Collins Expert in the economics of energy supply from spaceand Adriano Autino, “What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace,” (2010) <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>. TQ)

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

1AC Colonization Adv (2/3)

**Asteroid mining is a prerequisite to extraterrestrial development**

**Crandall in 2008(William, MBA at California Polytechnic Institute and President of AbundantPlanet.org, “**Enabling Profitable Asteroid Mining” (A letter from William Crandall to Obama), November 11th, 2008, NB

<http://abundantplanet.org/files/toBarackObama-2008-11-05.pdf>)

Dear President-Elect Obama, Congratulations! Thank you for bringing such intelligence and heart to this country’s highest office. Thank you too for your interest in science, technology, and education. Concerning space, I urge you to change the focus of America’s space program from exploration to resource development. Space offers excitement for scientists and dreamers, but it also offers economically valuable resources. Three have been identified—location, energy, and minerals—but only one is currently exploited. Satellites generate significant value by relaying bits and by imaging Earth’s surface. The other two resources are now within reach. To open the high frontier, we need to develop an industrial infrastructure in space. Asteroid mining is the next step. We will achieve far greater success, in the long term, by pursuing a rational course of industrial development in space, rather than lunging out with our current technology to achieve a few Hollywood moments on the moon. The supply and demand of the platinum group metals (PGMs) presents the most viable economic vector for extraterrestrial development. The National Academies recently classified PGMs as “most critical” for industrial development. More than three-quarters of the world’s platinum—and more than 85% of the rhodium—comes from a single geological feature in South Africa. Econometric forecasts suggest that these reserves may be depleted by mid-century. Fortunately, perhaps a quarter of near-Earth asteroids are platinum rich; many are easier to reach than the moon. Following the development of this initial economic vector, the third space resource— space-based solar power—becomes economically attractive. Asteroid minerals and solar energy may then lead to the birth of entirely new extraterrestrial economies. As you ponder our country’s priorities in space, please consider incorporating the wealth of asteroids into the economic fabric of human society.

**And, geographic isolation supercharges every impact and makes extinction inevitable in the status quo—plan disperses the species to solve.**

Sowers 2 (George F., “The Transhumanist Case for Space” April 2002, <http://www.georgesowers.com/Other_pdf/The_trans_case_for_space.pdf>, accessed 6-9-11, JMB)

**What can we do to maximize our odds of survival**, irrespective of what those odds might actually be? Furthermore, as humans or aspiring transhumans, we desire much more than mere survival. We also wish to grow in our capabilities and enjoy not only continued life but an ever increasing abundance of life. In this light the question becomes one of risk management. How can we best avoid any large-scale events that would either threaten our survival or significantly degrade our quality of life or limit our ability to grow our technology? Risk management is a fairly standard technique practiced in the management of many (if not most) large scale engineering projects, especially those involving significant amounts of technological development. It came of age in the era of the massive nuclear power plant projects10 and has become stock and trade in the aerospace and defense industry.11 The logic of risk management is straightforward. A risk is an event that has consequences adverse to the achievement of the project’s goals. It is quantified by two numbers: the probability of the event and the severity of the consequences. Typically, the severity of the consequences is measured in dollars of additional cost or weeks of schedule delay or some technical measurement of the performance of the system. The risk management process consists of several basic steps. First is risk identification, followed by risk assessment and analysis and finally risk handling. Risk identification involves the recognition of possible future adverse events—events with consequences detrimental to the projects goal’s. Risk assessment and analysis is the process of estimating the probability of occurrence and consequences of the identified events. Since uncertainty is a significant element of risk, a key element of risk analysis is bounding the uncertainties on the estimated probabilities and consequences. Finally, risk handling is determining and executing a set of actions to reduce the overall risk level, the point of risk management. By now you may be wondering what all this has to do with transhumanism and space. The transhumanism agenda can certainly be seen as embodying a set of goals, among them being extended

1AC Colonization Adv (3/3)

(Cont. Sowers 2)

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

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Inherency

There is currently no funding for asteroid extraction

Crandall 11’

(William BC Crandall MBA Founder Space Wealth, Space Wealth, profitable space sustainable economy, Is Profitable Asteroid Mining A Pragmatic Goal?, February 23, 2011,)

Platinum group metals are also critical as catalysts in hydrogen fuel cells, which are key to a possible postcarbon, “hydrogen economy.” 28 In 2008, TheNational Research Council identified PGMs as the “most critical” metals for U.S. industrial development. 29 Platinum group metals are abundant in certain types of nearEarth asteroids (NEAs). NEAs that are mineralogically similar to one of the most common types of “observed fall” meteorites (Htype, ordinary chondrites) offer PGM concentrations (4.5 ppm) 30 that are comparable to those found in profitable terrestrial mines (36 ppm). 31 Other meteorites suggest that some asteroids may contain much more valuable metal. 32 The PGM value of a 200 m asteroid can exceed $1 billion, or possibly $25 billion. 33 **Over 7,500 NEAs have been detected. 34 Close to a fifth of these are easier to reach than the moon; more than a fifth of those are ≥200 m in diameter: 200+ targets. 35 President Obama requested, and Congress has authorized, a fourfold increase in detection funding ($5.8 m to $20.4 m/year).** 36 **This could lead to ~10,000 known 200 m NEAs in a decade. 37 But detection is just a start. The costs to locate, extract, and process asteroid ore are not well understood. 38 Before significant private capital is put at risk, we need to learn more. In cooperation with other forward looking nations, 39 the U.S. should purchase an option to develop asteroid resources by investing in the knowledge required to mine asteroids. We can then choose to exercise this option if terrestrial PGM supplies do in fact collapse. Asteroids may also be able to supply other metals that are increasingly at risk. 40 There are several candidates: In 2009, the U.S. imported 100% of 19 key industrial metals.**

**No Asteroid mining now, Obama’s vague asteroid agenda has put NASA on a path to mediocrity.**

**“The Scotsman”** 11 (News.Scotsman.com, NASA defiant over US domination of space, <http://news.scotsman.com/world/Nasa-defiant-over-US-domination.6795315.jp>, July 03, 2011, google news, NC)

THE lack of a new vehicle to immediately replace the shuttles is a cause of controversy at Nasa, whose follow-on spaceflight programme, Constellation, was cancelled by President Barack Obama last year because it was behind schedule, over budget and - according to an inquiry commission's findings - on an "unsustainable trajectory". Thousands of space programme workers are being laid off as the space agency enters a period of uncertainty, with Mr Obama having laid out a vague agenda for landing astronauts on an asteroid in 14 years time, but critics suggesting that his lack of vision has put Nasa on a "path to mediocrity". But Nasa chief and former astroanaut Major Charlie Bolden told critics: "Some say our final shuttle mission will mark the end of America's dominance in human spaceflight. American leadership in space will continue for at least the next half century - we have laid the foundation for success."

Inherency

NASA has no intention to mine asteroids, they just want to study them

Wall 11(Mike, Space.com Senior writer, space.com, NASA Spacecraft Arrives at Arizona – size asteroid next week, <http://www.space.com/12175-nasa-dawn-spacecraft-asteroid-vesta-july.html>, 07-05-11, google news, NC)

A NASA spacecraft is just 11 days away from a historic rendezvous with an asteroid the size of Arizona. NASA's Dawn probe should enter into orbit around Vesta on July 16, becoming the first spacecraft to visit the 330-mile-wide (530-kilometer) space rock — the second-largest object in the main asteroid belt between Mars and Jupiter. Dawn is expected to spend a year studying the space rock from above, marking the first time a spacecraft has ever made an extended visit to a large asteroid. Scientists hope Dawn's mission will help them learn about the early days of the solar system and the processes that formed and shaped rocky planets like Earth and Mars. [Photos: Asteroid Vesta and Dawn "Bodies like Vesta are building blocks," Dawn principal investigator Christopher Russell of UCLA told reporters in a recent briefing. "So we're going back and doing some sort of investigation into our roots, the roots of the solar system." A long journey Dawn is now in the home stretch of a nearly four-year cosmic chase. The probe launched in September 2007 and has logged about 1.7 billion miles (2.7 billion km) during its travels. As of Friday (July 1), Dawn had closed to within 53,400 miles (86,000 km) of Vesta, researchers said. Dawn will be just 9,900 miles (16,000 km) from Vesta when the space rock's gravity captures the probe on July 16. At that point, Dawn and Vesta will both be about 117 million miles (188 million km) from Earth. The capture shouldn't be a dramatic, nail-biting affair punctuated by last-minute thruster burns. Dawn has been using its low-thrust ion propulsion system to close in on Vesta slowly but surely, and it should slide nicely into orbit on July 16. The spacecraft will begin its science operations in early August, researchers said. Studying a protoplanet Vesta is so large that many scientists classify it as a protoplanet. The object was well on its way to becoming a full-fledged rocky planet long ago, scientists said, but circumstances intervened. "The formation of Jupiter started stirring up that region of the asteroid belt and preventing materials from coming together any longer," Russell said. [Photos: Asteroids in Deep Space] So Vesta is a sort of time capsule, preserving some record of how the solar system came together 4.5 billion years ago. "As we explore Vesta, we take a virtual journey back in time to the beginning of the solar system," said Carol Raymond, Dawn deputy principal investigator at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif. During its year at Vesta, Dawn will map the giant asteroid's cratered surface fully, study its composition and investigate its geological history. It will do this from several different orbits, ranging from 1,700 miles (2,700 km) above Vesta to just 120 miles (200 km), researchers said. On to the next big thing Dawn should wrap up its science work at Vesta in July 2012. But at that point, the probe's mission will only be half-finished. It will then jet off for another asteroid encounter, this time with the dwarf planet Ceres — the largest object in the asteroid belt. Dawn should arrive at the 605-mile-wide (974 km) Ceres in early 2015. The spacecraft's observations will allow scientists to compare the two giant bodies, which have been shaped by different forces, researchers said. "The Dawn mission is unique in that we're going to be the first mission to rendezvous with not just one body, but two solar system bodies," said Robert Mase, Dawn project manager at JPL. "These are two of the last unexplored worlds in our inner solar system."

Solvency

Solvency- better than mars or moon

Asteroid mining is economically feasible and is substantially better than Mars and the Moon- NEA orbiting habitat allows for constant extraction of bountiful resources

Gaurav Misra, The “Tesla” Orbital Space Settlement, Birla Institute of Technology and Science (BITS)-Pilani, Goa, India, 40th International Conference on Environmental Systems Spain, American Institute of Aeronautics and Astronautics, july 12th, 2010, http://www.spacearchitect.org/pubs/AIAA-2010-6133.pdf

In comparison to the Moon and Mars, most NEAs require lower cost. A smaller mission is required to retrieve asteroid material, since there is very little fuel spent on landing and launching from an asteroid's micro-gravity as compared to the Moon and Mars.Furthermore, in space, the parameter which measures the difficulty of delivering mass from one orbit to another is not distance, but the required velocity change, delta-v (also denoted Δv), needed to perform this transfer. There are a number of known asteroids more accessible than the Moon and Mars in terms of delta-v from the LEO4.In comparison to the resources available on asteroids, the Moon‟s surface is volatile-poor and metal- poor. In the future, the rising cost of resource acquisition on Earth will surpass the falling cost of acquiring equivalent or substitute materials in space. This is likely to provide the economic catalyst for large-scale acquisition and utilization of space resources. In fact, given favorable technical developments and target asteroid conditions, we may soon be able to obtain some resources in space at lower costs than we can mine and process them on Earth. Although the value of NEA resources runs in billions of dollars, at current market prices, a big disadvantage of is that they are "temporary assignment" missions since they can be reached economically at only certain times in their orbit. For example, a given asteroid may be economically attractive in terms of delta-v for several months which recurs at seven year intervals. One may advocate the construction of a surface base on an NEA and argue on the advantage of an orbiting habitat. However, there are a number of difficulties for habitation owing to the micro gravity on the asteroid‟s surface. A settlement in an NEA orbit can practically mine and process the materials almost 365 days a year. The proximity of the settlement to the asteroid will minimize the launch costs and maximize the mass returned to the market thereby ensuring greater returns. The extracted materials can easily be processed on the orbiting settlement, thereby substantially reducing the time delay from commitment of capital to the mining project until the sale of the product. Apart from processing extracted materials, the settlement can also: Manufacture mining related machinery, and custom built robots. Lease out work space and equipment to mining companies. Provide abode to the mining crew. Provide space for orbital hotels and low-g recreation thereby generating revenues from the tourism industry. The settlement can support research and exploration activities for the NEAs since as of now, less than 10% of the NEA population has been compositionally characterized; even sizes of NEAs are poorly constrained. So even for radar determined diameters (which are one of the best) the uncertainties are as high as 30-40%. With more than 1000 known potentially hazardous NEAs, the settlement can serve as an asteroid tracking observatory, this can also facilitate technical analysis of potential asteroids that show commercial and economic promise in the near future. There is a growing need of an “industrial powerhouse” in space in order to efficiently harness the bountiful resources on the NEAs. Further sections in the paper analyze the orbital location and the structural design of such a space settlement, which the author has named Tesla mentioned in honor of the late inventor Nikola Tesla.

Solvency- better than alternatives

Mining the Moon or Mars is too hard; asteroids are a better starting point.

Science Clarified 11 (Science Clarified, How will humans mine asteroids and comets, 04-13-11, NC)

As planetary scientist John S. Lewis says in this excerpt from his fascinating book Mining the Sky , the asteroid belt contains enough iron to construct an enormous space city. We have enough asteroidal iron [in the asteroid belt] to make a metal sphere . . . 550 miles in diameter. Hollowed out into rooms with iron walls, like a gigantic city, it would make a spherical space structure over . . . 1,200 miles in diameter. . . . With a nine-foot ceiling, we could provide each family with a floor area of 3,000 square feet for private residential use and still set aside 3,000 square feet of public space per family. This artificial world would contain enough room to accommodate more than ten quadrillion [a million times a billion] people. Very simply, that is a million times the ultimate population capacity of Earth. It is fair to ask why the inhabitants of such colonies, as well as people still living on Earth, would choose to get metals, minerals, and other resources from asteroids and comets rather than from larger cosmic bodies. Why not mine the Moon first, for example, or perhaps the planet Mars? After all, the Moon and Mars are both far larger than all of the asteroids put together, and both are closer to Earth than most of the asteroids and comets (the NEAs being an obvious exception). First, whether they live on Earth or in space cities, people will naturally want to obtain cosmic resources as easily and cheaply as possible. The fact is that mining the asteroids will be far easier and more economical than mining a large body like the Moon. The Moon's surface gravity is about one-sixth that of Earth, which is strong enough to require a good deal of fuel to land miners and their equipment on its surface. More importantly, getting the processed metals and minerals off the Moon's surface would take even larger amounts of fuel. An added problem is that most of the valuable metals and minerals on the Moon are spread out over thousands of square miles and bound up inside mixtures of rock and dirt, many lying deep underground; it would require a lot of exploration, as well as strenuous and expensive digging and processing, to free them.

Solvency- tech

Asteroid mining requires no future technololgy, its really quite simple

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)

Assuming such commitments do materialize, however, the technical difficulties will be relatively minimal. Indeed, scientists emphasize that humans can reach and mine the asteroids and comets mostly using technology that exists or is presently in development. It is true that this technology will have to be applied on a much vaster scale than people have ever experienced. But it is doable nonetheless. "This isn't Star Wars," say the Minor Planet Center researchers. "The asteroids aren't against us. It's really pretty simple stuff." People have already demonstrated the ability to travel and live in space, and "the engineering factors that go into 'docking' with an asteroid are not difficult." 49 The biggest difficulty will rest in the human decision to begin the mammoth enterprise of exploiting the riches of the solar system. Countries, peoples, and governments have accomplished such large-scale goals before, as the Europeans did when they settled and transformed North and South America or as the Americans did when they aimed for and reached the Moon in the 1960s. One thing is certain. These prior undertakings, though enormous in their own times, will be positively dwarfed by the adventure that awaits humanity in the asteroid belt and beyond.

**Humans already have the capability to mine and take samples from asteroids—Japanese Hayabasa and US Stardust prove**

Zukerman 10 (Wendy, Staff Writer at New Scintist, New Scientist Vol 206, Issue 2765, *The Falcon has Landed*, June 19, 2010, <http://web.ebscohost.com/ehost/detail?sid=0c6eb678-b7d0-48a8-be8d-d57c85ee62a7%40sessionmgr10&vid=20&hid=21&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=51842635>, AG)

 Only the Millennium Falcon could rival the journey this bird has made. A capsule from the spacecraft Hayabusa--Japanese for peregrine falcon--has landed in one piece in the Australian outback. It hopefully contains the first samples of an asteroid ever brought to Earth by human effort. Hayabusa entered the atmosphere at 11.21 pm local time on 13 June (see photo). Three hours earlier, the capsule, which should contain samples from the asteroid Itokawa, had separated from the spacecraft, according to the Japan Aerospace Exploration Agency (JAXA). Some feared that the capsule's parachute would not deploy: when Hayabusa landed awkwardly on Itokawa in 2005, the parachute controls could have been destroyed. Another concern was that a beacon needed to find the capsule had failed. Yoshiyuki Hasegawa of JAXA announced in the early morning of 14 June that the capsule had made a soft landing. "So we are very happy," he said. The beacon had also worked. The capsule will be opened at the Sagamihara Curation Center near Tokyo, Japan. But its contents will be revealed only after it has been cleaned and tested, which will take a couple of months. Hayabusa is not the first spacecraft to return material from beyond the moon. In 2006, NASA's Stardust spacecraft retrieved samples from the comet Wild 2. Hayabusa: The falcon has landed--what's it caught? A capsule from the spacecraft has landed in Australia--now we must wait to find out if it contains the first asteroid sample brought back to Earth Hayabusa's last flight

Solvency- complies with OST

Asteroids Mining follows the OST but cannot be claimed by countries

Vergano 07 (Dan, Writer for Life Magazine, Life Magazine P. 1D, *Cosmic Rock Stars; In sphere of asteroids, Science Sees Calamity – and opportunity*, February 17, 2007, <http://www.lexisnexis.com/hottopics/lnacademic/>, AG)

 Space law still has a few wrinkles to iron out first, though, when it comes to mining asteroids, cautions Frans von der Dunk of the International Institute of Air and Space Law at Holland's Leiden University. The United Nations' Outer Space Treaty makes nations liable for mining companies and allows mining, he says, but stops short of defining property rights, which makes gold mines in space a legally dicey pursuit. "Asteroids have been a low priority for too long," says Burrows, The Survival Imperative author, who calls for long-term space colonies to serve as a refuge for humanity if there's a catastrophic collision. "People worry about terrorism, with good reason, but while it doesn't do to get overexcited, there are bigger threats." Asteroid defense gets a hearing next month at an American Association for the Advancement of Science symposium in San Francisco. With new telescopes in Chile and Hawaii coming online, astronomers expect near-Earth asteroids to turn up nearly 100 times more often than today's rate of discovery.

Solvency- laundry list

Asteroid mining is easy

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)

In contrast, most asteroids and comets are small, manageable, and have extremely tiny gravities, all of which make them easier to mine. Mining ships will also not land on or take off from these bodies, which will save enormous amounts of fuel. A typical ship will stop beside an asteroid and the miners, wearing spacesuits, will transport over to the worksite by pushing off the side of the ship. (They may also use small jets attached to their suits.) This is possible because the ship, the miners, and the asteroid are all nearly weightless. For this reason, the miners will need to attach long tethers to their suits and tie the opposite ends of the tethers to spikes hammered into the asteroid. This will keep them from accidentally floating away into space while they are working. In addition, the mined materials in such a situation are, like the miners, nearly weightless, and will not need to be lifted off the asteroid's surface. This will not only save fuel, but will greatly reduce other risks. According to the scientists at the Minor Planet Center (at the Smithsonian Astrophysical Observatory): Getting asteroidal materials is not a risky business, like launching materials up from Earth or the Moon. Transporting asteroidal materials is all "interorbital" [i.e., takes place in orbit]. [There will be] no risks of crashes, no huge rockets. The gravity of the asteroids is negligible. A person can jump off any but the largest asteroids with leg power alone. 44 Another advantage of mining asteroids rather than the Moon is that the asteroidal metals and minerals are concentrated in a small, easily accessible space and are much purer in content. Almost all asteroids, Daniel Durda points out, "have a hundred times more metal not bound up in rocky minerals than do moon rocks." 45 On S-type and especially M-type asteroids, such materials will require very little processing. Indeed, a fair amount will be collectable even before the digging process begins. The surface of such bodies is rich in granules of metal, ranging from sand- to perhaps fist-sized pieces, all mixed with sootlike dirt. These granules "can easily be separated from the dirt," the Minor Planet Center experts say, using only magnets [in the form of magnetic rakes] and soft grinders. Some engineering designs have "centrifugal grinders," whereby the dirt is fed into a rotating tank and shattered against the wall a time or two. Out come little metal disks, which are separated using simple magnets. 46 Once digging operations begin, larger deposits of metals and minerals will be separated with bigger grinding and chopping devices. Most likely, the miners will allow the loose rocks to float up and away from the asteroid's surface, where a large canopy, a sort of tarp made of nylon or some other tough material, will catch them. One group of experts describes the advantages of such a canopy: Companies will most probably use a canopy because the canopy would be quite profitable in terms of the amount of loose ore [rock mixture] it would collect. It would also prevent the area [around the worksite] from turning into a big dark cloud of debris which would pose problems for the operations. . . . A double-cone-shaped canopy is put around the asteroid. . . . The canopy is then rotated. A [small robotic device called a] dust kicker goes down to the asteroid and . . . kicks up the ore at low velocity. The ore strikes the canopy and is deflected so that it tends to rotate with the canopy, eventually sliding down the two [cone-shaped] funnels. 47 The equipment for processing the metal- and mineral-rich ore will be located at the tips of the two cones. After all of the usable materials have been mined, the miners will tie off the ends of the canopy and tow it either to a floating city or into Earth's orbit. That way, the canopy doubles as both a collection apparatus and transport device.

Solvency- return feasible

**Better propulsion through STPU enables additional PGMs to be brought back or an additional NEO to be explored.**

**Erickson 07** (Ken R. , AIP Conference Proceedings, Optimal Architecture for an Asteroid Mining Mission: System Components and Project Execution., January 30th 2007, Academic Search Complete, NC)

Solar-thermal Propulsion Unit (STPU) This novel method of propulsion, using either H2 or water, and a nuclear or solar thermal power source, has been quite extensively investigated (Zuppero, et al., 1999). The advantages are that either H2 from hydrolysis of asteroidal water or just water itself can be used with a solar power source to provide high thrust alternatives to LH2/LOX, using entirely space-based resources. If the hydrolysis unit functions, the STPU offers the ability to extend the project to deliver more PGMs, water, or Ni-Fe ore to LEO with a separate launcher, or to allow the exploitation of an additional asteroid. If the unit does not function, unhydrolyzed water extracted from the NEA can be utilized to supply steam propulsion. Although LH2 provides a higher degree of thrust than water (700-800 sec versus 200 sec), it also requires much heavier containment, as well as a refrigeration system (Zuppero, et al., 1999). In making final decisions with regard to which system to invest in, this proposal favors the use of water-to-steam propulsion, solar-powered. It is far simpler, less expensive, and removes the necessity of heavy tanks required for LH2 storage (Zuppero, et al., 1999). The application will be an MET to either (a) bring back additional PGMs, ore and water with the steam-powered launcher; or (b) launch two of the LMs to a second NEA if the initial NEA is disappointing in its resources. The two additional landers could both be the PGM LMs, or could be one of each type of lander, depending upon mission parameters dictated from Earth. Since delta-V to depart from the NEA is so small, it is feasible to use this MET to deliver additional supplies to HEEO or LEO (Sonter, 2001).

**The Spacecraft have the means to return by themselves**

Erickson 07 (Ken R. , AIP Conference Proceedings, Optimal Architecture for an Asteroid Mining Mission: System Components and Project Execution., January 30th 2007, Academic Search Complete, NC

Return Launchers The return launchers include: a) the primary launch unit that brought the mining platform to the asteroid. This will be equipped with LH2 and LOX propellant chambers, and provide maximum thrust for transporting PGMs, water and/or nickel-iron ore back to LEO. Sufficient LH2/LOX will remain after reaching the NEA to return to LEO for “minimum-return” of PGMs, and small amounts of water and Ni-Fe ore. b) a back-up launcher that can utilize solar-thermal steam propulsion. If the ISRU equipment for producing LH2/LOX malfunctions, this system can utilize asteroidal water to return the PGMs, and smaller samples of water and nickel-iron ore if desired. This could provide mass payback ratios as high as 1000:1 (Zuppero, et al., 1999). Transport of water may be managed through thin collapsible polybenzoxazole membranes (Zuppero and Lewis, 1998), ore and PGMs through vectran-kevlar composite inflatable bags such as are being currently tested for orbiting space hotels by Bigelow Aerospace (Berardelli, 2006).

Solvency- return feasible

Return is possible using resources from asteroids

Honan 11 (Daniel, Big Think, The first trillionaires will make their fortunes in space, Bigthink.com, NC)

Asteroids represent a dual threat and opportunity for humanity. In the starkest terms, an asteroid collision could lead to the extinction of the human race, as presented in this terrifying computer-simulated video. And yet, asteroids also represent an opportunity for the salvation of the human race. Asteroids contain a wide range of resources, including nickel-iron metal, silicate minerals, trapped or frozen gasses, and water, which could be utilized by a spacecraft's steam propulsion rocket for a return trip to Earth. Asteroids have also been thought of as a possible site for the colonization of space. After all, it was the impact of asteroids that transformed life on Earth and may have made human life possible in the first place. As Peter Diamandis has noted, there are many motivations for going to space. It was curiosity that drove NASA's budgets for fifty years. Another fundamental motivator to go to space is to back up the biosphere. Diamandis suggests that we "record all of the genomes on this planet, all the works of art, and back it up off earth." Twenty trillion dollars isn't bad motivation either, and the drive to create wealth from space may very well prove the key to human survival and our future prosperity.

**Minerals can be returned to earth easily and inexpensively - Water contained in asteroids can be extracted and can be converted to fuel for steam propulsion rockets.**

Sonter in 2006 (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, “Asteroid Mining: Key to the Space economy, accessed through EBSCO, NB,

<http://www.space.com/2032-asteroid-mining-key-space-economy.html>)

Spectroscopic studies suggest, and 'ground-truth' chemical assays of meteorites confirm, that a wide range of resources are present in asteroids and comets, including nickel-iron metal, silicate minerals, semiconductor and platinum group metals, water, bituminous hydrocarbons, and trapped or frozen gases including carbon dioxide and ammonia.  As one startling pointer to the unexpected riches in asteroids, many stony and stony-iron meteorites contain Platinum Group Metals at grades of up to 100 ppm (or 100 grams per ton).  Operating open pit platinum and gold mines in South Africa and  elsewhere mine ores of grade 5 to 10 ppm, so grades of 10 to 20 times higher would be regarded as spectacular if available in quantity, on Earth. Water is an obvious first, and key, potential product from asteroid mines, as it could be used for return trip propulsion via steam rocket. About 10% of Near-Earth Asteroids are energetically more accessible (easier to get to) than the Moon  (i.e. under 6 km/s from LEO), and a substantial minority of these have return-to-Earth transfer orbit injection delta-v's of only 1 to 2 km/s. Return of resources from some of these NEAs to low or high earth orbit may therefore be competitive versus earth-sourced supplies.

Solvency- asteroids nearby

A great deal of Asteroids are in close proximity to the Earth

Durda 6’

(Dr. Daniel D. Durda Southwest Research Institute Department of Space Studies, The Solar System beckons with resources unimaginable on Earth. Ad Astra, Volume 18 Number 2, Summer 2006. QJ)

**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.

**Solvency- best for environment**

**Asteroid mining is most ecologically and economically sustainable for space**

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 maximize the benefits derived from off-planet resources, profitable asteroid mining may be our most pragmatic deep-space goal for the next few decades. For ecologically sustainable terrestrial development, what targets offer richer sources of the most critical of all industrial metals—the platinum group metals? Where else can we find these rare catalysts? [And] For economically sustainable extraterrestrial development, what targets offer greater potential financial returns? The Moon is slag; it and Mars require costly rockets for landing and liftoff; neither can offer a biologically benign gravity. This paper is part of an ongoing effort to (1) identify solar-system resources that offer humanity the greatest potential benefits, (2) describe technologies that can be used to reach and manipulate those resources, and (3) plan the demonstration missions that will bring us closer to realizing financially compelling returns. More generally, the paper aims to increase our understanding of the value of the tools— especially the robotic tools—required to reach our long-term goals in space. Multi-generational space development programs to “sustainably send humans into the solar system” (Charles Bolden)1 and “make our dreams in space a reality” (James Cameron)2 need to deliver real economic benefits. The following sections explore motivations, resource demand, technological demonstrations, and the alignment of agency priorities with societal needs:

Solvency- better than earth mining

The cost of asteroid mining will soon be cheaper than mining resources from Earth

Charles L. Gerlach 2005 INTERNATIONAL SPACE DEVELOPMENT CONFERENCE, National Space Society, Washington, DC, May 19–22, 2005, Profitably Exploiting Near-Earth Object Resources, , Gerlach Space Systems LLC, CEO of Gerlach Space Systems LLC (GSS), former law professor, graduate of Harvard College and Harvard Law School. http://abundantplanet.org/files/Space-Ast-Profitably-Exploiting-NEO-Gerlach-2005.pdf

In the future, the rising cost of resource acquisition on Earth will surpass the falling cost of acquiring equivalent or substitute materials in space. This is likely to provide the economic catalyst for large-scale acquisition and utilization of space resources. In fact, as we will show in this paper, for some resources, these costs may already be relatively close (Figure 1), and given favorable technical developments and target asteroid conditions, we may soon be able to obtain some resources in space at lower costs than we can mine and process them on Earth. Due to our incomplete knowledge of asteroid geology and conditions and the lack of tested technology solutions, initial recovery of non-terrestrial resources will be risky and expensive; however, the potential returns – including the ability to establish a viable planetary defense against asteroid and comet collisions – are enormous. The NEO Miner mission concept reviewed in this paper envisages use of multiple lightweight, teleoperated, and semiautonomous landers extracting and processing platinum group metals from highly-accessible near-Earth asteroids and returning these materials to Earth for sale. Near-Earth asteroids are classified by orbital parameters into Apollos, Amors, and Atens (Figure 3). In addition, Arjunas are a group of small objects in very Earth-like, and therefore very accessible orbits. Accessibility is defined in terms of change-in-velocity requirements for outbound and return trajectories. In space, the parameter that determines how easy or difficult it is to deliver mass from one orbit to another is not distance but the required velocity change needed to perform the transfer. One characteristic that makes NEOs particularly attractive for resource utilization is the relatively low delta-v required to reach them and return resources from them. Many near-Earth asteroids require less energy to reach than the surface of the Moon, and return to Earth orbit requires far less than return from the Moon (Figure 4).

NEA mining will change the economic and dynamic aspects of energy production

Charles L. Gerlach 2005 INTERNATIONAL SPACE DEVELOPMENT CONFERENCE, National Space Society, Washington, DC, May 19–22, 2005, Profitably Exploiting Near-Earth Object Resources, , Gerlach Space Systems LLC, CEO of Gerlach Space Systems LLC (GSS), former law professor, graduate of Harvard College and Harvard Law School. http://abundantplanet.org/files/Space-Ast-Profitably-Exploiting-NEO-Gerlach-2005.pdf

While untested and fraught with engineering challenges, NEO mining has the potential to dramatically change the dynamics of many segments of the natural resources industry. It transforms the dynamics and economics of almost every aspect of resource production. Robotic mining of near-Earth objects has several potential advantages over traditional terrestrial mining. Based on what we have learned about asteroid geology and operating in micro-gravity environments, we can conceive of radically new approaches to mining on an asteroid that may ultimately become much more cost-effective than more traditional mining operations. These advantages and all of the other attractive features of NEOs as targets for mining operations would appear to justify the risk and investment required to take the first steps.

Solvency- sustainable

Resource exploitation from Space is key to sustainable future.

Sato, 07. (Rebecca Sato. Expert Freelance Writer/Author. “A Third Way: Is Space Industrialization the Answer to Sustainable Development?” 10-08-11. <http://www.dailygalaxy.com/my_weblog/2007/10/a-third-way-is-.html>. TQ)

Political scientist Rasmus Karlsson suggests that space could provide us with a sustainable future that is simply not possible from an earthbound only perspective. Writing in the October issue of Interscience publication, International Journal of the Environment and Sustainable Development, Karlsson, a researcher at the University of Lund, Sweden, explains that over the years, two strands of thought on sustainable development have emerged. They are ecologism and environmentalism. Ecologism offers a solution by emphasizing the need for major socioeconomic reform aimed at a post-industrial era. Environmentalism, in contrast, focuses on the preservation, restoration, and improvement of the natural environment within the present framework. However, Karlsson, suggests that there is a third approach to sustainable development that has until now been excluded from the agenda - namely a large-scale industrial expansion into space. He suggests that access to the raw materials found on the Moon as well as unfiltered solar energy could be used to increase dramatically our stock of resources and energy while providing unlimited sinks for pollutants. Such an approach would satisfy two of the most demanding issues regarding sustainability, finding renewable energy sources and the disposal of pollutants. Resource scarcity, pollution, and dwindling fossil fuels, have become of serious environmental concern in the last few decades. As such, environmentalists have called for massive reductions in energy and material consumption. Seemingly unrelated but running in parallel is that the promise of space exploration has been limited to technological optimists whose economic framework rarely acknowledges any such scarcity. Karlsson suggests that it is time to reconcile the politics of scarcity with this technological optimism and to devise a unified political vision for the 21st century that will lead to a truly sustainable planet by extending our reach into space. Some worry that industrializing space would be a cop-out from finding sustainable solutions on Earth, but others believe the two can go hand in hand. As the world population grows, it seems inevitable that we will run out of space and time for creating the perfect world on just one planet. For certain, the sustainable development problem is a vast and complicated concern for which there are few easy answers. It’s also worth noting that many who criticize industrializing space are not themselves willing to give up all potentially polluting “modern” conveniences while we search for more long-term solutions.

**Mining key to space development to becoming sustainable.**

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. )

The critical question is how? What goals will hasten space profitability? Neither the moon nor Mars offer the right stuff; only asteroids can get us from here to sustainability. Space offers vast potential wealth. We need to tap that wealth (and then tax it), so that space development can become truly sustainable. In order to do that, we need to unhinge our antediluvian romance with the goddess in the moon (von Braun’s Frau im Mond28 ), shift our attention from familiar, resource-poor celestial orbs, and focus on economically meaningful activities in space. We need to develop profitable space-based industries. With rising demands on federal spending—for social security, health care, new sources of environmentally benign energy, and improved education—the United States must focus its space dollars on those space resources that offer the highest possible return. To do otherwise, in an increasingly resource challenged world, is politically irresponsible.

Solvency- private interest

Aerospace business experts agree that government action is needed to motivate the private sector

Wall 2010 (Mike, senior writer for Space.com, cites Greason, Jeff Greason, president of XCOR Aerospace, and Spudis, Paul Spudis scientist at the Lunar and Planetary Institute in Houston, “Want to Mine the Solar System? Start With the Moon”, <http://www.space.com/9430-solar-system-start-moon.html>, 8/30/10, accessed 7/2/11)CNW

Most panelists agreed that economics will ultimately drive such extractive enterprises. Private industry, rather than government, will be doing most of the heavy lifting.

However, government leadership and [investment](http://www.space.com/9430-solar-system-start-moon.html) will likely be needed to get these businesses off the ground, several panelists said.

Some people in the aerospace industry are skeptical about the feasibility of extraterrestrial mining operations, Spudis said. To get them onboard, government should demonstrate the necessary technologies and know-how.

"Let the government lead the way, and let the private sector follow," Spudis said.

Government could also prime the pump for private industry, some panelists said, spurring demand for rocket fuel sold from orbiting filling stations.

"An appropriate government investment can catalyze it," Greason said. "Government shows the initial demand and the private sector figures out how to provide the supply."

The panel agreed about the transformative potential of extraterrestrial resource extraction. Once business gets a foothold in space, and it becomes obvious how much money there is to be made, space will open up to humanity. The sky is no longer the limit.

Asteroid mining will lead to commercial mining

Crandall et. al 11 February 23 2011 “William BC Crandall has a MBA study the economic and commercial feasibility of extraterrestrial resource development, “Asteroid Mining A Pragmatic Goal?” [http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf)

**If the first asteroid mining demonstration missions are run, *from the start,* with partners in the robotics, mining, and space infrastructure industrie**s, perhaps as few as three large-scale demonstrations **can jump-start commercial asteroid mining**. NASA may initiate ***autocatalytic* asteroid mining** through a series of successes: 1. Return 1.0 tonne *pulverized44* but unrefined asteroid ore to Earth. PGM-5 concentration: ~4.5 ppm 2. Return 10 tonnes *pulverized and partially refined* asteroid ore to Earth. PGM-5 concentration: ~4.5% (~45,000 ppm) 3. Return 100 tonnes *more fully refined* asteroid ore to Earth. PGM-5 concentration: ~45%45 [Large satellites: ~5 t. The ISS: ~450 t.] The value of the ore returned is on the order of $100, $10 million, and **$1 billion,** for the five most important PGMs: ruthenium, rhodium, palladium, iridium, and platinum. **If the missions are successful, and if the knowledge gained by executing them is well published, industrial investors may choose to keep the ball rolling.**

Solvency- private interest

**Initial success of NEO mining will serve as a catalyst for commercial expansion in space**

**Gerlach 2005**

(Charles, CEO Gerlach Space Systems, “Profitability Exploiting Near-Earth Object Resources” delivered at 2005 International Space Development Conference in Washington D.C , May 19-22 2005, NB

http://abundantplanet.org/files/Space-Ast-Profitably-Exploiting-NEO-Gerlach-2005.pdf)

When viewed in the context of traditional mining practices, the NEO Miner platform represents a classic example of a disruptive technology. Disruptive technologies bring to the market very different value propositions than have been available previously. Generally, disruptive technologies initially underperform established products in mainstream markets, but they have other features that a few fringe (and generally new) customer value. Products based on disruptive technologies are typically cheaper, simpler,smaller, and frequently more convenient to use. Neo Miner does not represent an incremental improvement to traditional resource production processes. It is a radical departure that is smaller and cheaper than a traditional mining operation and many, in some ways, be considered inferior. However, it has the potential to be highly disruptive of traditional mining methods. As a disruptive technology, initial success is likely to fuel rapid improvements in performance and reductions in cost. The use of multiple landers with modular components is a powerful tool for risk reduction that enables the capture of economies of scale that can dramatically drive down the cost of this equipment over time. Once successful operation of the platform is demonstrated, it will become viable to build landers using assembly-line production processes and deploy multiple missions to one or more asteroids simultaneously, producing significant marketable quantities of resources for sale in terrestrial markets and for use on orbit. In addition, it will be possible to update the NEO Miner platform in each successive generation based on data and experiences gathered through each deployment. This could enable dramatic improvements in the functionality of the landers as well as drive down their cost to a point that dozens of missions with hundreds of landers can be launched.

Solvency- Robots best

Robots are key to mining

Crandall et. al 11 February 232011 “William BC Crandall has a MBA study the economic and commercial feasibility of extraterrestrial resource development, “Asteroid Mining A Pragmatic Goal?” PG.7 [http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf)

Design, Build, and Operate Robotic Miners Advanced robotics is the key to profitable asteroid mining.70 Semiconductor and nanoscale hardware appears likely to sustain the exponential growth of Moore’s Law for decades.71 Robotic miners can draw on this growing power—if we can get new computational technology off planet and to the target asteroids.72 Robotic miners face many challenges. They must manage exponential complexity (a by-product of growing computational power), survive the environmental rigors of space, and execute the physically demanding work of hard-rock mining. They need to be logically robust and physically tough: able to process tonnes of rock while utilizing gigawatts of power.73 Nontrivial engineering, to be sure. The training required to design, build, program, and operate these robots is also far from trivial, as anyone who has assimilated an “undergraduate” robotics text can attest.74 Governments can raise the appeal of such a challenging educational career by making a clear commitment to extraterrestrial resource development. Fundamental robotics R&D can also benefit a wide range of terrestrial industries.

Solvency- full commitment

**Full commitment to Space mining is the ONLY way to garner any solvency.**

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. )

After the nation’s second worst economic failure in over a century, the taxpaying public is reexamining priorities. None of your recommendations will receive the support that it requires if the value proposition of space remains as it is: unclear. Cold War motivations are gone and younger generations are otherwise excited. What compelling reason could possibly make the extraordinarily high price of space travel politically and economically viable? Rather than the resource-poor moon, or too distant Mars, our national civil space agency should focus on asteroid mineral resources—specifically the platinum group metals. The terrestrial sources of these vital metals are in rapid decline. Our national civil space agency should demonstrate that asteroid metals mining is technologically feasible and economically compelling. National investments in technological frontiers have produced huge economic returns: the Panama Canal, the intercontinental railroad, the interstate highway system. The nation should now invest in the development of new sources of industrially critical metals. Profitable asteroid mining would bring necessary industrial resources to the nation—and new tax revenue. This income could be used to develop ever more productive space technologies, that could lead to a growing stream of valuable extraterrestrial resources that would benefit the nation and the world. In these efforts, on-site humans could productively compliment industrial robots. If space can be shown to offer real value, the public—and their political representatives—will support it. Solve real problems; get real support.

Solvency- program improvement

NEO mining transforms the resource industry and creates better mining techniques

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

While untested and fraught with engineering challenges, NEO mining has the potential to dramatically change the dynamics of many segments of the natural resources industry. It transforms the dynamics and economics of almost every aspect of resource production. Robotic mining of near-Earth objects has several potential advantages over traditional terrestrial mining Based on what we have learned about asteroid geology and operating in micro-gravity environments, we can conceive of radically new approaches to mining on an asteroid that may ultimately become much more cost-effective than more traditional mining operations. These advantages and all of the other attractive features of NEOs as targets for mining operations would appear to justify the risk and investment required to take the first steps.

Solvency- launch systems sufficient

Current launch systems can be used for space mission

Alibay No Date

( Farah Alibay et.al graduate from the Massachusetts Institute of Technology, SURVEY, CAPTURE, RELOCATION AND EXPLORATION OF A NEAR-EARTH OBJECT, PG 13 QJ)

**Launch systems were been discussed** in Sections 4 and 5, **for the robotic and human mission respectively. One of the key enablers for this type of mission is that existing launch vehicle technology and human support systems would be used, rather than building a dedicated launch vehicle.** In particular, it is strongly encouraged that **either the approach taken by Space Adventures, using an adapted Soyuz vehicle** (Space Adventures), **an adaptation of the Dragon vehicle** (SpaceX) **or the planned Multi Purpose Crew Vehicle (MPCV) be used by NASA, instead of building a new heavy lift launcher and human capsule, as was suggested for the Constellation program. Table 6 below provides a summary of the launch systems.**

**Terrestrial mining bad-causes terrorism**

Terrestrial mines are magnets for terrorism

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)

Inevitably, anti-state violence has affected mining companies, and their employees. In the 2004/2005 Fraser Institute survey of mining companies, 50 percent of the respondents (n = 259) indicated that they considered the security situation in the Philippines to be a strong deterrent to investment in the Philippines; in the 2005/2006 Fraser Institute survey of mining companies, this figure had risen to 57 percent of the survey respondents (n = 322) (Fraser Institute 2005, 2006). As one unnamed mining company president stated, ‘In the Philippines, the terrorist and security threat is real’(Fraser Institute 2005, 46). This concern is well founded in that there are instances of armed groups attacking mining companies. In December of 1999, the NPA killed a man engaged in negotiating community consent for the Australian mining company Newcrest Mining Corporation in the Province of Abra on the island of Luzon (Conrado Balweg Punished 2000). In February 2002, the NPA burned a vehicle owned by a copper processing company on the island of Leyte (NPA Metes Punishment on Social Menaces in Leyte 2002). In March of 2002, unidentified gunmen opened fire on a truck carrying employees of TVI (Toronto Ventures Incorporated) Pacific, a Canadian mining company, from its Canatuan Gold Project (Figure 2 and Table 1) to the nearby town of Siocon in the Province of Zamboanga del Norte on the island of Mindanao; two security guards employed by TVI Pacific were killed in this attack (Canatuan Incident 2002). In December 2002 another attack by unidentified gunmen8 on a truck carrying employees of TVI Pacific from its Canatuan Gold Project occurred and three security guards were killed along with two male employees of the mine and eight women and children (Thirteen Die in Attack Near Canatuan 2003). What facilitates attacks upon mines by armed groups is the fact that both mineral deposits, and the ideal terrain for guerrilla warfare, originate in mountainous areas. Mineral deposits are usually found in mountainous regions because of the complicated geological forces that occasion their genesis (National Research Council 1999). The literature on guerrilla warfare shows that mountainous terrain is significantly related to higher rates of civil war (Fearon and Laitin 2003). Fighting is mostly a matter of moving, hiding and shooting and the ability to do all three is conditioned by the lie of the land and climate (O’Sullivan 1991). Rough terrain, and an abundance of hiding places, will allow a poorly armed force to easily hold off a numerically superior, and better-armed opponent. The mountainous terrain of the Philippines islands, and their humid tropical vegetation cover, make them an excellent venue for an insurgency (Le Billon 2004). The use of mountainous areas as an operating area for insurgents becomes particularly important in a Philippine context when one considers that it has long been established NPA doctrine to operate in these areas (Guerrero 1979).

Terrestrial mining bad- environment

We need to start mining space. Mining on earth sucks – Romania proves.

Fodor 10 (Dumitru, Romanian Professor, PhD habitat engineering?, Mining Industry and Environment, <http://upet.ro/anale/mine/pdf/Annals-Mining-Engineering-2010.pdf>, academic search preimer, NC)

The mining activities of useful mineral extraction and capitalization opened the way to civilizatrion, progress and welfare in Romania. The solid mineral exploitation and processing in Romania have been known since very old times. The Romanian mining industry continuously developed until the last decade of the XXth century when significant transformations and adapting to the transition of the market economy took place. The useful mineral deposits of Romania are numerous and presents a large diversity of types, represented by: mineral fuels of all types, precious metal ores, ferrous and non-ferrous ores, non-metal and radioactive ores, salt, useful rocks of all types, etc. From geographic point of view the deposits are spread over the whole Romanian territory, the ore depsosits being found mostly in the mountaineering areas and the coal and non - metal ores in the hilly regions and intra-mountain depressions. Before 1990, mining has been practiced in Romania in 41 mining basins located on the territory of 23 counties. In Romania, the deposit conditions are difficult and very difficult like for instance: complex tectonics, small reserves, thin layers and veins, low grades ores, very deep exploitation, difficult hydro-geological conditions, etc. In such deposits only small scale exploitation operations could have been developed, but they caused a strong and visible impact on the environment. Romania is crossed by a dense network of rivers which sources are in the mountains close to the mineral deposits, but their flow-rates are relatively small and their length is reduced. The water of these rivers is sued for the production process of the mining industry. The development of Romanian mining industry particularly during the second half of the XXth century led to the concentration of the mining activities in big industrial zones situated near the useful mineral deposits areas such as: Uricani, Rovinari, Motru, Berbesti-Alunu, Moldova - Noua, Abrud, Baia - Borsa, Balan, Brad, etc. Each and every one of the aspectes mentioned above are specific for Romanian mining and represent disadvanatges for the environment protection which have to be reviewed in details. The mining industry cause a significant impact on the environment and it occurs within all the technological exploitation and processing stages. Regardless the method used, for the capitalization of a useful mineral deposit there have to be implemented numerous and different physical and chemical operations and processes and there result on one hand, the sueful mineral and on the other hand, the waste mined out with the ore. The useful minerals themselves contained in the crude ores represent almost always, low grade materials of the total ore bulk mined out. These low grade percentages have different values. For metallic ores, the percentage of useful mineral is lower, ranging between tens of percentages for the non-ferrous ores and rare metals and higher for the ferrous ores, namely 25 - 50% and sometimes, even more, for the non-metal ores, the useful mineral percentage may reach some tens of percentage in come cases. The sepcific deposit conditions impact the environment as follows: 􀀀 Occupation and degradation of large surface areas for the development of exploitation, dumping and useful mineral storage operations as well as for the location of industrial installations of the types necessary for the production processes; 􀀀 Low contents of useful mineral determining the production of high amounts of waste by the useful product unit achieved; 􀀀 Production of high and varies polluting residues ( solid, liquid and gaseous ) with diffe-rent rates of toxicity as a result of the large variety of mined out deposits; 􀀀 Elimination of poisonous elements with negative impact on the atmosphere, flora and fauna of the zone; Contamination of the surface waters, modification of the hydro-geology and pollution of the phreatic waters; 􀀀 Modification of the relief and resettlement of industrial projects and human settlements from the exploitation areas; 􀀀 Production of the residues in the region of the deposi ts situated in the narrrow mountaineering and hilly areas often afforested involving difficult and expensive traffic conditions, deforestation works, blocakge of valleys etc., which negatively impact the natural habitats; 􀀀 Degradation of land surfaces because of the vertical and horizontal displacement and sliding event of the waste dumps and tailings management facilities causing sevre and very severe accident consequences; 􀀀 Chemical pollution of soil which may impact the soil fertility for many years; 􀀀 Pollution of water courses of the mining exploitation area with severe consequences because of the low flow-rates and short water courses which make inefficient the dilution of the toxicity and the natural regeneration of the water; 􀀀 Mining localities with high population density are located in valley very polluted by themining residues of all types and where the climate is not quite optimal for living. Because of all these reasons, the useful mineral mining and processing activities have a negative impact on the environment due to the release of toxic matters in the atmosphere, the contamination of surface waters

Terrestrial mining bad- environment

(cont. Fodor 10)

becuase of the used water discharge in the emissary, modification of the hydro-geological regime and pollution of phreatic waters take out of sue of large surface areas occupied by the open pit and the mining yards, waste dumps and tailings management facilities, industrial constructions, etc. If the negative impact caused by the mining industry on the air and water significantly diminish or even dissapear completely at the closure or termination of the mining operations in the zone, the impact on the territory (soil flora, fauna, landscape) determined by the construction of waste dumps, tailings management facilities and industrial installations last longer and are more intense. In the past, the focus was on the obtaining of high

production rates neglecting the ecological impact of the mining industry as a whole, and determined the accumulation of some severe damages on the environment and currently, thes edamages have to be dealt with and removed. Below, there are described the main impacts caused by mining activity on the environment.

Now is key- limited resources

**The time is now: we need to start mining space to solve for lack of terrestrial resources**

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

Today we face new hungers, new dangers. It now appears likely that terrestrial sources of certain metals—which are required for ecologically sustainable technological societies—may not be able to satisfy 21st Century global demand. At this historic juncture in space development, the U.S. has a terrific opportunity to re-launch its civil space agency as an economically vital, extraterrestrial branch of the USGS, creating fantastically detailed maps of—and greatly improving our access to—the mineral wealth of the solar system. Rather than ask, “Where should we try to send humans next?” NASA should ask, “What can we do to create economic value, off planet, for the taxpayers who are investing in our efforts?”

Now key – finite resources on Earth makes it necessary to fund for space mining.

Forgan and Elvis 11. [Duncan Forgan (University of Edinburgh) and Martin Elvis (Harvard Smithsonian Center for Astrophysics); “Extrasolar Asteroid Mining as Forensic Evidence for Extraterrestrial Intelligence”; 3-29-11. <http://arxiv.org/PS_cache/arxiv/pdf/1103/1103.5369v1.pdf>. TQ)

 Planets have ﬁnite natural resources. This truism has become painfully apparent to mankind in recent decades, through examples such as shrinking biodiversity and the increasing challenges facing engineers and geoscientists attempting to extract fossil fuels from the Earth. All life acts as consumers at some level, but the level of consumption is typically regulated through population control and other pressures introduced by the ecosystem . Advances in technology have allowed humans to circumvent these controls, with the effect that humans have vastly increased their population, placing strains on local resources. There has also been a continued increase per capita in consumption of precious metals for technologies such as computers, mobile phones and the infrastructures which enable them to function. The proposed green technologies of the future, such as hydrogen fuel cells and CO2 scrubbers, will only enhance this need for already rare resources (Elshkaki & Van Der Voet, 2006; Schuiling & Krijgsman, 2006). Such resources can be found in the asteroids. Meteoritic analysis (Kargel, 1994), suggests that large quantities of gold, platinum and other precious metals exist in the asteroids of the Solar System, as well as large amounts of other elements such as ironn, nickel, magnesium and silicon. He concludes that successful operations at modest mining rates could increase the total production rate of some materials by a factor of 10. By applying simple empirical models (where market value scales as the square root of production rate), approximate threefold decreases in price can also be expected, over timescales of a few decades. Indeed, if the supply of precious metals such as platinum is to continue to meet technological demands, asteroid mining may become essential within the coming century (Elshkaki & Van Der Voet, 2006). Besides these industrially driven arguments, SETI scientists are driven by the possibility of detecting extraterrestrial intelligence by evidence of their activities in the Outer Solar System and the asteroids (Papagiannis, 1978, 1995). Developing asteroid mining technology for commercial reasons will certainly assist the implementation of studies of this nature.

Now is key to Asteroid Mining

AbundantPlanet. 10. (Public Benefit and California corporation. “The Age of Asteroid Mining”. 2010. <http://www.abundantplanet.org/home>. TQ)

Now is the time to start mining asteroids—Mineral exploration has already begun! More than 5,000 near-Earth asteroids (NEAs) have been discovered in the last decade. In the next 15 years, 500,000 NEAs are expected to be discovered by telescopes now under construction. Many NEAs (15%) are easier to reach than the moon. Many are abundant sources of valuable minerals that we can use in space and that we need on Earth: the U.S. now imports 100% of 18 industrial minerals. Terrestrial sources for some industrial minerals may be depleted in decades. The value of the metals in a single asteroid can exceed a trillion dollars.

Now is key- short term resource shortages

Now is Key – not enough minerals for short-term trade is enough to trigger economic collapse.

Parthemore 11 – (Christine Parthemore. MA from Georgetown’s Security Studies Program, Director of the Natural Security Program, “Elements of Security: Mitigating the Risks of U.S. Dependence on Critical Minerals,” <http://www.cnas.org/files/documents/publications/CNAS_Minerals_Parthemore.pdf>. TQ.)

Central to this narrative is a conundrum for policymakers. Reserve estimates show that global supplies of almost all minerals are adequate to meet expected global demands over the long term, and for decades into the future for most minerals. The U.S. Geological Survey (USGS) indicates, for example, that world supplies of rare earths will be adequate for more than 100 years.13 These estimates, however, can be meaningless in the near term if supplies are insufficient, or if suppliers reduce exports or otherwise manipulate trade. For example, most experts project that global production of rare earths will likely be insufficient to meet the world’s demand over the next two to three years. The long-term sufficiency of supplies has no practical effect because it takes years and high capital costs to start up new mining and processing businesses for rare earths. Thus, the risks of inaction are high. A range of political, economic and geographic factors can disrupt supplies and cause price spikes that can create rifts in bilateral relations, trade disputes, accusations of economic sabotage and instability in countries that possess rare reserves of prized minerals. They can also give supplier countries extraordinary leverage that can alter geopolitical calculations, especially when single countries control most world supplies. For U.S. policymakers, the risks fall into two rough categories: Disruptions, delivery lags and price spikes that affect military assets and place unanticipated strains on defense procurement budgets; and lack of affordable access to minerals and raw materials preventing important national economic growth goals.

Now is key- Orion spacecraft

NOW IS KEY: the Orion spacecraft needs to start developing to ensure success in getting samples from asteroids

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

Only in the last decade have targets in large numbers been found. Earlier this year, as part of his plan to revamp human spaceflight, President Barack Obama said he wanted NASA to launch a human mission to an asteroid in 2025. Congress has fought the president's overall plan, but a Senate version of NASA's budget appears to support an asteroid mission. Some members of the House still seem to favor a return to the moon. The uncertainty hasn't stopped Lockheed Martin, which has a NASA contract to develop an Orion spacecraft, from developing a proposed mission to a nearby asteroid later this decade. The plan, led by Josh Hopkins, found that an asteroid mission is possible as early as 2019 using a pair of enhanced Orion spacecraft with a two-person crew. "Given that Orion is already in development we think it would be plausible," Hopkins said. "But it's a decision that would have to be made soon, probably within the next year." Under the Lockheed plan, the space capsules, crammed with food, water and supplies, would launch in November 2019 and spend three months flying more than 7 million miles to an asteroid that's about 33 feet across. Such an asteroid's gravity would be negligible, so the crew would "park" their vehicle nearby and spacewalk over, exploring and taking core samples. There would also be time to gaze homeward. From the surface of the asteroid, Earth would probably appear as a small, bright blue and white ball, about one-eighth the diameter of the moon, Hopkins said. After about five days the crew would climb back into one of the capsules and spend three months flying home.

Advantages

SETI Advantage

Asteroid mining key to SETI

Asteroid Mining key to finding E.T/ alien civilization would mine space too

Speigel Apr 6, 2011 – 6:30 PM “Lee Speigel Contributor for http://www.aolnews.com/2011/04/06/searching-for-an-et-scientists-say-look-for-signs-of-aliens-min/ Searching for an ET? Scientists Say Look for Signs of Aliens Mining Asteroids”

After 50 years of searching the heavens with radio telescopes to try to contact alien life, so far the attempts of SETI (Search for Extraterrestrial Intelligence) scientists seem to have fallen on deaf ears**. So is there another way to try to find aliens in our galactic neighborhood? Some scientists suggest looking for signs of ETs mining asteroids**. Interesting concept, because **it shouldn't be difficult to detect any outer space mining operations conducted by aliens, especially something that would kick up an unusual amount of dust in the process as they search for precious metals found in rocky asteroids**. "The development of civilizations like ours into spacefaring, multi-planet entities requires significant raw materials to construct vehicles and habitats. Interplanetary debris, including asteroids and comets, may provide such a source of raw materials," write Duncan Forgan of the University of Edinburgh and Martin Elvis of the Harvard Smithsonian Center for Astrophysics. The two scientists have written a paper to be published in the International Journal of Astrobiology. "**We present the hypothesis that extraterrestrial intelligences (ETIs) engaged in asteroid mining may be detectable from Earth." They speculate that any alien mining efforts would result in specific effects that might be seen by Earth-based technology**. The **first clue to a possible deep-space mining activity is that a chemical signature would result in the debris ring encircling a star**. This debris "may be the leftovers from planet formation, and is expected to be common in planetary systems," Forgan and Elvis write. Second, an alien mining operation would cause detectable changes in the sizes of objects in those debris discs. Forgan and Elvis believe that these would be big clues for finding extraterrestrials**. "If technological civilizations more advanced than ours exist in the galaxy ... and asteroid mining is a common activity which underpins their existence, then searching for signatures of targeted asteroid mining** (or TAM) is an appropriate activity for SETI to undertake," the scientists suggest. It should be pointed out that they also realize their theory isn't the last word in detecting ETs. It's possible that some of these asteroid debris changes, whether physical or chemical, could be caused by the simple natural act of asteroids bumping or colliding into each other. "We cannot expect a conclusive detection of extraterrestrial intelligence by TAM -- what it can provide is a call to attention. Debris disc systems with unusual dust size distributions and locations ... provide astrobiologists with candidates for further study," the scientists write. The idea of going to asteroids to find usable materials is one that NASA is already implementing. The space agency is looking to send the first manned mission to a nearby asteroid in 2025.

**Asteroid mining will provide the setting necessary to do SETI research**

Korea Times 11 (Korea Times, Korea Times, Korea Times April 5, 2011, *Signs of Mining May Lead to Alien-Life*, April 5, 2011, <http://www.lexisnexis.com/lnacui2api/results/docview/docview.do?d>ocLInkInd= true&rIs b=21\_T12275149608&format=GNBFI&sort=BOOLEAN&startDocNo=1&resultsUrlKey=29\_T12

\ 275149611&cisb=22\_T12275149610&treeMax=true&treeWidth=0&csi=174045&docNo=1 , AG)

Scientists have spent 50 years sending radio signals deep into space in an attempt to establish contact with extra-terrestrials. But it now appears there might be a much simpler way of finding alien life-we should look for signs of mining in asteroid belts, reported British Daily Mail on Monday. The theory goes that materials such as gold, platinum, iron and silicon are plentiful in asteroids, so intelligent alien life would be likely to exploit this. Any extrasolar mining would produce three effects that should be detected from Earth. Firstly, scientists are aware of the specific ratio of elements found in common debris belts. Therefore, using spectroscopy, they should be able to spot asteroid belts where this ratio is different. Secondly, aliens would be more likely to mine large asteroid belts because they have more elements and minerals for harvesting. Lastly, any large scale mining would result in a great deal of dust that would take heat from the nearby star and generate an identifiable thermal signature. The claims were made by Dr Duncan Forgan, of the University of Edinburgh, and Dr Martin Elvis, of the Harvard Smithsonian Center for Astrophysics in Cambridge, Massachusetts.

**Asteroid mining key to SETI**

**Asteroid mining and detection has side benefit of helping us identify aliens**

Dillow 11 (Clay. Columnist for Popular Science. Popular Science *To Find Intelligent ETs, First Look for Signs of Mining in Distant Asteroid Belts*  03.30.2011. Lexis) TS

 Finding advanced alien races in other parts of the galaxy [isn't so hard](http://www.technologyreview.com/blog/arxiv/26582/), according to Duncan Forgan of the University of Edinburgh and Martin Elvis at the Harvard Smithsonian Center for Astrophysics. Rather than look for direct evidence of cloud cities anchored to far-off rocks, we simply need to ask ourselves what our civilization might look like in the future, then look for signs of that. Specifically, we need to look at other planetary systems' asteroid belts for signs of mining. The idea is that at some point, our home planet will run short of natural resources, and when that happens we will have to tap asteroids for sources of metals and other materials that will enable future economies and technologies. Any other advanced, intelligent civilization would likely face the same challenge, and by scanning faraway asteroid belts for signs of interplanetary mining operations, we should be able to pick up signs of life with current and future telescope tech. Extrasolar mining should produce three types of signatures that we can detect from Earth, Forgan and Elvis write in their paper First, we know that debris belts contain certain ratios of elements, and using spectroscopy we could spot rings in other systems where those ratios are off. Second, it makes sense that we (and any other civilization) would mine large asteroids first rather than small ones, so we could monitor debris rings for artificial drops in the number of large rocks (also doable from earth). Thirdly, all the dust kicked up by mining activities would absorb heat from the nearby star, generating an identifiable thermal signature. Find all three of these indicators in the same place, and you've probably got extrasolar mining going on and an intelligent race of beings to make contact with. Right? Not exactly. Forgan and Elvis concede that all of these indicators can also occur naturally. So their asteroid-belt stress test for mining isn't exactly a hard indicator of intelligent life. But, they say, monitoring for these telltale sings would help us flag solar systems that should get a second, harder look. And since planet hunting missions are already scanning the skies for some of these things, why not peruse the data for them?

Large-scale asteroid mining may get in the way of SETI-searching rays due to thermal energy

Forgan 11(Duncan, and Martin Elvis, researchers at the University of Edinburgh, Institute for Astronomy and Harvard-Smithsonian Center for Astrophysics, Cornell University Library, Extrasolar Asteroid Mining as Forensic Evidence for Extraterrestrial Intelligence, 2011, <http://arxiv.org/PS_cache/arxiv/pdf/1103/1103.5369v1.pdf>, AG )

Drilling into asteroids on a large scale requires large inputs of energy. Any debris thrown off during drilling may be strongly heated and reformed. Glassy silicas such as obsidian and tektites may be detected, as well as fluorescing silicon oxide (SiO), a byproduct from the vapourisation of silicates. However, these have also been modelled in hypervelocity systems (Lisse et al., 2009). Dust produced during mining will also have an initial thermal energy imparted to them. If this thermal energy is high enough, this may also have an effect on SEDs and imaging, requiring models to assume an unusual temperature gradient in the disc. Heated dust will cool on short timescales (of order a few minutes). If mining is prolific in the system, then theremay be variability in the system’s flux at a givenwavelength, with periodic fluctuations correlated with the cooling time. If detected, the strength of these fluctuations could be used to model the artificial dust production rate, and ultimately estimate the local mining rate in the system. However, these fluctuations will be extremely small compared to the mean signal, and will require very high-cadence observations to detect them.

**Asteroid mining key to economy/SETI**

Mining solves for aliens and economy.

Gilster 11. (Paul Gilster. Paul Gilster is a writer specializing in computers and technology as well as a reviewer of Deep Space exploration. Found at Centauri Dreams. “Asteroid Mining: A Marker for SETI?” <http://www.centauri-dreams.org/?p=17357> TQ)

Debris disks are what’s left over when the gaseous disks around young stars go through their normal evolution, leaving rocky and icy debris in various sizes, like the comets and asteroids found in our own Solar System. We’ve been learning a great deal about debris disks through spectroscopy and imaging ever since the first detection of such a disk around the star Vega, back in the 1980s. These days, we have finely tuned instruments like the Herschel Space Telescope and Spitzer that can provide a wealth of new data. How could we use that data to search for potential evidence of an extraterrestrial intelligence manipulating a debris disk? It’s a fascinating notion (and thanks to Adam Crowl for calling my attention to this paper). The authors assume that the engineering limitations we have experienced in our own history will also hold for alien cultures. Like us, they will need large quantities of raw material to build the structures their civilization requires. And like us, if we are ever to build a space faring civilization, they will need to mine such materials as they move into nearby space, building space vehicles and large habitats as sections of the population move off-planet. Both biological and post-biological civilizations will, then, need the resources demanded by their own growth. From our perspective, targeted asteroid mining (TAM) presents high initial costs but great potential for profits, lowering the costs of manufacturing future technologies. In fact, Forgan and Elvis argue that the expertise we would gain by creating the necessary infrastructure for asteroid mining could be brought to bear on other aspects of space exploration. Given its hazards, asteroid mining is likely to be turned over quickly to automated workers, putting an emphasis on developing advanced artificial intelligence as we evolve a post-biological culture.

Asteroid Mining is necessary for extracting precious metals and can be used to detect extra-terrestrial life

Forgan and Elvis 11’

(Duncan H. Forgan and Martin Elvis Scottish Universities Physics Alliance (SUPA), Institute for Astronomy, University of Edinburgh, March 29, 2011 <http://arxiv.org/PS_cache/arxiv/pdf/1103/1103.5369v1.pdf> QJ)

Planets have finite natural resources. This truism has become painfully apparent to mankind in recent decades, through examples such as shrinking biodiversity and the increasing challenges facing engineers and geoscientists attempting to extract fossil fuels from the Earth. All life acts as consumers at some level, but the level of consumption is typically regulated through population control and other pressures introduced by the ecosystem. Advances in technology have allowed humans to circumvent these controls, with the effect that humans have vastly increased their population, placing strains on local resources. There has also been a continued increase per capita in consumption of precious metals for technologies such as computers, mobile phones and the infrastructures which enable them to function. The proposed green technologies of the future, such as hydrogen fuel cells and CO2 scrubbers, will only enhance this need for already rare resources (Elshkaki & Van Der Voet, 2006; Schuiling & Krijgsman, 2006). Such **resources can be found in the asteroids. Meteoritic analysis** (Kargel, 1994**), suggests that large quantities of gold, platinum and other precious metals exist in the asteroids of the Solar System, as well aslarge amounts of other elements such as iron, nickel, magnesium and silicon.** He concludes that successful operations at modest mining rates could increase the total production rate of some materials by a factor of 10. By applying simple empiricalmodels (where market value scales as the square root of production rate), approximate threefold decreases in price can also be expected, over timescales of a few decades. **Indeed, if the supply of precious metals such as platinum is to continue to meet technological demands, asteroid mining may become essential within the coming century** (Elshkaki & Van Der Voet, 2006). **Besides these industrially driven arguments, SETI scientists are driven by the possibility of detecting extraterrestrial intelligence by evidence of their activities in the Outer Solar System and the asteroids** (Papagiannis, 1978, 1995). **Developing asteroid mining technology for commercial reasons will certainly assist the implementation of studies of this nature.**

Resources Advantage

Resources- General

General- UQ

UQ- Resources running out/ asteroids solve

Terrestrial resources are running out, asteroid resources may provide a solution

Ross 01 (Shane D. Control and Dynamical Systems Caltech 107-81, Near-Earth Asteroid mining, <http://www.esm.vt.edu/~sdross/papers/ross-asteroid-mining-2001.pdf>, Google Scholar, NC)

Many terrestrial resources, such as precious metals and fossil fuels, are running out. As new terrestrial sources are sought, materials are obtained at increasing economic and environmental cost. Society pays for this depletion of resources in the form of higher prices for manufactured goods, would-be technologies that are not developed for lack of raw materials, global and regional conflicts spurred by competition for remaining resources, and environmental damage caused by development of poorer and more problematic deposits. Utilization of asteroid resources may provide a partial solution to the problem, as they hold the potential for becoming the main sources of some metals and other materials. Precious metals and semiconducting elements in iron meteorites, which form the metallic cores of asteroids, are found in relatively large concentrations compared to Earth sources. In such sources, it may be possible to extract up to 187 parts per million (ppm) of precious metals, which includes Au, the Pt-group metals (Pt, Ru, Rh, Pd, Os, and It), Re, and Ge. More than 1000 ppm of other metals, semiconductors, and nonmetals may may one day be extracted and imported by Earth from asteroids, such as Ag, In, Co, Ga, and As.

Minerals in Asteroids key to stop resource shortages.

Kolber 06 – (Jonathan Kolber, Co-founder and Vice-President at Space Energy Access Systems “Investing in Outer Space,” Oct 11th, 2006 . <http://pennysleuth.com/investing-in-outer-space> TQ)

Yes, there’s gold in “them thar asteroids” — and diamonds, and every other element and mineral to be found on Earth, apparently in similar ratios. The difference is that the asteroids could be the remnants of a planet many hundreds of times bigger than Earth. Calculations have established that we could strip mine the entire Earth to a depth of ½ mile and not acquire nearly the volume of natural resources available free for the taking in asteroids. Such a resource literally dwarfs anything in human history or perspective, and when we finally do begin mining asteroids, the whole notion of resource shortages will rapidly diminish to a historical footnote.

Mining asteroids is necessary to cope with population growth

The Political Economy of the Inner Solar System: A Forecast , Marilyn Dudley-Flores, PhD and Thomas Gangale, OPS-Alaska and ‘Atenisi University, Kingdom of Tonga, Political Economy of the Inner Solar System, 2010, http://www.atenisi.edu.to/scholarship/Dudley-Flores/2010\_PoliticalEconomyOfTheInnerSolarSystem.pdf, ES

Sustaining a more globally extensive advanced industrialized world system of societies (WSS) populated by two to three more billion people than today may depend upon access to space-based energy sources. It is logical to expect the exploitation of these sources based on: 1) an increasing number of industrializing societies leapfrogging to advanced industrial status, 2) a rising global population, among whom are an increasing number of those who desire all the fruits of advanced industrialization, 3) the decline in easily extractable petroleum resources, and 4) the known and unforeseen challenges of an Earth becoming more extreme as global warming and its effects play out. Bringing extraterrestrial energy sources online will not be without substantial effects. Their use will set an event cascade in motion. Following, we may expect the birth of a multiplanet economy and, then, a multi-world system of societies (MSS). And, over the long run, the birth of this expanded human ecology will spell the death knell of the Westphalian nation-state system and give rise to the transnational state. This expanded economy and system of societies will be founded in its broad outlines upon disparity – namely, disparity of energy needs, disparity in population size, and disparity in depth of gravity well. The energy needs of a heavily populated Earth will be provisioned by small populations in a variety of offworld environments. And, by virtue of their low-gravity advantage (requiring less fuel for lift-off and landings) and their energy surplus, these societies will emerge as centers of manufacturing and shipping in an expanded multi-planet economy. Deep gravity well Earth will stand at a disadvantage in such an economy.

General- Links

Mining solves resource shortages/environmental destruction

**Resources are becoming scarcer on earth - forcing us to aggressively search the environment for lower grade materials at higher financial and environmental costs. Asteroids are key to solving the resource shortage and the financial and ecological problems that it brings.**

**Gerlach 2005** (Charles, CEO Gerlach Space Systems, “Profitability Exploiting Near-Earth Object Resources” delivered at 2005 International Space Development Conference in Washington D.C , May 19-22 2005, NB

http://abundantplanet.org/files/Space-Ast-Profitably-Exploiting-NEO-Gerlach-2005.pdf)

We are approaching an important crossroads in history as we begin to experience the concrete global implications of limited supplies of many of the key natural resources upon which our industrial civilization is built. While we will not fully exhaust supplies of fossil fuels and other critical resources for decades or even centuries, we have reached a point where we can identify indisputable limits and begin to more fully appreciate their potential consequences. Fortunately, we have time to learn to better conserve existing natural resources and seek new supplies. Faced with these emerging realities, space resources – especially the resources of near-Earth space – become increasingly viable and even attractive options. Though limited, the resource base of our planet is complex and differentiated. As we have increasingly exploited its resources, we have aggressively explored the Earth in search of the most accessible deposits of ores and fuels. As we have used up the most accessible resources, we have had to dig deeper, accepting lower grade materials that are more costly to produce both in terms of financial investment and damage to our environment. Independent of local resource scarcities and variations on individual planets, our solar system is differentiated on a large scale. Just as processes of crustal evolution have produced concentrations of useful materials at different depths and locations on the Earth's surface, general processes of solar system evolution have produced concentrations of different resources in different parts of the solar system. These processes have produced vast supplies of a variety of materials distributed in zones, ranging from metalrich silicates near the Sun through concentrations of organic and rocky material in the mid-solar system to concentrations of ices in the outer solar system. Melting has also concentrated metals in asteroidal cores exposed later by collisions and fragmentation.

Mining solves resource shortages/Economy

Asteroids contain rich deposits of diminishing metals—identification and demand of metals show they’re necessary for industry and economy

Abundant Planet 09 (Abundant Planet, organization enabling profitable profit mining, **Review of United States Human Space Flight Plans Committee at** NASA Headquarters, ***Review of United States Human Space Flight Plans Committee, August 3, 2009, http://www.nasa.gov/pdf/383154main\_53%20-%2020090803.7.toAugustineCommittee-2009-08-03.pdf,*** AG***)***

Asteroids, on the other hand, offer rich deposits of metals that are currently in demand. They generate only very small gravitational effects, so expensive, high-powered rockets are not required. Asteroids also offer structural materials (e.g., iron, nickel, and silicon), volatiles (which can be used for in-space propulsion), and semiconductors. These can be used to build a wide range of evolving infrastructure, including, in the fullness of time, spinning habitats that can precisely simulate biologically benign, Earth-normal gravity.63 Thanks to several Hollywood blockbusters, the potential dangers of an asteroid impact are widely known.64 But the fact that asteroids contain high value minerals that are critical for industrially development is less widely known. This knowledge gap may be partially addressed next June, when the Hayabusa, a Japan Aerospace Exploration Agency (JAXA) spacecraft, is expected to return the first asteroid samples to Earth.65 (The European Space Agency (ESA) is planning a similar mission.66) Nearly 1,000 near-Earth asteroids have been identified that are easier to reach than the moon (requiring a lower delta-V).67 Thousands more of these “very near-Earth asteroids” (VNEAs) are expected to be identified in the next 10-20 years, as new sky-survey telescopes (Pan-STARRS and the LSST68) register 500,000 NEAs.69 With the Hayabusa, JAXA has shown, at a cost of “about $170 million,”70 that asteroid materials can be reached and returned to Earth. The number of potential targets is now increasing exponentially. Fine, but is there demand for these materials? Yes, quite a bit. We are being made increasingly aware that Earth’s resources are limited. Concern about “peak oil” has become widespread: “A debate rages over the precise date of peak oil, [but] this rather misses the point, when what matters—and matters greatly—is the vision of the long remorseless decline that comes into sight on the other side of it,” as Colin Campbell, founder of the Association for the Study of Peak Oil, points out.71 Yet oil is only one critical industrial resource that may be at or near peak. The U.S. Geological Survey reports that the United States imports 100% of 18 minerals that are essential for industry.72 In 2008, the National Academies identified the platinum group metals (PGMs)—used in automotive catalytic converters and fuel cells— as the “most critical” for current industrial development.73 “There is simply not enough platinum and rhodium going round on this planet to satisfy the collective demand of automotive emission-control systems,” as Johannes Schwank, professor of chemical engineering at the University of Michigan, explained in 2007.74 Some projections show terrestrial platinum reserves depleted within a few decades.75 More than 75% of the world’s platinum—and more than 85% of the rhodium—comes from a single geological feature in South Africa, the “Bushveld Complex.”76 Nearly half of all available platinum, and 84% of all rhodium, is used for automotive catalytic converters.77 A single asteroid can contain more than a year’s worth of current platinum production—worth tens of billions of dollars—as well as other high-value metals such as gallium, indium, and other rare earths, and literally tons of iron and nickel.

Mining solves resource shortages/Economy

Asteroids have tons of resources that could be turned into profit

Bonsor No Date (Kevin, Journalist, Howstuffworks, How will asteroid mining work?, HowStuffWorks.com, NC)

Scientists think asteroids are leftover material from the early formation of the solar system or debris from the destruction of a planet. There are tens of thousands of asteroids circling the sun. Most are grouped inside the asteroid belt, between the orbits of Mars and Jupiter. Some asteroids that stray from this orbit, though, flying close to Earth on occasion -- you've probably heard about the possibility of these asteroids smashing into Earth in the future, as in the movie "Armageddon." Most asteroids fit into three basic categories: • C-type - More than 75 percent of known asteroids fit into this category. The composition of C-type asteroids is similar to that of the sun without the hydrogen, helium and other volatiles. • S-type - About 17 percent of asteroids are this type. These contain deposits of nickel, iron and magnesium. • M-type - A small number of asteroids are this type, and they contain nickel and iron. Even without a manned mission to do a full-scale study of an asteroid, scientists know a lot about what asteroids contain. Astronomers use telescopic spectroscopy, which analyzes light reflected from the asteroid's surface, to find out what might be there. In addition to iron, nickel and magnesium, scientists think water, oxygen, gold and platinum also exist on some asteroids. Water interests space explorers most because it could help keep a space colony alive. Without water, there is really no way to move forward with human exploration of space. Water could also be broken down into hydrogen and oxygen to form rocket engine propellant. The metal ore on the asteroids could be mined and used for building spacecraft and other structures for a space colony. Corporations that might not be interested in exploring space for the adventure and science could be interested in the treasures that a space mining operation could send back to Earth. One NASA report estimates that the mineral wealth of the asteroids in the asteroid belt might exceed $100 billion for each of the six billion people on Earth. John S. Lewis, author of the space-mining book Mining the Sky, has said that an asteroid with a diameter of one kilometer would have a mass of about two billion tons. There are perhaps one million asteroids of this size in the solar system. One of these asteroids, according to Lewis, would contain 30 million tons of nickel, 1.5 million tons of metal cobalt and 7,500 tons of platinum. The platinum alone would have a value of more than $150 billion! Asteroids have amazing potential for industry. But what will it take to land on an asteroid, find these valuable materials, extract them and process them? In the next section, you will find out how asteroid mining operations might supply the Earth and its colonies on other planets with a plenitude of materials.

There are untold riches in space, and we have the ability to get to them

Honan 11 (Daniel, Big Think, The first trillionaires will make their fortunes in space, Bigthink.com, NC)

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

General- impacts

Resources key to econ

Mining for resources is key to the economy

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)

**Identifying and mining nickel, cobalt, and a variety of other commodities that are in short supply on Earth, or those that could be mined, produced, and delivered more cheaply in space than on Earth could contribute to and drive the world‟s technology and associated economy to a scale never before contemplated.** T**his is based, of course, on the assumption that the economics are favorable. Large multi-national, quasi-governmental industrial groups** are likely to develop over the next few decades to handle projects of such magnitude, if they haven‟t already begun to assemble. In the beginning, the economics would likely be underwritten by governmental support, **perhaps by a group of governments cooperating in funding and technology but followed later by some governments funding programs to accommodate their own particular self-interests.**

Mining is key for economy – Resources obtained are involved in economic exchange.

Crandell et. al , 11 (William C. Crandell. MBA, Founder of Space Wealth, “Is Profitable Asteroid Mining: A Pragmatic Goal?,” Space Wealth, 23 February 2011. [http://www.spacewealth.org/files/Is-P@M-Pragmatic-2010-08-23.pdf](http://www.spacewealth.org/files/Is-P%40M-Pragmatic-2010-08-23.pdf). TQ)

Economic resources in space are of three types: Location, energy, and matter. Some near-Earth locations already support profitable industrial engagements. Low-Earth andgeosynchronous-Earth orbit host hundreds of revenue-generating satellites (worldwideindustry revenues in 2008: >$140 billion).19 Beyond Earth’s atmosphere, solar radiation is abundant; it powers most satellites. Orbiting space-based solar power systems (SBSP)may be able to deliver huge quantities of clean, sustainable energy to Earth.20 But to date,nothing from the vast reaches beyond Earth orbit has ever been involved in an economicexchange. To incrementally expand our current off-planet economy, the next resource is clear: N**e**ar-Earth asteroids. To take this next step, we need our space agencies to make asteroid mining a priority and demonstrate how it can done.Agencies should support SBSP, but it should not be a top priority for two reasons. First,SBSP already attracts interest from commercial firms and defense-related institutions.21Second,even if SBSP supplies >99% of the world’s electricity,we’re still justin Earthorbit.We haven’t begun to tap the mineral wealth of the inner solar system. We need out space agencies to reach out—with robots, certainly; perhaps with humans—to find, get hold of, and bring back an economically significant chunk of matter,and sell iton the open market. We need them to prime the pump for economically and ecologicallysustainable, post-Earth-as-a-closed-system, industrial societies.

Near Earth Asteroids contains mineral that are key to our economic infrastructure

Durda ‘6

(Dr. Daniel D. Durda Southwest Research Institute Department of Space Studies, The Solar System beckons with resources unimaginable on Earth. Ad Astra, Volume 18 Number 2, Summer 2006. QJ)

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

Resources key to econ

Asteroid mining is immensely profitable and helps raise standard of living

Science Clarified 11 (Science Clarified, How will humans mine asteroids and comets, 04-13-11, NC)

The first questions that all potential investors ask, of course, are what is the nature of these abundant resources contained in asteroids and comets, and what are they worth? Scientists answer first that the asteroids are composed of iron, nickel, platinum, and other metals, as well as sulfur, aluminum oxide, carbon compounds, and other minerals. Many asteroids also contain smaller amounts of volatiles, including hydrogen, oxygen, and water. As for the value of these materials to people on Earth, Lewis cites the example of the smallest known M-type asteroid—Amun. It is about 1.2 miles across and has a mass of about 30 billion tons. To put this large tonnage in perspective, imagine that the raw materials from the mining operation are loaded into a fleet of space shuttles like those presently in NASA's fleet. The cargo bay of a typical shuttle holds about twenty-five tons, equivalent to 250 two-hundred-pound people. It would take four hundred shuttles (or four hundred trips by one shuttle), therefore, to haul ten thousand tons of asteroidal material; and it would take 1.2 billion shuttles (or 1.2 billion trips by one shuttle) to carry all of the materials mined from Amun. Regarding the materials themselves, Amun's total tonnage breaks down into many different metals. The most abundant of these are iron and nickel, which alone would have a market value of about $8 trillion. (Keep in mind that a trillion is a million times a million.) Supplies of another metal, cobalt, on Amun would be worth perhaps $6 trillion. Then there are rarer metals such as platinum, iridium, osmium, and palladium, which together would add another $6 trillion to the investors' profits. The nonmetals, including carbon, nitrogen, sulfur, phosphorus, oxygen, hydrogen, and gallium, would be worth at least $2 trillion. If humans mined all of Amun, therefore (which would take many years), the gross profits would come to at least $22 trillion. It is difficult to estimate the upfront costs of such a mining operation. But even if they were as high as $1 trillion, the net profits would still be $21 trillion. Clearly, asteroid mining will be an extremely profitable business. Remember also that all of the valuable resources and profits cited are from a single small asteroid. What would all of the asteroids in the asteroid belt together be worth? Lewis speculates about the asteroidal iron alone: To raise the standard of living of the people of Earth to present-day North American, Japanese, or Western European levels, we need about 2 billion tons of iron and steel each year. With the asteroidal supplies of metal at hand, we could meet Earth's needs for the next four hundred million years. . . . Suppose that we were to extract all the iron in the belt and bring it back to Earth. Spreading this amount of iron uniformly over all the continents gives us a layer of iron . . . half a mile thick. . . . This is enough iron to cover all the continents with a steel frame building 8,000 stories (80,000 feet, or 15.2 miles) tall. 42 When one factors in the other metals available in the asteroid belt alone, along with the many nonmetals, the total resources could sustain a human population a million times larger than the present one for several thousand years. And this does not take into account the trillions of asteroids and comets in the Kuiper Belt and Oort Cloud. (The comets contain far fewer metals, but do have many minerals, as well as an abundance of volatiles that could be used for food production and making fuels.)

Resources key to econ

Asteroid Mining is necessary for resources and can prevent the impact of an Asteroid plummeting into Earth

Sonter 6’

(Mark Sonter, an independent scientific consultant working in the Australian mining and metallurgical industries, National Space Society. Asteroid Mining: Key To The Space Economy QJ)

T**he Near Earth Asteroids offer both threat and promise. They present the threat of planetary impact with regional or global disaster. And they also offer the promise of resources to support humanity's long-term prosperity on Earth, and our movement into space and the solar system. The technologies needed to return asteroidal resources to Earth Orbit** (and thus catalyze our colonization of space) **will also enable the deflection of at least some of the impact-threat objects. We should develop these technologies, with all due speed! Development and operation of future in-orbit infrastructure (for example, orbital hotels, satellite solar power stations, earth-moon transport node satellites, zero-g manufacturing facilities) will require large masses of materials for construction, shielding, and ballast; and also large quantities of propellant for station-keeping and orbit-change maneuvers, and for fuelling craft departing for lunar or interplanetary destinations.** **Spectroscopic studies suggest, and ‘ground-truth' chemical assays of meteorites confirm, that a wide range of resources are present in asteroids and comets, including nickel-iron metal, silicate minerals, semiconductor and platinum group metals, water, bituminous hydrocarbons, and trapped or frozen gases including carbon dioxide and ammonia.**

Resources key to econ

Asteroids contain rich deposits of diminishing metals—identification and demand of metals show they’re necessary for industry and economy

Abundant Planet 09 (Abundant Planet, organization enabling profitable profit mining, **Review of United States Human Space Flight Plans Committee at** NASA Headquarters, ***Review of United States Human Space Flight Plans Committee, August 3, 2009, http://www.nasa.gov/pdf/383154main\_53%20-%2020090803.7.toAugustineCommittee-2009-08-03.pdf,*** AG***)***

Asteroids, on the other hand, offer rich deposits of metals that are currently in demand. They generate only very small gravitational effects, so expensive, high-powered rockets are not required. Asteroids also offer structural materials (e.g., iron, nickel, and silicon), volatiles (which can be used for in-space propulsion), and semiconductors. These can be used to build a wide range of evolving infrastructure, including, in the fullness of time, spinning habitats that can precisely simulate biologically benign, Earth-normal gravity.63 Thanks to several Hollywood blockbusters, the potential dangers of an asteroid impact are widely known.64 But the fact that asteroids contain high value minerals that are critical for industrially development is less widely known. This knowledge gap may be partially addressed next June, when the Hayabusa, a Japan Aerospace Exploration Agency (JAXA) spacecraft, is expected to return the first asteroid samples to Earth.65 (The European Space Agency (ESA) is planning a similar mission.66) Nearly 1,000 near-Earth asteroids have been identified that are easier to reach than the moon (requiring a lower delta-V).67 Thousands more of these “very near-Earth asteroids” (VNEAs) are expected to be identified in the next 10-20 years, as new sky-survey telescopes (Pan-STARRS and the LSST68) register 500,000 NEAs.69 With the Hayabusa, JAXA has shown, at a cost of “about $170 million,”70 that asteroid materials can be reached and returned to Earth. The number of potential targets is now increasing exponentially. Fine, but is there demand for these materials? Yes, quite a bit. We are being made increasingly aware that Earth’s resources are limited. Concern about “peak oil” has become widespread: “A debate rages over the precise date of peak oil, [but] this rather misses the point, when what matters—and matters greatly—is the vision of the long remorseless decline that comes into sight on the other side of it,” as Colin Campbell, founder of the Association for the Study of Peak Oil, points out.71 Yet oil is only one critical industrial resource that may be at or near peak. The U.S. Geological Survey reports that the United States imports 100% of 18 minerals that are essential for industry.72 In 2008, the National Academies identified the platinum group metals (PGMs)—used in automotive catalytic converters and fuel cells— as the “most critical” for current industrial development.73 “There is simply not enough platinum and rhodium going round on this planet to satisfy the collective demand of automotive emission-control systems,” as Johannes Schwank, professor of chemical engineering at the University of Michigan, explained in 2007.74 Some projections show terrestrial platinum reserves depleted within a few decades.75 More than 75% of the world’s platinum—and more than 85% of the rhodium—comes from a single geological feature in South Africa, the “Bushveld Complex.”76 Nearly half of all available platinum, and 84% of all rhodium, is used for automotive catalytic converters.77 A single asteroid can contain more than a year’s worth of current platinum production—worth tens of billions of dollars—as well as other high-value metals such as gallium, indium, and other rare earths, and literally tons of iron and nickel.

**Resource shortages- war**

Resource Wars are upon us – Darfur proves

Klare 06 (Michael T., professor of peace and world security studies at Hampshire College, Alternet.org, The Coming Resource Wars, <http://www.alternet.org/environment/33243> ,03-10-06, Google Scholar, NC)

It's official: the era of resource wars is upon us. In a major London address, British Defense Secretary John Reid warned that global climate change and dwindling natural resources are combining to increase the likelihood of violent conflict over land, water and energy. Climate change, he indicated, "will make scarce resources, clean water, viable agricultural land even scarcer" -- and this will "make the emergence of violent conflict more rather than less likely." Although not unprecedented, Reid's prediction of an upsurge in resource conflict is significant both because of his senior rank and the vehemence of his remarks. "The blunt truth is that the lack of water and agricultural land is a significant contributory factor to the tragic conflict we see unfolding in Darfur," he declared. "We should see this as a warning sign."

Lack of Resources Lead to Resource Wars.

Collins & Autino 10 –Patrick Collins (Expert in the economics of energy supply from space) *&* Adriano Autino, “What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace,” (2010) <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>. TQ)

World peace and preservation of human civilization - The major source of social friction, including international friction, has surely always been unequal access to resources. People - fight to control the valuable resources on and under the land, and in and under the sea. The natural resources of Earth are limited in quantity, and economically accessible resources even more so. As the population grows, and demand grows for a higher material standard of living, industrial activity grows exponentially. The threat of resources becoming scarce has led to the concept of ‘‘Resource Wars’’. Having begun long ago with wars to control the gold and diamonds of Africa and South America, and oil in the Middle East, the current phase is at centre stage of world events today [37]. A particular danger of ‘‘resource wars’’ is that, if the general public can be persuaded to support them, they may become impossible to stop as resources become increasingly scarce. Many commentators have noted the similarity of the language of US and UK government advocates of ‘‘war on terror’’ to the language of the novel ‘‘1984’’ which describes. a dystopian future of endless, fraudulent war in which citizens are reduced to slaves.

Resource shortages- cycle of war

Resource wars create a viscous cycle- causing them to rarely end

The Anatomy of Resource Wars, MICHAEL RENNER, October 2003, World Watch Paper, http://www.worldwatch.org/system/files/EWP162.pdf, ES

In contrast to the cold war era, today’s conflicts are less about ideologies and seizing the reins of state than about the struggle to control or plunder resources—capturing sites rich in minerals, timber, and other valuable commodities or controlling points through which they pass on the way to markets. Paul Collier, director of the Development Research Group at the World Bank, has been one of the earliest to argue that greed and the availability of “lootable” natural resource wealth are key factors. Although some of today’s conflicts have their roots in long-standing grievances, there is a self-sustaining vicious cycle at work in which the spoils of resource exploitation fund war, and war provides the means and conditions that allow continued illegitimate access to these resources. The conflict in the Sudan provides a telling example: Oil exports have permitted the central government to carry on with the war against southern rebels. To keep paying for the war, the government must expand oil production, but this requires exploiting oil deposits deeper and deeper in rebel-held territory. To control oil-rich areas in southern Sudan, government forces are conducting a scorched earth campaign at terrible human cost. Oil finances the war; the war provides access to oil.

Resource wars increasingly likely now

Global privatization has caused a greater gap in class- causing escalated resource wars

Michael T. Klare, 2002, Resource wars: the new landscape of global conflict, http://books.google.com/books?id=4swk0glJuswC&pg=PA25&lpg=PA25&dq=resource+wars+lead+to&source=bl&ots=Giolyvrw\_D&sig=ccleOnphVMXgsyyYYVcfvGLdtZg&hl=en&ei=itAUTvj1BonkiALOo9T6DQ&sa=X&oi=book\_result&ct=result&resnum=7&ved=0CEUQ6AEwBg#v=onepage&q=resource%20wars%20lead%20to&f=false, ES

Global market forces can also increase the likelihood of conflict, most notably when a contested resource is seen as being so valuable in monetary terms that none of the claimants involved is willing to accept its loss. This appears to be the case in the Democratic Republic of Congo (formerly Zaire), where several internal factions and foreign powers have been fighting for control over the lucrative gold and copper fields of the south and west. A similar situation has long prevailed in Sierra Leone- in this case, involving internal conflict over the country's valuable diamond fields. Typically, contests of this sort arise in poor and underdeveloped countries where possession of a mineral deposit or oil field is seen as the only viable route to the accumulation of wealth. The risk of internal conflict over resources is further heightened by the growing divide between the rich and the poor in many developing countries--a phenomenon widely ascribed to globalization. While those at the top of the economic ladder are able to procure the basic necessities of life, those at the bottom are finding themselves increasingly barred from access to such vital commodities as food, land, shelter, and safe drinking water. As supplies contract and the price of many materials rises, the poor will find themselves in an increasingly desperate situation-and thus more inclined to heed the exhortations of demagogues, fundamentalists, and extremists who promise to relieve their suffering through revolt or ethnic partition. "The distribution of [economic] competitiveness is now uneven," the Institute for National Security Studies observed in 1999. "This pattern raises the disturbing prospect of a ‘globalization gap’ between winners and losers .... Leaders of the losers often blame outsiders or unpopular insiders for economic hardship. Some foment crises to distract domestic attention from joblessness and hunger." This danger will only grow more acute as increased economic competition and pressure from international lending agencies force the governments of developing nations to eliminate subsidies on food and other basic commodities and to privatize such essential services as water delivery. A foretaste of this was provided in April 2000, when Bolivia's major cities were paralyzed by protests against a government plan to privatize municipal utilities and impose fees on drinking water, At least five people died in skirmishes with the police, and many more were injured. Order was restored only after President Hugo Banzer declared a state of emergency and ordered army troops to clear major thoroughfares."

Resource wars- magnitude

Resource wars cause great power wars, civil wars, and terrorism

Klare 01 (Michael T. Klare, professor of Peace and World Security Studies at Hampshire college and defense correspondent for The Nation, Resource Wars: the New Landscape of Global Conflict, <http://books.google.com/books?id=4swk0glJuswC&pg=PA222&dq=resource+wars+remain+limited&hl=en&ei=DRYaTrHGDoyksQOx_L3jCw&sa=X&oi=book_result&ct=result&resnum=2&ved=0CC4Q6AEwAQ#v=onepage&q&f=false>, accessed via google books on 7/10/11)CNW

Most resource wars of the future will occur in the developing world- notably, in countries where the national government is weak or corrupt and where local and external actors are competing for political power. Armed combat will most likely be limited to periodic skirmishing between militias and other paramilitary formations. Typically, the civilians living in the combat zones will suffer the greatest casualties, as has been the case in the Angola, Congo, Liberia, and Sierra Leone. And while a handful of individuals may profit from the sale of diamonds and old-growth timber to foreign firms, most of the people living in these societies will remain entrapped in poverty and despair.

Further resource conflict also holds great peril for the major powers. Although interstate warfare over vital materials may be less common than internal wars, such fighting will often prove more intense and violent. Soldiers deployed by outside powers to protect supply sites in distant lands will be at risk both on the battlefield and, as targets of terrorism, away from it. Indeed, terrorism is likely to become a common feature of future resource wars. The presence of foreign troops in resource-producing regions will often stir up resentments among those living in the area, especially if they view these resources as part of their natural birthright. The American military deployment in Saudi Arabia, for example, has provoked widespread hostility among these Saudis who reel that the kingdom’s oil wealth should be used solely for the advancement of Islam. The 1996 bombing of the Khobar Towers in Dhahran is thought to be the work of local opponents of the Saudi government’s close ties with the United States.

Asteroid mining solves resource wars

Mining is feasible as well as necessary to solve for Resource wars.

Collins & Autino 10 (Patrick Collins Expert in the economics of energy supply from spaceand Adriano Autino, “What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace,” (2010) <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>. TQ)

Although the use of extra-terrestrial resources on a substantial scale may still be some decades away, it is important to recognize that simply acknowledging its feasibility using known technology is the surest way of ending the threat of resource wars .That is, if it is assumed that the resources available for human use are limited to those on Earth, then it can be argued that resource wars are inescapable [22,37]. If, by contrast, it is assumed that the resources of space are economically accessible, this not only eliminates the need for resource wars, it can also preserve the benefits of civilization which are being eroded today by‘ ‘resource war-mongers’’, most notably the governments of the ‘‘Anglo-Saxon’’ countries and their ‘‘neo-con’’ advisers. It is also worth noting that the $1trillion that these have already committed to wars in the Middle-East in the 21st century is orders of magnitude more than the public investment needed to aid companies sufficiently to start the commercial use of space resources. Industrial and financial groups which profit from monopolistic control of terrestrial supplies of various natural resources, like those which profit from wars, have an economic interest in protecting their profitable situation. However, these groups’ continuing profits are justified neither by capitalism nor by democracy: they could be preserved only by maintaining the pretence that use of space resources is not feasible, and by preventing the development of low-cost space travel. Once the feasibility of low-cost space travel is understood, ‘‘resource wars’ ’are clearly foolish as well as tragic. A visiting extra-terrestrial would be pityingly amused at the foolish antics of homo sapiens using long- range rockets to fight each other over dwindling terrestrial resources—rather than using the same rockets to travel in space and have the use of all the resources they need!

**Resource shortages- sustainability**

**Critical resources from asteroid mining are key to ecologically sustainable terrestrial development**

**Crandall et al in 2011(William, MBA at California Polytechnic Institute and President of AbundantPlanet.org,Larry Gorman Professor of finance @ Cal Poly, Peter Howard, Senior Scientist @ Exelixis inc ., “**Is profitable asteroid mining a pragmatic goal?”, February 23rd 2011, NB

[http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf))

To maximize the benefits derived from off-planet resources, profitable asteroid mining may be our most pragmatic deep-space goal for the next few decades.

▪ For ecologically sustainable terrestrial development, what targets offer richer sources of the most critical of all industrial metals—the platinum group metals? Where else can we find these rare catalysts?

▪ For economically sustainable extraterrestrial development, what targets offer greater potential financial returns? The Moon is slag; it and Mars require costly rockets for landing and liftoff; neither can offer a biologically benign gravity.

Water shortage- war/ short timeframe

Water shortages will cause wars in the near future

Klare No Date (Michael, Professor at Hampshire Collage, Resource Conflict, <http://pawss.hampshire.edu/topics/resource/index.html>, Google Scholar, NC)

Several factors underlie the increased frequency and intensity of resource conflict in the 21st Century. These are: (1) economic globalization; (2) unsustainable consumption; (3) population growth; and (4) economic warfare in poor and developing countries. Economic globalization: The growing internationalization of finance and trade is having an effect on many worldwide phenomena, including the demand for and consumption of basic resources. Globalization increases the demand for resources in several ways, most notably thought the spread and acceleration of industrialization. As nations become industrialize, their need for many resources—especially energy, timber, and minerals—grows substantially. Most manufacturing processes require large supplies of energy plus a wide range of raw materials. With globalization, therefore, we have seen a substantial increase in the consumption of these materials by the newly-industrialized countries (NICs). For example, the consumption of energy by the developing countries is rising by 3.7 percent per year—nearly three times the rate for the older industrialized countries (source: U.S Dept. of Energy, International Energy Outlook 2002). This means that the competition for access to energy supplies (and other vital materials) will grow ever more intense in the years ahead. Unsustainable consumption: Although the global stocks of most vital materials are sufficient for current requirements, the consumption of many of them is growing at such a rapid pace that serious scarcities could arise in the year ahead. This is especially true for oil and water, two of the world's most vital resources. The earth possesses only a certain amount of conventional (i.e., liquid) petroleum—perhaps 2,500 billion barrels—and, over the past 140 years, approximately one-third of this amount has been consumed. But because the global consumption of oil is rising so quickly, we are likely to consume the next one-third by 2020. At this point, it will prove very difficult to satisfy the global demand for oil unless vast new reserves are found or new more fuel-efficient vehicles enter widespread use. Worldwide water use is also growing at an unsustainable rate as more and more people move to cities and acquire water-intensive devices like dishwashers and indoor showers. As the available supply of these and other vital materials dwindle, the competition for access to remaining resources will surely increase. Population growth: The world’s human population is expected to grow by about three billion people between now and 2050 (rising from 6.2 billion people in 2002 to about 9.3 billion in 2050). Obviously, all of these additional humans will require food, shelter, clothing, energy, and other necessities. Theoretically, the early as a whole possesses sufficient stocks of the necessary materials to satisfy these needs, but unfortunately many of the countries with the highest levels of population growth are located in areas where the where the availability of some vital resources is in doubt. This is especially true for two critical materials: water and arable land. Severe scarcities of both have already developed in parts of Africa, Asia, and Latin America where population rates are especially high. This could lead to intense competition for access to these resources in the years ahead. In particular, it could provoke conflict over the distribution of shared water resources in such areas as the Nile and Jordan river basins, where water is already scarce and the combined population is expected to triple over the next 50 years.

Resources- platinum

Platinum- UQ

UQ for platinum- demand high

**Demand for PGMs high: cars, electronics, jewelry, fuel cell tech**

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

Demand for platinum and other PGMs will continue to be very strong, and under some scenarios, demand may even outstrip known terrestrial reserves. The global platinum market was worth about $5.5 billion in 2003 with the two largest components by far being automotive ($2.7 billion) and jewelry ($2 billion). The volume demand for platinum by industry segment is shown in Figure 8. The growing number of automobiles and the potential large-scale adoption of fuel cell technology are likely to drive significant growth in demand for [PGMs] platinum and other platinum group metals over the next twenty years. The platinum jewelry market continues to grow rapidly as well, fueled significantly by growing demand in Asia.38 In addition to supplementing the traditional platinum supply, opportunities may exist to exploit the unique quality of ultra-pure asteroid-derived platinum to market jewelry and other precious objects made from it at premium prices. According to a British government study,39 even without full-scale fuel cell adoption, the transportation industry uses a significant portion of the world’s PGM output. As of 2002, the automotive industry used about 71 metric tons of platinum and palladium annually, equal to 20 percent of global production. This is expected to increase with more stringent pollution controls on diesel automobile engines in Europe and North America. The petroleum industry uses platinum in the catalytic cracking (breaking down of heavy hydrocarbons into lighter ones) of hydrocarbons in refineries. The electronics industry is using increasing amounts of platinum and palladium in the manufacture of hard disk drives and capacitors. In the electronics-related glass industry, demand for platinum is accelerating because it is a required in the production of liquid crystal displays. The chemical industry uses platinum as a catalyst to lower the energy required for a wide range of chemical reactions, such as those used to produce silicone. The "other" category above includes applications such as platinum fillings, spark plugs, pacemakers, catheters, and many other items that require a high-temperature-resistant or a corrosion-resistant metal. Platinum prices have remained close to historic highs over the past two years and are expected to remain strong. Current high platinum prices (e.g., $872/oz on May 2, 2005) highlight the critical impact that a supply/demand imbalance can have on price.40 Increasing demand from Chinese jewelry market has been driven by China’s economic expansion since the mid 1990s. Increasing demand from transportation is due to more stringent emissions controls on diesel vehicles combined with growing market penetration of diesel vehicles in Europe, and anticipated higher auto demand due to economic recovery as well as to fuel cell adoption in the longer term. In addition, mutual funds have increased their investment in platinum.41 As the same time as demand remains strong and growing, mine expansion efforts are not meeting published company goals. The strong rand has inhibited new capital investment in South Africa. Meanwhile, an oversupply of palladium and other PGM byproducts has reduced margins. 42

UQ for platinum- prices high

Energy shortages in South Africa ensure high platinum prices

Smith 2011 (Michelle, reporter for platinuminvesting.com, “Will South Africa’s energy Crisis Imapct Platinum?”, <http://platinuminvestingnews.com/2175-will-south-africas-electricity-crisis-impact-platinum.html>, 6/1/11, accessed 6/28/11)CNW

In South Africa, platinum miners are faced with rising electricity prices and uncertainty about supply. Platinum prices are expected to continue soaring through to the end of the year with some [predictions](http://www.platinum.matthey.com/pgm-prices/weekly-price-bulletins/16th-may-2011-to-20th-may-2011/) as high as $2,000 an ounce. The risk of power losses may be one of the factors supporting those prices, but it may also be the factor that cripples expansion.

South Africans, with their stressed power grid, consume the most electricity in the winter, from June to August. This year, temperatures began dropping in May and Eskom, the nation’s public power producer, is already seeing sharp peaks in consumption… and increasing concerns about inadequate [supply](http://www.ft.com/cms/s/0/0790f654-8a10-11e0-beff-00144feab49a.html#axzz1NyK8vyJp) leading to blackouts.

The concerns are not unjustified. South Africa’s power problems have brought platinum production to a halt before. In 2008, operations were shut down for days. The effect, according to [Energy Policy](http://www.duke.edu/~cy42/Pt.pdf), was that platinum rose $20 per gram in a span of just weeks. In January 2008, reduced power supplies caused platinum prices to reach all-time [highs](http://www.commodityonline.com/news/Mining-South-Africa-to-improve-power-supplies-37018-3-1.html) above $2,100 an ounce.

Platinum- Links

Asteroids key to platinum supply

Asteroid Mining is necessary for elements like platinum and planetary defense

Valentine 7’

(Dr. Lee S. Valentine is the Executive Vice President of the Space Studies Institute in Princeton, New Jersey, Critical Trajectories for the Human Settlement of the High Frontier, NEW TRENDS IN ASTRODYNAMICS AND APPLICATIONS III. AIP Conference Proceedings, Volume 886, pp. 123-130 (2007),

**The evolution from small tourist stations of the next decade to large space hotels will make economical the use of fully closed life-support systems. These could be considered the first space colonies. Derivatives of these commercial space hotels may form suitable Moon and asteroid mining habitats. Using nonterrestrial materials is a key to opening the space frontier. Dozens of rendezvous missions to Near Earth Objects will be needed to assay their resources and to plan rational NEO diversion. The development of NEO mining techniques serves two purposes, raw materials supply and planetary defense.** We need economical trajectories to and from these bodies. These trajectories must not only be economical in terms of delta V or time, but in dollars, and in the time value of money, factors not generally considered by the OMB. Satellite solar power stations may be a $500 billion per year market worldwide and cheap nickel steel from asteroids may be an enabler of power satellite construction. One asteroid of the right size and composition in a suitable orbit could open this market. **Platinum group metals may be an important export, either as a primary product, or as a byproduct of nickel steel alloy production. Other products, derived from carbon, may also be important. The first economical product from an asteroid mine is likely to be water, for propellant or life-support and radiation shielding in space hotels.**

Metallic Asteroids provide amazing profits.

Ross 0**1** (Shane D. Control and Dynamical Systems Caltech 107-81, Near-Earth Asteroid mining, <http://www.esm.vt.edu/~sdross/papers/ross-asteroid-mining-2001.pdf> , Google Scholar, NC)

Kargel [1997] estimated that one metallic asteroid of modest size (1 km) and fair enrichment in platinumgroup metals would contain twice the tonnage of PGMs already harvested on Earth combined with economically viable PGM resources still in the ground. At recent prices, this asteroid’s iron, nickel, PGMs, and other metals would have a value exceeding that of the world’s proven economic reserves of nonmetallic and metallic mineral resources. The availability of asteroid metals would lower market prices. Even then, the value of the asteroid-derived materials would be enormous. The mining scenario Kargel considered is one involving coproduction of precious metals (for Earth markets) and semiconductors marketed to a future space photovoltaics industry (e.g., for production of solar power cells). He assumed the asteroid mined to be a 1 km metallic asteroid in the 90th percentile of iridium richness, because this type is rich in semiconductors. As it turns out, the semiconductors are where most of the money is if there is a large-scale space solar power industry (see Table 2). The precious metals would be sold in Earth markets, and would be insensitive to launch costs. However, Kargel assumed that asteroidal semiconductors placed into LEO would acquire a value p, approximated by p = p! + Corbit, where p! is the cost of these materials purchased from terrestrial sources, and Corbit is the launch cost to LEO per kg. There, they would be made into photovoltaics, as it is advantageuous to do the manufacturing in space rather than launch prefabricated modules from Earth (owing to launch cost considerations). Currently, Corbit "$20,000/kg on most systems. Kargel assumed that efficient high-volume launch systems would be developed in the near future, lowering the launch cost to $3,000/kg, i.e., a reduction that would seem sufficient to make commercial space solar power economical.

Platinum- Impacts

Platinum shortage kills fuel cells

The shortage of platinum is already resulting in a lack of funding for fuel-cells, because its rarity drives the price too high

Crandall 2009 (William BC, MBA from California Polytechnic and founder of Abundant Planet, address to the Review of United States Human Space Flight Plans Committee, <http://www.nasa.gov/pdf/383154main_53%20-%2020090803.7.toAugustineCommittee-2009-08-03.pdf>, 8/3/09, accessed 6/27/11)CNW

A single asteroid can contain more than a year’s worth of current platinum production—worth tens of billions of dollars—as well as other high-value metals such as gallium, indium, and other rare earths, and literally tons of iron and nickel.80 Critically, platinum shortages are already effecting U.S. energy policy decisions. Hydrogen fuel cells are widely understood to “reduce greenhouse gas emissions faster than any other [automotive] technology,” and yet funding for Department of Energy hydrogen research programs was cut earlier this year, due to the relative unavailability— “the high cost”—“of precious-metal [platinum group metal] catalysts.”81 A national civil space agency could—and should—build upon this demand for industrially critical metals, and formulate an easy to understand motto that captures its core purpose: “We bring essential resources from space to Earth.” Or, today, as the agency develops and runs demonstration projects that show the technical feasibility of asteroid mining: “We make it possible to bring essential resources from space to Earth.”

**Platinum has a market**

**PGMs have a market and has a tangible benefit to 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

What makes platinum group metals (PGMs) an attractive product is the existence today of an easily identified, well understood market. Given a reasonable estimate of the cost to produce a quantity of platinum and deliver it to a given buyer at a given time in the future, one can calculate the financial return required to justify the investment with a reasonable degree of accuracy. The existence of the clearly defined market means that one can focus on the nuts and bolts of the capability required to address that market, rather than on building the market itself. And, ironically, this is in many ways an easier business case to build and defend than many of those for the Earth-based businesses that were so readily funded in the late 1990s.37

**Platinum key to oil dependence**

PGM K2 end dependence on petroleum but there’s not enough supply now. Asteroid mining will provide that back up.

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

Fuel cell adoption may ultimately become the most important dynamic in the platinum market. Platinum is critical to fuel cell performance because it is critical to achieving the required levels of fuel cell power density and efficiency. It is essential to the catalysis of anodic and cathodic reactions in the stack. It is important to the catalysis of reforming, shift, and preferential oxidation reactions in the fuel processor. The fuel cell industry's demand for platinum and other PGMs is expected to eventually dwarf all other sectors and will place an incredible strain on the supply of platinum and the environment.

Just as O’Neill43 justified investment in the development of his massive L5 space colonies with the need to construct space solar power satellites (SSPS) to meet the world’s growing energy needs, exploitation of asteroid resources in part be justified by the desire to find new, more environmentally friendly ways to meet our energy needs in the face of fossil fuel depletion. One step that can be taken to address growing fossil fuel demand is to shift from a petroleum economy to a hydrogen economy, where the gasoline internal combustion is replaced by hydrogen fuel cells. However, one potentially serious roadblock to this shift is the requirement for platinum as a catalyst in fuel cells,44 with limited platinum reserves and high platinum production costs may slow or even halt fuel cell adoption (Figure 10).

**Platinum boosts economy**

**Asteroid mining boosts economy: Platinum is a precious metal**

Blair in 2000 (Brad R.  Research Associate. Center for Commercial Applications of Combustion In Space. Colorado School of Mines. Space Resources Roundtable 2, p. 5 *The Role of Near-Earth Asteroids in Long-Term Platinum Supply* May 5, 2000. Google Scholars. TS)

 High-grade platinum-group metal concentrations have been identified in an abundant class of near-Earth asteroids known as LL Chondrites. The potential existence of a high-value asteroid-derived mineral product is examined from an economic perspective to assess the possible impacts on long-term precious metal supply. It is hypothesized that extraterrestrial sources of platinum group metals will become available in the global marketplace in a 20-year time frame, based on current trends of growth in technology and increasing levels of human activities in near-Earth space. Current and projected trends in platinum supply and demand are cited from the relevant literature to provide an economic context and provide an example for evaluating the economic potential of future asteroid-derived precious and strategic metals. Two primary market categories exist for platinum: Industrial and precious metals, each having distinctly different demand characteristics (Christian, 1997). Primary industrial uses include emissions-control catalysts or ‘autocatalysts,’ chemical refinery components, and manufacturing of electronics and hard disks. Precious metal uses include jewellery and investment products, such as the US platinum eagle coin. Consumption of platinum in jewelry and autocatalysts accounted for over 70% of demand last year, and form the primary consumer base for the metal (Johnson Matthey, 1999). Platinum jewelry has been increasingly fashionable in China and parts of Europe, following a strong lead in Japan. The Japanese market has the strongest jewelry demand internationally, with over five times the annual consumption of any other country. This ‘platinum fever’ could easily spread to other parts of Asia in the short and medium term, exerting an upward pressure on demand. Autocatalyst consumption is on the rise (projected at 5% annual growth – Christian, 1999) and has the potential for sustained long-term growth as developing nations adopt emissions standards similar to the U.S. and Europe.

Oil dependency causes warming

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

Reynolds, American Surveyor, 10

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

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

Oil Dependency Kills economy and heg

Oil dependency kills the economy, heg, and funds terrorism

Reynolds, American Surveyor, 10

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

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

Oil Dependency causes wars

Oil dependency causes wars – empirics

Reynolds, American Surveyor, 10

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

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

Oil Dependency causes war with China and tanks foreign relations

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

Reynolds, American Surveyor, 10

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

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

Global Warming- extinction

Global warming leads to extinction- highest probability

Roach 4 (John, http://news.nationalgeographic.com/news/2004/01/0107\_040107\_extinction.html , *National Geographic*, July 12.4) ET

As global warming interacts with other factors such as habitat-destruction, invasive species, and the build up of carbon dioxide in the landscape, the risk of extinction increases even further, they say. In agreement with the study authors, Pounds and Puschendorf say taking immediate steps to reduce greenhouse gas emissions is imperative to constrain global warming to the minimum predicted levels and thus prevent many of the extinctions from occurring. "The threat to life on Earth is not just a problem for the future. It is part of the here and now," they write.

Warming expands on itself and risk extinction

**Brown, 08**

(Lester E. Brown, Director and Founder of the global institute of Environment in the U.S “Plan B 3.0: Mobilizing to Save Civilization”, <http://www.earth-policy.org/images/uploads/book_files/pb3book.pdf>, published in 2008 by the Earth Policy Institute, p. 66)

Beyond what is already happening, the world faces a risk that some of the feedback mechanisms will begin to kick in, further accelerating the warming process. Scientists who once thought that the Arctic Ocean could be free of ice during the summer by 2100 now see it occurring by 2030. Even this could turn out to be a conservative estimate.78 This is of particular concern to scientists because of the albedo effect, where the replacement of highly reflective sea ice with darker open water greatly increases heat absorbed from sunlight. This, of course, has the potential to further accelerate the melting of the Greenland ice sheet. A second feedback loop of concern is the melting of permafrost. This would release billions of tons of carbon, some as methane, a potent greenhouse gas with a global warming effect per ton 25 times that of carbon dioxide.79 The risk facing humanity is that climate change could spiral out of control and it will no longer be possible to arrest trends such as ice melting and rising sea level. At this point, the future of civilization would be at risk. This combination of melting glaciers, rising seas, and their effects on food security and low-lying coastal cities could overwhelm the capacity of governments to cope. Today it is largely weak states that begin to deteriorate under the pressures of mounting environmental stresses. But the changes just described could overwhelm even the strongest of states. Civilization itself could begin to unravel under these extreme stresses.

Warming- biodiversity

Warming kills biodiversity

 Butler, 07

(Rhett. Butler, Economist, 3/26/07, http://www.mongabay.com/about.htm. March 26)

Using a variety of climate scenarios, assumptions and methods of analysis, we estimated that somewhere between 5% and 50% of the species we analyzed are at risk of extinction, with the central range of estimates falling between 15% and 37%. This is on the basis of warming projected until 2050, so the year 2100 risks of extinction from climate change are likely to lie in the upper half of this range (or above)," he explained. "Our estimates of potential extinction were preliminary values intended to define the order of magnitude of the problem. We found that the extinction risks from climate change are probably similar to those from habitat loss, and conceivably even greater in some regions." Dr. Thomas cautions that not all the species "committed to extinction" will disappear by 2050 due to the inherent lag time of extinction."When the climate becomes unsuitable for the long-term survival of a species, it does not mean that it will die out immediately. For species with long-lived individuals, in particular, it may be many decades or even centuries before the last individuals die out. So, these are the numbers of species that may be declining towards extinction from 2050 onwards, not the numbers that will have died out by that date. "How does climate change affect biodiversity? Climate change can affect species in myriad ways including the expansion, contraction, and "migration" of habitat; increased incidence of disease and invasive species; changes in temperature, precipitation, and other environmental conditions; shifts in food availability; and failure of ecological relationships with other species -- for example the loss of critical pollinators or mutualistic nutrient fixers. In the past some species may have escaped extinction by "migrating" north or southward in response to climate change. Today humans have made it a lot tougher by fragmenting, converting, and destroying habitats and potential migration corridors. Peter Raven, director of the Missouri Botanical Garden and a renowned expert on biodiversity, says that climate change will also make conservation efforts more difficult." As the climate changes, protected areas will not be able to shift due to surrounding urban areas and agricultural zones," he told mongabay.com via telephone. "This makes them all the more susceptible to the impact of climate change, whether it is rising sea levels, a dip in precipitation levels, or warmer temperatures."

Loss of biodiversity risks extinction

**Diner, 94**

(David, Judge Advocate General, Vice Chief of Staff, United States Department of the Army Personnel, Plans and Training Office Chief, 1994 , Colonel David N., United States Army Military Law Review Winter, p. lexis)

By causing widespread extinctions, humans have artificially simplified many ecosystems. As biologic simplicity increases, so does the risk of ecosystem failure. The spreading Sahara Desert in Africa, and the dustbowl conditions of the 1930s in the United States are relatively mild examples of what might be expected if this trend continues. Theoretically, each new animal or plant extinction, with all its dimly perceived and intertwined affects, could cause total ecosystem collapse and human extinction. Each new extinction increases the risk of disaster. Like a mechanic removing, one by one, the rivets from an aircraft's wings, n80 mankind may be edging closer to the abyss.

AT: substitutes

Platinum key – others fail

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

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

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

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

Asteroid Advantage

Asteroids- UQ

**UQ for asteroids/mining solves**

We have no detection and deflection of asteroids in the status quo, but we need to act NOW in a 3 step approach: tracking, studying, and deflection

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

But hope is not a strategy, and as small as the probabilities might be, the possible consequences of such an impact merit efforts to mitigate the risk. Despite human inventiveness and rapidly expanding knowledge, the ability to detect threatening as teroids and comets is weak, and there are no proven systems for deflecting them. Scientists have identified the problem and analysed possible approaches for addressing it, but no one has begun to implement any of the proposed techniques. The threat of collision from asteroids and comets calls for a three-step approach to mitigating the risks: first, find and track objects that are potentially hazardous to the Earth; second, study their characteristics so as to understand which mitigation schemes are likely to be effective; and third, test various deflection techniques to ascertain the best way to adjust the orbits of asteroids and comets, and possibly field a planetary-defence system. Each of these steps would benefit from international cooperation or agreement. It takes an asteroid like Apophis, or a comet like Shoemaker–Levy 9, to remind us that the threat from space is real. And while the probabilities of a strike are small, the consequences are potentially cataclysmic, making our current state of near ignorance unacceptable .

No Asteroid protection now

Congress refuses to offer enough money to catalogue all harmful asteroids—Spaceguard Project underfunded

Leary 07 (Warren E., New York Times Media Group, International Herald Tribune, NEWS, Page 3. *Lack of money Hampers Hunt of Killer Asteroids*, March 17. 2007, AG)

The National Aeronautics and Space Administration can find and track most nearby asteroids that could hit and damage Earth, but there is not enough money in its budget to finish the project within a 15-year deadline mandated by Congress, according to an agency report. The report, released Friday, said that about 20,000 asteroids and comets orbit relatively close to the planet and could deliver blows ranging from destroying cities to ending all life. William Ailor of the Aerospace Corporation, Enhanced Coverage Linking Aerospace Corporation, -Search using: Company Profile News, Most Recent 60 Days Company Dossier a not-for-profit U.S. Air Force research group that sponsored the planetary defense conference, said that the problem of finding killer asteroids could be solved more easily if more countries were involved. Interest is growing, he said, noting that the European Space Agency was planning a mission called Don Quijote to test ways to deflect asteroids. ''Should one nation, the United States, be responsible for the entire planet?'' Ailor asked. The objects being hunted, ranging from 140 meters to more than a kilometer and a half in diameter, or 450 feet to more than a mile, represent about 20 percent of the asteroids and comets whose paths routinely cross the space between the Sun and Earth's orbit, it said. Rather than trying to detect, track, catalogue and characterize all of the more than 100,000 ''near Earth objects,'' as Congress asked in a 2005 NASA authorization bill, the study said it would be more realistic to focus on those representing a real potential hazard. But accomplishing this by 2020 would require using ground-based telescopes sponsored by other agencies for other purposes; possibly building a dedicated observatory for finding and tracking hazardous bodies; and launching a spacecraft to observe the space around Earth from Venus. Such an undertaking, the report said, would cost more than $1 billion, money that the agency does not have. ''Due to current budget constraints, NASA cannot initiate a new program at this time,'' it said. NASA runs a program, the Spaceguard Survey, to track the largest potentially hazardous objects, those greater than a kilometer in diameter, which could devastate most of life on Earth if they struck the planet. That is what scientists believe happened to the dinosaurs about 65 million years ago. The Spaceguard program, using ground-based observatories, is budgeted at $4.1 million a year through 2012. Donald Yeomans, director of the Spaceguard program, said that there were believed to be 1,100 of these larger objects and that the survey had catalogued about 73 percent of them. The initial goal of tracking 90 percent of them should be reached by 2010, more than a year later than originally planned, he said. Yeomans, attending a planetary defense conference in Washington last week, said that the goal of surveying 90 percent of potentially hazardous objects could be reached more cheaply than in the NASA study by using only ground-based observatories. But Congress would have to change its goal from 2020 to 2026, he said. Building, launching and operating a deep space orbiting infrared observatory to complete the task more quickly could cost another $700 million, he said.

No Asteroid protection now

It’s impossible to accurately predict the trajectory of dangerous asteroids—Govt. is cutting budget for the telescope and smaller factors not paid attention to.

Shiga 08 (David, researcher for The New Scientist, New Scientist Vol 199, Isue 1994, *Forecast for Asteroid May be Off by Millions of Miles*, July 12, 2008., http://www.newscientist.com/article/mg19926643.500-killer-asteroid-predictions-off-by-millions-of-miles.html , AG)

Thanks to the way asteroids radiate heat unevenly, our predictions of the path of the solar system's most dangerous rock could be way off. YOU'D think that by now we'd have a firm grip on the trajectory of the solar system's most worrisome chunk of rock. In fact we have only a hazy understanding of how likely the asteroid Apophis is to strike Earth. What's more, budget cuts may shut down the telescope that could clarify the situation. Since Apophis was discovered in 2004, asteroid-watchers have known that it has a slim chance of hitting Earth in 2036. At 270 metres wide, it is too small to rival the object that wiped out the dinosaurs, but it could cause devastating tsunamis were it to hit the ocean. Worrying as this is, we have been able to take comfort in the computed probability of impact, which is just 1 in 45,000. Now it seems the true risk is unclear, thanks to minute effects that the calculations didn't take into account. "You really can't estimate the probability because it's driven by these unknown physical parameters," says Jon Giorgini of the Near-Earth Object Program at NASA's Jet Propulsion Laboratory in Pasadena, California. Whether Apophis ends up on a collision course with Earth depends on what happens during a close encounter between Apophis and our planet in 2029. During this swingby, the Earth's gravity could alter the asteroid's path enough to put it on a collision course with us when its orbit brings it back in 2036. One problem, says Giorgini, is that our calculations do not include effects arising from the fact that Earth is not a perfect sphere. This slightly alters its gravitational field and could make a difference to the asteroid's path when it swings close to Earth. Yet the most powerful steer could come from the way the sunlit asteroid radiates heat, says Giorgini. Radiation gives rise to a small thrust, and since warmer areas of the asteroid radiate more than cooler ones, there is a net force on the asteroid. This phenomenon - the Yarkovsky effect - means our calculations of Apophis's path could be out by millions of kilometres, according to Giorgini, who will present his results at the Asteroid, Comets, and Meteors conference in Baltimore, Maryland, on 17 July.

AT: Asteroid Painting

Asteroid painting has its problems.

Wolff 09 (Eric, Discover Magezine, Diamonds in the Sky: The Asteroid Menace, <http://blogs.discovermagazine.com/sciencenotfiction/2009/03/05/diamonds-in-the-sky-the-asteroid-menace/>, march 05 2009, NC)

Of course, there are potential problems with this theory. Asteroids have low gravity, and they are mostly gravel and loose rock. It’s not clear if the paint would remain in place. And the expense of trucking all that paint into space would not be inconsiderable. So what are the alternatives? One idea involved installing a lot of small, solar power rockets which would slowly, over time, change the direction of the asteroid. Another would be to install a conveyor belt that digs out asteroid dirt and flings it out into space, changing its direction by Newton’s Third Law.

Asteroids- Links

Mining solves asteroid impact- gravity tractor

Mining and using non-terrestrial material can be used to make gravity tractor technique to deflect asteroids

 Valentine 7’

(Dr. Lee S. Valentine is the Executive Vice President of the Space Studies Institute in Princeton, New Jersey, Critical Trajectories for the Human Settlement of the High Frontier, NEW TRENDS IN ASTRODYNAMICS AND APPLICATIONS III. AIP Conference Proceedings, Volume 886, pp. 123-130 (2007),

A successful space tourism industry, beginning with suborbital tourism, will greatly drive down the cost of access to orbit over the next 15 years. **Inexpensive transportation to low Earth orbit is the first requirement for a great future on the High Frontier. Inexpensive means the cost associated with a mature transportation system.** A mature system has a cost of three to five times the cost of the propellant. The first cheap, reliable and highly reusable rocket engines are just now appearing in vehicles. **With an assured market and high flight rate, the heretofore glacial progress in reducing the cost of space transportation is likely to become rapid. This is the first critical enabling example of synergy between free market economics and scientific and technical progress in space.** It will not be the last. New high power switches and ultracapacitors developed for the automotive market make possible cheap, robust and reliable mass driver engines. **In space construction, using masses of nonterrestrial materials make the gravity tractor technique much more capable than previous schemes to maneuver asteroids. Ion propulsion will continue to improve and the first solar sails will be flown. Advanced robotics will allow remarkable improvements in productivity.** The computing power available to robots began to follow the exponential Moore's law less than decade ago. The first commercial autonomous mobile robots appeared in late summer 2006. Humans, however, will be required for the foreseeable future in repair and supervisory roles, particularly in unstructured settings such as asteroid mines.

Mining solves asteroid impact

**We can use the resources from asteroids then deflect them from Earth’s path**

Mark Sonter , Asteroid Mining: Key to the Space Economy, From Ad Astra Online February 2006, http://www.nss.org/settlement/asteroids/key.html, ES

The Near Earth Asteroids offer both threat and promise. They present the threat of planetary impact with regional or global disaster. And they also offer the promise of resources to support humanity's long-term prosperity on Earth, and our movement into space and the solar system. The technologies needed to return asteroidal resources to Earth Orbit (and thus catalyze our colonization of space) will also enable the deflection of at least some of the impact-threat objects. We should develop these technologies, with all due speed! Development and operation of future in-orbit infrastructure (for example, orbital hotels, satellite solar power stations, earth-moon transport node satellites, zero-g manufacturing facilities) will require large masses of materials for construction, shielding, and ballast; and also large quantities of propellant for station-keeping and orbit-change maneuvers, and for fuelling craft departing for lunar or interplanetary destinations. Spectroscopic studies suggest, and ‘ground-truth' chemical assays of meteorites confirm, that a wide range of resources are present in asteroids and comets, including nickel-iron metal, silicate minerals, semiconductor and platinum group metals, water, bituminous hydrocarbons, and trapped or frozen gases including carbon dioxide and ammonia.

Mining solves for Asteroid impacts as well as economy – technological advances make it possible

Sonter 06- ( Mark Sonter. scientific consultant working in the Australian mining and metallurgical industries. Department of Civil and Mining Engineering in University of Wollongong,. “Asteroid Mining: Key to the Space Economy,”, February 2006, http://www.nss.org/settlement/asteroids/key.html/. TQ)

The Near Earth Asteroids offer both threat and promise. They present the threat of planetary impact with regional or global disaster. And they also offer the promise of resources to support humanity's long-term prosperity on Earth, and our movement into space and the solar system. The technologies needed to return asteroidal resources to Earth Orbit (and thus catalyze our colonization of space) will also enable the deflection of at least some of the impact-threat objects. We should develop these technologies, with all due speed! Development and operation of future in-orbit infrastructure (for example, orbital hotels, satellite solar power stations, earth-moon transport node satellites, zero-g manufacturing facilities) will require large masses of materials for construction, shielding, and ballast; and also large quantities of propellant for station-keeping and orbit-change maneuvers, and for fuelling craft departing for lunar or interplanetary destinations. Spectroscopic studies suggest, and ‘ground-truth' chemical assays of meteorites confirm, that a wide range of resources are present in asteroids and comets, including nickel-iron metal, silicate minerals, semiconductor and platinum group metals, water, bituminous hydrocarbons, and trapped or frozen gases including carbon dioxide and ammonia. As one startling pointer to the unexpected riches in asteroids, many stony and stony-iron meteorites contain Platinum Group Metals at grades of up to 100 ppm (or 100 grams per ton). Operating open pit platinum and gold mines in South Africa and elsewhere mine ores of grade 5 to 10 ppm, so grades of 10 to 20 times higher would be regarded as spectacular if available in quantity, on Earth. Water is an obvious first, and key, potential product from asteroid mines, as it could be used for return trip propulsion via steam rocket. About 10% of Near-Earth Asteroids are energetically more accessible (easier to get to) than the Moon (i.e. under 6 km/s from LEO), and a substantial minority of these have return-to-Earth transfer orbit injection delta-v's of only 1 to 2 km/s.

Asteroids- Impacts

Asteroids impact- extinction

**Asteroid collision will cause extinction: multiple scenarios**

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.

**Colonization Advantage**

**Colonization Links**

Mining key to mars- tech, fuel, and research

Asteroid mission is prerequisite to Mars mission: tech testing, solar system education and fuel

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: sav[e]ing 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, 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."

Mining key to colonization- Mars

Starting with asteroids is key to moving to mars

 Crandall et. al 11 February 232011 “William BC Crandall has a MBA study the economic and commercial feasibility of extraterrestrial resource development, “Asteroid Mining A Pragmatic Goal?” PG.2 [http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf)

**Offering only one-third Earth’s gravity, Mars may never be healthy for Earth-evolved, cellular life. We need gravity**.5 The delicate molecular and computational apparatus within every watery cell of DNA life6 may require gravitational conditions rather close to what they have been for 4 billon years: 980 Galileos (}0.3%). Humans may hope to *visit* Mars, but making it an “ultimate goal” is just not rational. The Moon, offering only one-sixth Earth’s gravity, is even less hospitable**. On the other hand, rotating cylinders, as small as a couple hundred meters in diameter,** appear quite capable of precisely simulating Earth-normal gravity.**7 Such habitats—likely built from asteroids, rather than material drawn up out of expensive gravity wells—seem to be the most plausible context for realizing our long-term goal of “humans [venturing] out into the solar system and ... beyond**” (Charles Bolden).8 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. 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

Mining key to colonization- resources

**Mining asteroids provides a near-infinite opportunity for humanity to grow—solar system resources can support some quadrillion people comfortably.**

Sonter 06 (Mark, member of the National Space Society, Space.com, Asteroid Mining: Key to the Space Economy, February 6, 2006, http://www.space.com/2032-asteroid-mining-key-space-economy.html, AG)

Our knowledge of asteroids and comets has expanded dramatically in the last ten years, with images and spectra of asteroids and comets from flybys, rendezvous, and impacts (for example asteroids Gaspra, Ida, Mathilde, the vast image collection from Eros, Itokawa, and others; comets Halley, Borrelly, Tempel-1, and Wild-2. And radar images of asteroids Toutatis, Castalia, Geographos, Kleopatra, Golevka and other... These images show extraordinary variations in structure, strength, porosity, surface features. The total number of identified NEAs has increased from about 300 to more than 3,000 in the period 1995 to 2005. The most accessible group of NEAs for resource recovery is a subset of the Potentially Hazardous Asteroids (PHAs). These are bodies (about 770 now discovered) which approach to within 7.5 million km of earth orbit. The smaller subset of those with orbits which are earth-orbit-grazing give intermittently very low delta-v return opportunities (that is it is easy velocity wise to return to Earth). These are also the bodies which humanity should want to learn about in terms of surface properties and strength so as to plan deflection missions, in case we should ever find one on a collision course with us. Professor John Lewis has pointed out (in Mining the Sky) that the resources of the solar system (the most accessible of which being those in the NEAs) can permanently support in first-world comfort some quadrillion people. In other words, the resources of the solar system are essentially infinite... And they are there for us to use, to invest consciousness into the universe, no less. It's time for humankind to come out of its shell, and begin to grow!! So both for species protection and for the expansion of humanity into the solar system, we need to characterize these objects and learn how to mine and manage them. Once we learn how to work on, handle, and modify the orbits of small near-earth objects, we will have achieved, as a species, both the capability to access the vast resources of the asteroids, and also the capability to protect our planet from identified collision threats. Since the competing source of raw materials is "delivery by launch from Earth," which imposes a launch cost per kilogram presently above $10,000 per kg, this same figure represents the upper bound of what recovered asteroidal material would be presently worth in low earth orbit. Future large scale economic activity in orbit is unlikely to develop however until launch cost drops to something in the range $500 to $1,000 per kilogram to LEO. At that point, any demand for material in orbit which can be satisfied at equal or lower cost by resources recovered from asteroids, will confer on these asteroidal resources an equivalent value as ore in true mining engineering terms, i.e., that which can be mined, have valuable product recovered from it, to be sold for a profit. Now, $500,000 per ton product is extraordinarily valuable, and is certainly worth chasing!

Mining key to colonization- **propellants**

Propellants produced on comets creates a new industry and is a prerequisite for colonization

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

The availability of inexpensive, locally produced propellants on orbit and beyond would revolutionize the economics of space operations. Many space-derived propellant systems have been proposed.28 By far the greatest bulk of materials launched from Earth into space are volatile propellants. In space, expendables used on the [ISS] International Space Station and manned space missions consist overwhelmingly of volatiles (e.g., air, water, propellant). In addition, the largest proportion by far of materials used by most processing industries is made up of volatiles and organics. Extraction and processing of volatiles from comets combined with technologies such as orbital fuel processing and storage depots29 and even solar-thermal steam rockets30 could enable a wide variety of new possibilities along the path from our current small-scale space operations to largescale space industrialization. Native volatiles could be processed to supply space operations, while making possible new industries with low up-front investment. Bootstrapping of transportation with native fuels and industry with chemical microreactors could provide the technological and economic resources for large-scale space industry and space colonization.

Mining key to colonization- **volatiles**

**Volatile resources found in asteroids are profitable and key to human survival in outer space.**

Nichols 93. (Charles R. Nichols. Works for Bose Corp. University of Arizona Press. “Resources of Near-Earth Space” Chapter 21. Edited by J.Lewis. <http://www.uapress.arizona.edu/onlinebks/ResourcesNearEarthSpace/resources21.pdf>. TQ)

The space resources literature continues to mature in its recognition of the importance of economic perspective. Cutler and Hughes (1985) identiﬁed low initial capital investment and quick payback as the prime requirements for economic feasibility of space mining. They identiﬁed propellants and metal plate, delivered to low Earth orbit (LEO) as the best products. Cutler also identiﬁed the design and development of mining processes as the biggest time bind (Gertsch et al. 1985). Cordell and Steinbronn (I988) found space resources pivotal for large-scale human operations in space, concluded that volatiles should be mined even if lunar oxygen were already in production, and agreed that keeping initial costs down was vital. The cost of placing a pound of goods into LEO currently exceeds $3000. Although designs for cheap launch services abound, they have not as yet been subjected to the rigors of the market. However, the economic viability of space resource utilization would probably survive the development of low cost launch technology. Leonard et al. (1987) concluded that a propellant mine at Phobos would be proﬁtable as long as Earth-to-LEO launch cost exceeds $250 to $560 per pound. Space-based industry can provide goods to LEO at a much lower cost than Earth-to-LEO under certain conditions. The cost of developing a new supply must be justiﬁed by a large demand (by weight) for the product. The cost of providing the product from space must be well below the cost of delivering it from Earth. Finally, the product must be easy to make from materials already present in space. Space planners have attempted to predict the future needs of the space community, and have identiﬁed some volatile products which look promising. Volatiles in large quantities will be needed for life support for a permanently manned station. Propellants could be used for moving satellites. spacecraft, humans, and raw materials. Volatile reagents can be transported to other space factories and used to reduce the cost of their products, such as lunar oxygen and steel. Volatile products for life support include water, oxygen, and nitrogenfor humans, and carbon dioxide and fixed nitrogen for agriculture. Their availability allows a lifestyle in space characterized by abundance and self-sufﬁciency, as contrasted with the canned air, sponge bath. and reconstitutedfood lifestyle of the Apollo missions.

Volatiles in comets are easy to mine and are very important: fuel, construction and sustaining life

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

The other NEO resources of particular interest are the volatiles locked up in these bodies. Comets are thought to be covered by a layer, between 10 centimeters and 10 meters thick, of dirt and/or dark carbonaceous sooty material. A little less than half of the mass of the typical comet is believed to consist of rock-like dust bound together by the ices that make up the rest of the comet (approximately 50-percent water ice, 10-percent CO and CO2, and 0.5-percent of a conglomerate of carbon, hydrogen, oxygen and nitrogen (CHON) materials).27 The reason both active and dormant comets are attractive from a space resources development perspective is the presence of so many volatiles that could one day be tapped as sources for water, oxygen, and hydrogen fuel for space missions. These objects are rich in the raw materials required to make rocket propellant, construction materials, and even plant food. They are the crucial elements for operating in space and sustaining life there. Volatiles are likely to be easier to extract and process in space than other types of resources (e.g., metals, semiconductors). There is no complicated chemistry or need to reduce rock to rubble. Conceptually, one might need only to vaporize the ice and condense it into a cold finger that can be transported to a desired location or even tapped directly to fuel a solar-thermal steam rocket.

Mining key to colonization- water

Asteroids may hold frozen water and organic compounds on their surface—theory and Themis asteroid prove

Atkinsin 09 (Nancy, senior writor for Universe Today, Universe Today, *More Water “Out There”: Ice Found on Asteroid*, October 8. 2009, <http://www.universetoday.com/42319/more-water-out-there-ice-found-on-asteroid/>, AG)

For the first time, astronomers have confirmed that an asteroid contains frozen water on its surface. Analysis of asteroid 24 Themis shows evidence of water ice along with organic compounds widespread across the surface. The scientists say these new findings support the theory that asteroids brought both water and organic compounds to the early Earth, helping lay the foundation for life on the planet. Humberto Campins of the University of Central Florida in Orlando and colleagues recorded spectra of 24 Themis over a seven-hour period, and were able to study 84 percent of the rotational period of the spinning rock, Rob Cowen reported in Science News. Using NASA’s Infrared Telescope Facility on Hawaii’s Mauna Kea, the spectra revealed the consistent presence of frozen water as different parts of the asteroid’s surface came into view. Analyses of the sunlight reflected off the asteroid also show that organic compounds are widespread on the surface, he added, including polycyclic aromatic hydrocarbons, CH2 and CH3. The new finding corroborates earlier observations of the same asteroid by astronomers Andrew S. Rivkin and Joshua Emery who also used the Infrared Telescope Facility. Over several years, Rivkin and Emery had found evidence of frozen water in single spots on 24 Themis but had not studied the asteroid as it made one entire rotation. Together, the two teams’ findings reveal that the asteroid’s entire surface is coated with frozen water, Campins says. The 160-kilometer wide asteroid averages a distance from the sun of about 3.2 times that of Earth’s. At that range, frozen water on the surface would readily vaporize, Campins said. That means the ice must be continually replenished, possibly by a reservoir of frozen water within the rock. One possibility is that ice lies buried several meters below the surface of 24 Themis, and when hit by space debris, the ice makes its way to the surface. If this is the case, it could confirm that some asteroids resemble comets, becoming active suddenly and venting material into space when pockets of ice vaporize, Campins said. Another option is that an action similar to the recent findings of water on the Moon, where solar wind interacts with a rocky body without an atmosphere to create H2O and OH molecules. Without an atmosphere, the body is exposed to solar wind, which includes hydrogen ions. The hydrogen is able to interact with oxygen in surface of the asteroid to create water molecules. Campins shared his findings at the annual meeting of the American Astronomical Society’s Division for Planetary Sciences.

Asteroid Mining key to a more effective transportation through space.

Rather et. al 10. (Dr. John Rather. President of RCIG, inc. “New Technologies and Strategies to Exploit Near Earth

Asteroids for Breakthrough Space Development” 1-28-08. <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=0b838150-5bc6-4b13-8c3f-1ea4ad483fc3%40sessionmgr11&vid=1&hid=10>. TQ.

 Even one captured ten-meter diameter dust and rock “rubble Pile” asteroid can enable a vast improvement in human safety for travel from low Earth orbit to the vicinity of the moon or beyond. Robotic devices can burrow into the asteroid and reform its material into useful configurations. Ample material, amounting to more than 800 metric tonnes per trapped asteroid, will be available for radiation shielding to enable regular travel through the Van Allen belts. About 1 kg per square centimeter of shielding material surrounding interior habitats for human passengers will provide protection as effective as the atmosphere at the Earth’s surface and will therefore eliminate hazards to humans from solar flares and energetic cosmic particles. Transformed asteroids also can be steered into convenient elliptical orbits that make use of their considerable inertia to transport “hitch-hiking” passengers and cargo up from low Earth orbit at very low cost. Basically, the natural gift of large orbital momentum can be utilized without launching it from the Earth. There will be no threat to the Earth from such methods because the objects remain small enough that they would be disrupted in the atmosphere before reaching the surface if they should accidentally be perturbed into impact trajectories. Routine momentum exchange with hitch-hiking orbital transfer payloads may require a low thrust solar-plasma engine attached to the asteroid for continuous station keeping, but this is a minor detail. Ultimately, asteroids that osculate the orbits of Earth and Mars (or the asteroid Main Belt) can be similarly modified to provide safe and comfortable human transport for long duration trips.

Mining key to colonization- water

**Space colonies require water, which only asteroids contain - means plan is a prerequisite to space colonization. Also, the valuable rare minerals found in asteroids will pump billions of dollars into federal coffers.**

**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)

Even without a manned mission to do a full-scale study of an asteroid, scientists know a lot about what asteroids contain. Astronomers use telescopic spectroscopy, which analyzes light reflected from the asteroid's surface, to find out what might be there. In addition to iron, nickel and magnesium, scientists think water, oxygen, gold and platinum also exist on some asteroids. Water interests space explorers most because it could help keep a space colony alive. Without water, there is really no way to move forward with human exploration of space. Water could also be broken down into hydrogen and oxygen to form rocket engine propellant. The metal ore on the asteroids could be mined and used for building spacecraft and other structures for a space colony. Corporations that might not be interested in exploring space for the adventure and science could be interested in the treasures that a space mining operation could send back to Earth. One NASA report estimates that the mineral wealth of the asteroids in the asteroid belt might exceed $100 billion for each of the six billion people on Earth. John S. Lewis, author of the space-mining book Mining the Sky, has said that an asteroid with a diameter of one kilometer would have a mass of about two billion tons. There are perhaps one million asteroids of this size in the solar system. One of these asteroids, according to Lewis, would contain 30 million tons of nickel, 1.5 million tons of metal cobalt and 7,500 tons of platinum. The platinum alone would have a value of more than $150 billion!

**Coloni**zation- AT: Mars and moon solve

**Mars and Moon are impossible for human survival**

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

Mars is not the ultimate goal. Offering only one-third Earth’s gravity, Mars may never be healthy for Earth-evolved, cellular life. We need gravity.5 The delicate molecular and computational apparatus within every watery cell of DNA life6 may require gravitational conditions rather close to what they have been for 4 billon years: 980 Galileos (}0.3%). Humans may hope to visit Mars, but making it an “ultimate goal” is just not rational. The Moon, offering only one-sixth Earth’s gravity, is even less hospitable.

**Colonization- Asteroids best**

**Asteroid mining and asteroid habitats are most suitable.**

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**Space power advantage**

**Space Power- UQ**

UQ- US space power declining

Obama’s plan on skipping the Moon mission will substantially decrease the US’ technological superiority, giving way for countries like China and Russia.

Quek 10 (Tracy Quek, US correspondent, The Straits Times, *Skipping the moon: One giant leap back for the US?; Critics say scrapping lunar mission hurts US, but others plan to go deeper in space*, May 3, 2010, <http://www.lexisnexis.com/hottopics/lnacademic/>, AG)

IN 1966, as the United States-Soviet Union space race raged, a new science-fiction TV series fired up the public's imagination about space exploration. Star Trek's signature tagline - 'to boldly go where no man has gone before' - proved to be prophetic. Three years later, on July 20, 1969, American astronauts stood on the Moon. In the four decades since, the US remains the only nation to have sent humans to the Earth's satellite. But now, President Barack Obama's plan to overhaul some aspects of the US space programme is raising questions about whether the US has still got what it takes to lead in space, or if the country will be grounded by terrestrial concerns. The most controversial part of the strategy is to scrap a programme initiated under the Bush administration to return US astronauts to the Moon by 2020. The National Aeronautics and Space Administration should instead focus on the development of new space technologies in preparation for future deep space missions, he said on April 15. envisioned an asteroid visit by 2025, a mission to orbit Mars by 2035, and eventually a manned landing on the red planet - a feat he said he expected to see in his lifetime. Critics have attacked his proposal - which has not yet been approved by Congress - saying he is effectively grounding the US human space-flight programme and ceding hard-won ground to countries like China and Russia. The President's lofty goals will unfold over such a long timeframe - long after he leaves office - that there are no guarantees there will be the funding or political will to ensure it really happens, they say. 'The administration has said that it needs to cut back, and everything is on the table because the deficit is too high. So is the man-on-Mars project on the table? If the answer is 'no' then you should say that, if the answer is 'yes' then I have to ask, what is your level of commitment?' said Mr Dean Cheng, an analyst at The Heritage Foundation, a think-tank. Others also took issue with Mr Obama's Enhanced Coverage Linking Obama's - 'been there, done that' attitude towards the Moon. 'It's kind of like Christopher Columbus coming back from the New World and reporting to the King and Queen of Spain, and Spain deciding that we've already done that, let's move on to something else,' Mr Mark Whittington, a Houston-based writer and space policy analyst, told The Straits Times. The US Apollo space programme between 1961 and 1975 landed 12 astronauts on sites around the lunar equator, but 'there is still a lot of Moon to explore and work to see how we can use the Moon for the benefit of our own planet', he added. plan argue that there is more practical value in shooting for a near-Earth asteroid. Asteroids pose a real threat to the Earth and studying one could help scientists figure out how to avert a devastating collision. However, some fear bypassing the Moon would mean relinquishing a powerful symbol of US technological superiority, dealing a blow to its superpower status. China, Russia, India and Japan all have, or are committed to building, strong space programmes that include lunar missions. China is the leading contender to become the second country to send a man to the Moon and could do so by 2020. If China lands on the Moon before the US has the chance to go back 'even if it is by choice, this raises questions about where US science and technology stand in relation to China', said Mr Cheng. 'Coming on the heels of things like the financial bubble, it really raises questions about American credibility.' Things will get even more complicated if the US is not active in space at the same time China is making leaps in space exploration. Said Dr Scott Pace, director of George Washington University's Space Policy Institute: 'If the Chinese are part of a partnership with us, that's fine. But if the Chinese are going off by themselves separate from us and we're not also out there, then I think it is a problem.' Experts say they do not expect a similar US-Soviet contest over ideology between Washington and Beijing. The competition will instead be on the business and industrial fronts. Space-related technologies, such as satellites for navigation and communication, are essential to each country's key industries, including banking, media, shipping and airlines. Ironically, the Moon may be the best bet for broad international cooperation. Said Dr Pace: 'The Moon is within reach of many more countries today, so it is the easiest, most practical way to have international cooperation. Focusing on Mars and

(continued on next page)

UQ- US space power declining

(cont. Quek 10)

asteroids, we may be accidentally picking targets that are too hard for our partners.' How the US-China space collaboration pans out depends on how the two countries get along back on Earth. But to doubt US leadership in space for a long time to come is 'a little silly', said Professor John Logsdon, former director of George Washington University's Space Policy Institute. 'The US has been to the Moon and so if China reaches the Moon when we're going to other more difficult, more distant destinations, good for China. They are doing what the US did 40 years ago, so what does that prove?' he said. 'Going deeper and deeper into space with the potential of sending people to Mars - that is clearly a leadership programme.'

**Space Power- Links**

Space leadership key to hege

Empirically proven – Advancement in Space is key to hegemony.

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. )

The Cold War, which gripped the country in terrible fear, is over. In 1957, one month after Sputnik, Air Force Chief of Staff Thomas Dresser White declared that “for the first time since 1814, the U.S. homeland was in mortal danger.” 1 This fear persuaded the president, congress, and the nation to pay a terrific price for a victory in space. When Kennedy set the nation on a course to the moon, the United States had suffered a series of space defeats: The U.S. was not the first to orbit a satellite, was not the first to orbit an animal, was not the first to orbit a human, and was not the first to send probes by and to the moon. The nation was clearly behind, 2 felt threatened, 3 and believed that winning a race to the moon was worth a very high price. By taking the lead in this symbolic contest 4 for “prestige,” 5 the U.S. showed the world, and its people, that it could apply scientific knowledge, manage complex technology, and coordinate large engineering teams to solve problems of unprecedented scope. But Cold War rivals are now actively working to reduce nuclear arsenals. 6 The nation’s concerns have shifted from mutually assured destruction to problems that are far more complex and intertwined: achieving stable economic growth along with environmental sustainability. So what are we doing in space today? What will attract new generations? How about securing access to new sources of essential minerals and renewable energy?

Asteroid mining is key to space power

Asteroid mining falls under the definition of Space power

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>

 Social scientists and philosophers have struggled over the years to define the term power.1 Many books have been written and intellectual rigor applied to defining this familiar concept.2 Theorists have proposed different power types, resources, and relationships.3 For the purpose of defining space power, power is the ability of a state or non-state actor to achieve its goals and objectives in the presence of other actors on the world stage.4 Defining the term space may be as difficult as defining the term power.5 In fact, it appears there have been various incentives over the years to intentionally avoid defining the term space and, thus, where this unique environment begins.6 The definition of space, or even the acknowledgment of the existence of space as a separate environment, depends very much on who’s defining it and why.7 For the purpose of defining **space power, space is the area above the Earth’s atmosphere and extending out infinitely in all directions, beginning approximately 62 miles above the Earth’s surface**.8 Having defined the terms power and space, space power may now be defined. **Space power is the ability of a state or non-state actor to achieve its goals and objectives in the presence of other actors on the world stage through control and exploitation of the space environment.9 One may think of space power as an element of an international actor’s power**. It is similar to air, land, and sea power in this respect.10 However, it is essential to realize the term covers more than simply military power. As others have noted with respect to air power, sea power, and space power, an actor’s entire capabilities with regard to the operating environment contribute to its power there.11

**US has space dominance now, but china and India are catching up. Increased ability to exploit space through asteroid mining would give us a leg up on the competition Roy 2010** (Sourav, researcher, Al Jazeera Center for Studies, “Mission Absolute: American Hegemony in Space,” *Al Jazeera Network*, February, NB

<http://www.aljazeera.net/mritems/streams/2010/2/11/1_971142_1_51.pdf>)

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

**Space Power- Impacts**

Space power- laundry list impacts

US space power key to Laundry list of impacts

by John B. Sheldon Tuesday, September 4, 2007 John B. Sheldon, Ph.D., is a visiting professor at the School of Advanced Air and Space Studies, Air University, Maxwell AFB, Alabama. The views expressed here are his own, and do not represent the views of SAASS, Air University, the Department of the Air Force, or the Department of Defense Selling “Selling US space power short” US space power short http://www.thespacereview.com/article/948/1

**Something has gone wrong in articulating the mission of US space power**. As someone who teaches and advocates space power for a living, it is frustrating to see and hear the national security space community consistently selling itself short to the wider national security and policy community and the American public. All too often we are told that after investing billions upon billions of dollars from the American taxpayer, along with the decades-long dedication of America’s brightest and best scientists and engineers, and the far-reaching strategic vision of US military commanders that has transformed the Western way of war, space power enables us to “pump our gas” and lets us “withdraw cash from the ATM.” This message is underwhelming at best. It does no justice to the hard work and dedication of our space warriors, much less the capabilities fielded, which ensure that space power is there when it is needed across the globe around the clock. Just as importantly, the national security space community has done little to promote its vast achievements and its unprecedented influence in world affairs**. Some of this can be put down to both the highly classified and highly technical aspects of the mission, but even this cannot explain the lack of a simple, concise, strategic message articulating the value of US space power**. Instead of mentioning pumping gas and withdrawing money from ATMs, the national security space community should raise its sights higher to sell its space power message. Offered here are a few suggestions with which to rethink the message the national security space community should be promulgating to the American public, and the wider defense and policy community, based on three critical elements of US national power: economics, diplomacy, and the military**. Economics. Space power does more than pump gas or make sure that our courier packages get to where we need them on time. Space power ensures that the globalized economy in which we all live and work functions when we need it. It is this fast-moving globalized world, enabled by space power, that is motivating many countries around the world to purchase, and even build, their own satellites so that they can plug in to it.** **Space power ensures the efficient and safe functioning of most of the world’s major transportation networks in the air, at sea, and on the land. Space power enables the instantaneous and cheap global communication that we all take for granted, and is instrumental in the free flow of ideas and capital across the world.** Central to space power’s role in our globalized economy is the Global Positioning System (GPS), operated by Air Force Space Command (AFSPC). GPS provides positioning, navigation, and timing data, and all three of these have become indispensable for a wide variety of commercial and civil applications, ranging from just-in-time logistics, international air and maritime traffic control, and the functioning of cellular telephone networks, to name but just a few. It should also be remembered that a globalized world economy enabled by US space power is not always peaceful. Order must be maintained, and, in the eventuality that disorder should move to Earth orbit, it will be the responsibility of the US national security space community to restore order and protect space systems through developing space situational awareness and defensive and offensive counterspace capabilities against the kinds of threats evidenced by China’s anti-satellite test in January this year**. Diplomatic. The role of the US national security space community and its space systems in America’s diplomacy is both immense and intricate. US space systems are the eyes and ears of our decision makers in Washington, DC, and our military commanders around the world. AFSPC-operated systems such as the Defense Support Program (DSP) ballistic missile early warning satellites, and its follow-on, the Space-Based Infra-Red System (SBIRS) satellites, are our frontline defense against the growing ballistic missile threat.** Not only are they critical to US homeland security, they also magnify and enhance US diplomacy by providing reassurance to our allies around the world. AFSPC’s GPS satellites are the world standard for positioning, navigation, and timing, and are used and relied upon by all developed countries around the world. What is more, this global service is provided by the US to the world for free. Even competitors of GPS, such as the proposed European Galileo satellite navigation system, are based on

(continued on next page)

Space power- laundry list impacts

(Sheldon 2007 continued)

technical standards established by GPS. Furthermore, the US national security space community allows our decision makers to monitor events around the world, and shape them, while at the same time allowing the US to keep a very low profile in sensitive situations. US national security space enables the United States to be the truly global power it is today, and enables us to wield our other instruments of national power with greater precision, timeliness, and effectiveness. Military. Space power allows the United States and its allies to wage war appropriate to our political and ethical values. Space power is more than just enabling 24-hour, all-weather precision strike through GPS and actionable target intelligence from space-based reconnaissance; it’s about enabling our use of military force in accordance with our declared political and ethical values. It is about doing everything possible to ensure that innocent civilians are not killed, it is about our belief that the deliberate targeting of civilians is abhorrent to us, and that we will go beyond the last technological mile to ensure that their safety is a primary consideration, no matter how our enemies provoke us to do otherwise. Space power is also about ensuring that our soldiers, marines, airmen, and sailors are protected as much as possible from unnecessary danger, again thanks to GPS, allowing them all to do their already dangerous work without having to worry about friendly fire and being able to communicate instantaneously with headquarters and supporting forces, thanks to AFSPC military satellite communications. Space power is about protecting innocent civilians where possible, and allowing our forces to do their job. Yet our commitment to humanitarian values in the crucible of war, and now realized, albeit imperfectly, thanks to space power, should not blind us to the fact that space power is also about planning, coordinating, and delivering overwhelming firepower and dominant maneuver in the conventional battlespace, and about providing critical intelligence and command and control in the irregular battle. Space power keeps our footprint small and light, while allowing us to be agile and flexible, and making our air, land, and sea power more effective and lethal. Lastly, space power is about opening up more strategic and operational options for our civilian leadership and military commanders; it provides us with a decisive qualitative and quantitative edge over our adversaries. Never mind pumping gas, US national security space plays a critical role in the running of the globalized economy—an economy led and championed by the United States; in promoting and enabling American diplomatic power; and provides the basis for American military might today. This stuff should be selling itself, but it seems that the public and the wider policy community are not hearing it. The US national security space community is filled with many of our brightest officers, including some notable strategic thinkers. Given this, why does the national security space community sell itself short in the public domain when it is providing such a critically important capability to America and the world?

Economy- Adv

**Mining key to economy and environment**

**Asteroid mining is key to sustainable space development and global economic and environmental security**

**Crandall in 2008(William, MBA at California Polytechnic Institute and President of AbundantPlanet.org, “**Enabling Profitable Asteroid Mining” (A letter from William Crandall to Obama’s National Security Advisor General James L. Jones), August 7th 2008, NB

[http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf))

 “A 21st Century space policy ... and accompanying vision, must redress the unbalanced emphasis in our civil space program from a narrow focus on science and exploration toward an appreciation and enablement of development, exploitation, and expansion of humanity’s sphere of economic activity.” —Lt. Col. Peter Garretson (2009) “Asteroids are a combination of long-term resource, potential threat, and great scientific interest. [This] sells a heck of a lot better to the general public than going back to the moon.” —Rusty Schweickart, Apollo Astronaut (2009) Dear General Jones, President Obama’s government-wide review of space policy sets the context for an unprecedented reframing of the space value proposition. In our letter to the Augustine Committee (enclosed, and: http://abundantplanet.org/letters), we argue that: 1. Our national civil space agency must be able to show how its efforts benefit the public; 2. The clearest way to show real benefits is the economic development of space resources; and that 3. The key to genuinely sustainable space development is establishing commercial profitability. Our national civil space agency should be directed to help secure new sources of critical minerals and renewable energy, which are available in space. By developing near-Earth resources—asteroid minerals and solar power— we can increase American, and global, economic and environmental security, while simultaneously “pursuing the best trajectory for the future of human space flight—one that is safe, innovative, affordable, and [economically] sustainable” (the goal of the Augustine Committee).

Space mining solves space tourism/exploration

Mining is a prerequisite to space tourism and exploration.

Crandell et. al , 11 (William C. Crandell. MBA, Founder of Space Wealth, “Is Profitable Asteroid Mining: A Pragmatic Goal?,” Space Wealth, 23 February 2011. [http://www.spacewealth.org/files/Is-P@M-Pragmatic-2010-08-23.pdf](http://www.spacewealth.org/files/Is-P%40M-Pragmatic-2010-08-23.pdf). TQ)

NASA, a creation of the Cold War, demonstrated U.S. capacity to put boots on the Moon.In doing so, it fulfilled its mission (as a “non-military” branch) to help “beat the Soviets.”Today we need NASA—the largest civil space agency—in cooperation with industry and other space agencies, to demonstrate the capacity to put autocatalytic extraterrestrial resource development into action, to achieve a more rewarding economic success and to help “contribute solutions to [humanity’s] most pressing problems.”93In 1961, it was risky for JFK to commit to putting a man on the moon. Today, with the advancing power of computational systems of all kinds, it may be less risky to commit to making deep space profitable. Young people are ready for highly capable robots.94 They may be willing to pay the startup costs for profitable robotic asteroid mining—if they can see that it offers real promise for their future. “Humans will venture out into the solar system,” as Charles Bolden suggests .But anything less than an autocatalytic off-planet economy will keep us from ever becoming more than just tourists. The “game-changing” technologies that will “unlock new possibilities”95 are those that transform space from a consumer of resources into a source of value. We should go to space, first and foremost, to get the resources we need for ecologically sustainable development on Earth, where we all live. Such an effort can, simultaneously, build an economically sustainable infrastructure for thriving extraterrestrial civilizations

**Mining boosts econ- new industries/space economy**

**Space mining solves economy: creates entirely new industry**

Ross in 2001 **(**Shane D. Assistant Professor [Engineering Science and Mechanics](http://www.esm.vt.edu/) at [Virginia Tech](http://www.vt.edu/). Space Industry Report *Near-Earth Asteroid Mining* December 14, 2001. Google Scholar. TS)

Kargel [1997] estimated that one metallic asteroid of modest size (1 km) and fair enrichment in platinumgroup metals would contain twice the tonnage of PGMs already harvested on Earth combined with economically viable PGM resources still in the ground. At recent prices, this asteroid’s iron, nickel, PGMs, and other metals would have a value exceeding that of the world’s proven economic reserves of nonmetallic and metallic mineral resources. The availability of asteroid metals would lower market prices. Even then, the value of the asteroid-derived materials would be enormous. The mining scenario Kargel considered is one involving coproduction of precious metals (for Earth markets) and semiconductors marketed to a future space photovoltaics industry (e.g., for production of solar power cells). He assumed the asteroid mined to be a 1 km metallic asteroid in the 90th percentile of iridium richness, because this type is rich in semiconductors. As it turns out, the semiconductors are where most of the money is if there is a large-scale space solar power industry (see Table 2). The precious metals would be sold in Earth markets, and would be insensitive to launch costs. However, Kargel assumed that asteroidal semiconductors placed into LEO would acquire a value p, approximated by p = p! + Corbit, where p! is the cost of these materials purchased from terrestrial sources, and Corbit is the launch cost to LEO per kg. There, they would be made into photovoltaics, as it is advantageuous to do the manufacturing in space rather than launch prefabricated modules from Earth (owing to launch cost considerations). Currently, Corbit "$20,000/kg on most systems. Kargel assumed that efficient high-volume launch systems would be developed in the near future, lowering the launch cost to $3,000/kg, i.e., a reduction that would seem sufficient to make commercial space solar power economical.

**Mining boosts econ- new industries/space economy**

**NEOs provide key resources that are in short supply on earth and on the moon which help us get into space**

**Valentine 07** (Lee S. Executive Vice president Space Studies Institute, AIP Conference Proceedings, Critical Trajectories for the Human settlement of the High Froniter, Feburary 7 2007, Academic Search Complete, NC)

 It appears obvious that nonterrestrial materials are key to opening the space frontier.(10) The minimum cheap rocket transportation cost to low Earth orbit is an order of magnitude greater than the price of even the most expensive raw materials in common use. The Moon's resource potential has not been fully explored, but, for the purposes of this conference we should also think about the NEOs. In terms of delta V, some are the easiest bodies to reach in the solar system. These bodies taken together contain the full range of elements and are, in some cases, highly differentiated. (11) From the examination of meteorites, we have some working knowledge of their compositions. Many have higher concentrations of platinum group metals than the best terrestrial ores. Many contain volatiles that are in short supply on the Moon. There are at least 20 spectral types and close rendezvous missions to a representative of each type should be undertaken to assay their chemical and physical properties. Physicochemical characterization of NEOs will allow development of asteroid mining techniques. The ability to mine NEOs is also implies the ability to deflect them. The optimum method could be a gravity tractor (12) with most of the mass of the tractor to be obtained from the asteroid itself. Using mass drivers for propulsion instead of ion engines would allow orders of magnitude greater acceleration as well as much lower total electrical energy requirement. Whether a private enterprise could afford the insurance to swing one around the Moon or persuade the U.N. that it would be safe to return anything over 30 meters, is hard to say. The new PanSTARRS telescope array in Hawaii, of which the prototype saw first light in June, 2006 will increase the detection rate of NEOs. Most will be main belt asteroids but tens of thousands will be Earth crossers. Eventually, one will be found on an Earth impact trajectory. We need economical trajectories to and from these bodies. The trajectories must not only the economical in terms of delta V, but also eventually in dollars. NASA and the OMB do not generally consider the time value of money. If we are successful in our quest to expand the ecological range of the human race, the time value of money will be an additional factor in calculating trajectories.

**Space commerce key to hege**

**Space commerce leadership key to US hegemony**

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 foundational concept relates to the significance of space commerce. Along with many others, I believe that leadership in space commerce will be a critically important goal for America to achieve. There are two major reasons why. First, the sheer magnitude of the commercial opportunity is so enormous that leadership in space commerce will inevitably mean some significant degree of leadership in Earth commerce. And second, the technical capacity to engage in space commerce will enable leadership in technologies that will likewise be critical to the success of any nation. To put it bluntly, to forego leadership in space commerce is to forego leadership among nations.

AT: Mine moon CP

**AT: Mine moon CP- asteroid mission saves resources**

Experts agree sending people to asteroids saves resources

By [**Charlie White**](http://dvice.com/archives/author/charlie_white) Oct 23, 2009 Hey NASA: Skip the moon, send humans to asteroids, Mars moons [**http://dvice.com/archives/2009/10/hey-nasa-skip-t.php**](http://dvice.com/archives/2009/10/hey-nasa-skip-t.php) SH”

 As NASA readies [**the Ares 1-X test rocket**](http://dvice.com/archives/2009/08/ares-i-x-space.php), **a commission of experts appointed by the president says hold everything. NASA should forget about going to the moon for now, and land humans on a nearby asteroid or comet, or one of the two moons of Mars, says the Augustine panel. The reason? It will take a whole lot less fuel to get humans back from such low-gravity destinations.** It makes sense. The moon? Been there, done that. Let's get some big honking rockets, maybe even bigger than the Saturn V, and head out into deep space. Meanwhile, the Augustine panel recommends extending the life of the shuttle for another year — until 2011 instead of putting it in mothballs on October 1, 2010 — and keeping the International Space Station aloft until 2020 instead of crashing it into the ocean in 2015. Too bad this commission didn't exist when George W. Bush decided back in 2003 that our goal was to set up a base on the moon, and then head to Mars. **Among the eight options presented by the commission, a moon landing would only be a training mission, a stepping stone to destinations beyond. A Mars mission would only happen in the distant future. These new plans could work. Well, until another politician decides to change them.**

AT: Mine moon CP- asteroids have more resources

**Asteroids have more water and volatile materials on the moon**

**Pine** **in 1991**(Devera, Senior editor @ NCME [National Council on Measurement in Education] and Medical Editor @ Landmark and Senior Editor @ OMNI magazine, “101 Uses for An Asteroid: An Untapped Mother Lode Floats aimlessly in space”, published in Omni vol. 13 issue 12, September 1991 accessed through ebsco, NB

<http://web.ebscohost.com/ehost/detail?vid=4&hid=14&sid=61b6e4da-334c-44aa-93e8-f046e05d8e51%40sessionmgr13&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=9109232595>)

 Even though scientists don't know precisely what asteroids are made of, they have a pretty good idea o f the main components. For example, they consider asteroids to be as much as one-fifth water, a desirable commodity because it can be separated into liquid hydrogen and liquid oxygen to provide rocket fuel. Having, in effect, an off-planet filling station allows future spacecraft to be lighter and faster because they don't have to carry fuel for the entire trip. NearEarth asteroids contain 200 times as much water and other volatile materials-compounds of hydrogen, carbon, nitrogen, and oxygen-as the moon, another suggested mining site, according to John Lewis, professor of planetary science at the Lunar and Planetary Laboratory at the University of Arizona and director of science programs at the University of Arizona/ NASA Space Engineering Research Center. Water also provides one of the most effective shields against radiation, so the high water content of near- Earth asteroid dirt makes it an ideal radiation shield for the space station. Lewis envisions sending a one-ton spacecraft, specially designed to mine an asteroid, to bring back 50 or even 100 tons of material.

AT: Mine moon CP- asteroids better- more resources

Compared to the moon, asteroids have tremendously more concentrations of metals and water.

Ross 01 (Shane D., assistant professor at Virginia Tech in the Department of Engineering Science and Mechanics, Space Industry Report, *Near-Earth Asteroid Mining,* December 14, 2001, http://www.nss.org/settlement/asteroids/NearEarthAsteroidMining%28Ross2001%29.pdf, AG)

Many assume the Moon to be the obvious source of resources in space, but it is instructive to compare the richness of the resources available in meteorites (and by inference in the NEA population) with that of the Moon. Typical free metal concentrations in stony meteorites are about 20%, compared to a few hundred ppm in the lunar regolith. Iron meteorites, or metallic M-type asteroids, are even more metal-rich; about 99% 6This estimate is based on solar wind deposition of hydrogen (see text) 9 metal. C-type asteroids and carbonaceous meteorites typically have 5% to 20% water. The lunar surface, by contrast, has no native water. Solar wind implantation of hydrogen on the lunar surface offers up to about 50 ppm hydrogen, which, if fully released and fully converted into water, would optimistically give the lunar surface about 0.045% water. Overall, the lunar surface is volatile-poor and metal-poor, similar in composition to the slag discarded in metallurgical processing on Earth

Asteroid resources are better than lunar- both in accessibility and economically

JOHN S. LEWIS and MELINDA L. HUTSON, No Date, Professor Emeritus, Cosmochemistry & planetary atmospheres University of Arizona, Research Assistant Professor/adjunct faculty at Portland State University, ASTEROIDAL RESOURCE OPPORTUNITIES SUGGESTED BY METEORITE DATA, http://www.uapress.arizona.edu/onlinebks/ResourcesNearEarthSpace/resources20.pdf, ES

The near-Earth asteroids (NEAS) are best known as sources of meteorites. They also represent threats to Earth as giant impactors that can disrupt the biosphere catastrophically, as is believed to have happened at the end of the Cretaceous era. But in the long term, there is little doubt that the vast resource potential of the near-Earth asteroids will be of far greater interest. Interestingly (and fortunately), the near-Earth asteroids are compositionally diverse fragments exiled from the main asteroid belt by gravitational perturbations. They sample the belt widely, with km-sized chunks of natural stainless steel, the cores (possibly ice-rich) of extinct comets, primitive unmelted planetary materials, and differentiated rocks similar to lunar basalts all present in glorious profusion. The panoply of materials is vastly broader and richer than those known to be present on the Moon. At least one fifth of the near-Earth asteroids are volatile-rich, with abundances of hydrogen, carbon, nitrogen, etc. over 100 times as high as in the most volatile-rich lunar materials. Almost all the others are metal-rich, again with over 100 times the free metal content of lunar material. Also, about one fifth are energetically more accessible than the surface of the Moon. The main drawback is that the trip times to visit these nearby asteroids and return are about 1 to 3 yr, similar to Mars missions, compared to a one-week round trip to the Moon. Fortunately, schemes are already known by which spacecraft dispatched on round-trip missions to the best of these asteroids could return over 100 times their own mass of asteroidal resources to near-Earth space.

AT: Privatization

AT: privatization CP- perm solvency

Perm: Do both. The perm solves best because it allows the private sector to piggyback off of government effort, offsetting the initial costs and maximizing profit potential

Richard Gertsch\*\* and Leslie Gertsch†, 2000, Rock Mechanics and Explosive Research Center, University of Missouri - Rolla, Rolla, MO 65401, Mining Engineering Dept. and Center for Space Mining, Colorado School of Mines, Golden, CO 80401, ECONOMIC ANALYSIS TOOLS FOR MINERAL PROJECTS IN SPACE, http://www.kemcom.net/EconAnal.pdf , ES

While commercial ventures must make a profit (and sometimes substantial ones, as we shall see), governments and their agencies may not. However, even governments usually attempt to maximize the cost-benefit ratio (or cost-sales, if you will). A classic mineral example of profit being less than or equal to zero occurred during the brutal mineral economic climate in the middle 1980’s. During this period, certain South American countries mined copper at moderate loss. Their purpose was two-fold: first, it maintained an influx of hard-currency dollars from sales. Second, it allowed the mines (many state-owned) to remain open, and to be ready when better times returned. Recognizing that initial space ventures may have some degree of government involvement, profit may not be the apparent initial motive for the venture. Allowing a commercial operation to piggyback a government operation can accomplish two things: bootstrap further space operations, and offset some of the costs incurred by the government. Both are desirable outcomes. However, the process of selecting the participating companies may have unforeseen political and economic consequences. Government can also appeal to the profit motive with devices similar to the Air Mail Act of early this century, where it bids goods and services for fixed (perhaps even subsidized) prices, and lets private companies make whatever profit they can. Similar to the old Airmail Act, this has been proposed as a mechanism to deliver oxygen to cislunar space (Davis, 1983).

AT: privatization CP- perm solvency

NASA needs to work with private corporations to solve for space commerce

Lamassoure 03 (Elisabeth S. Director @ Center for Commercial Applications of Combustion in Space (CCACS) Space Technologies and Applications International Forum *Evaluation of Private Sector Roles in Space Resource Development* 2-Feb-2003) TS

A number of studies have shown the great potential space resource utilization holds for space exploration. For example, Duke (1998) analyzed possible lunar ice extraction techniques. A study by NIAC (Rice, 2000) showed how using this ice to produce H2/02 propellants would reduce the Earth launch mass (ELM) for a reference lunar outpost mission by up to 68%. Based on similar outpost assumptions, Nelson (2001) calculated how much a private venture must charge to transfer cargo and astronauts to the Moon. Borowski (1997) studied the lunar transportation improvements that nuclear thermal propulsion could provide. Considering low Earth launch costs, Stancati (1 999) showed that using lunar-based LOX and LH2, and nuclear thermal propulsion, ELM for space exploration could be improved by up to 5 1 %, but cost improvements would be negligible. These are only a few examples of the wealth of interesting engineering studies that characterize what we might call the “potential for space resources supply”. A few studies also characterized the “potential for space resources demand”. Outstanding examples include the commercial space transportation study (CSTS, 1994), which systematically quantified potential markets for future launch services; but also propellant demand studies such as Smitherman (2001), who quantified the demand for H2/02 propellants in low Earth orbit (LEO) for LEO-to-GEO (geostationary) Earth orbit transfer. Between these two bodies of research and analysis, there is a clear gap: among all the architectures proposed for space resources development, do any suggest (financially) viable private ventures? An integrated financial and engineering model based on a private investor perspective is the only way to bridge this gap, for three main reasons: First, an engineering-optimized architecture is not necessarily the most interesting to a private investor. For example, economies of scale could lead the engineer to build upfront the capacity to meet optimistic demand growth; while the private investor might prefer a scalable architecture, building capacity only as demand increases. Second, the metrics that interest private sector investors differ are not always the same ones that public sector engineers use for economic analyses. A ‘business case analysis’ is required to translate the engineering costs estimates into the metrics of interest to private sector investors. Third, an informed and effective public policy and strategy for space exploration demands that architecture trades, and initiatives regarding the private sector assess a wide range of scenarios. A single business case yields an outcome that depends on specific assumptions. For NASA to effectively incorporate the private sector into its longterm plans, it should explore a wide range of potential space ventures, the conditions under which they would flourish, the steps that NASA can take to encourage them, and the public benefitdcosts of those steps. To make these numerous case studies fast, accurate and comparable, a common analytic framework is needed.

AT: privatization CP- can’t solve/no markets

Privatization can’t mine asteroids yet, the commercialization of space mining will grow over time and markets are government dependent

Richard Gertsch\*\* and Leslie Gertsch†, 2000, Rock Mechanics and Explosive Research Center, University of Missouri - Rolla, Rolla, MO 65401, Mining Engineering Dept. and Center for Space Mining, Colorado School of Mines, Golden, CO 80401, ECONOMIC ANALYSIS TOOLS FOR MINERAL PROJECTS IN SPACE, http://www.kemcom.net/EconAnal.pdf , ES

Sales are generated by two complementary occurrences: 1) the existence of a product, and 2) a market for the product. Markets are based on need; there is no market if no one wants to buy the product. Therefore the product must be salable, not just producible. Sometimes “marketeers” forget that they must produce something before they can sell it. General Motors is a well-known poster-child for this problem. During the seventies and eighties, critics charged that GM forgot they had to make not just cars, but quality cars, before they had something to sell. In space, the problem is perhaps the opposite. Many products already have been identified, but the markets are either non-existent or government-dependent. Habitats, metals, concrete, water, air, He-3, etc., have no real demand yet except as government-sponsored activities. It becomes very difficult to calculate the true value of a product in this environment. Equation (1) becomes meaningless, and many would-be space entrepreneurs must justify their project by simply pointing out that they may be able to supply a low-demand government mission cheaper than the government can. The basic problem is that we all believe in the promise of space, but economically there is no clear path to what we can do tomorrow. The nearest to a space-based commercial venture now is satellite communications. That market has developed over the past several decades, not in the leaps and bounds foretold by visionaries, but in fits and starts controlled by consumer perceptions and development of supporting technology. In hindsight, trying to leapfrog the erratic steps of this evolution could have been disastrous as a commercial venture. It will be just as difficult, if not more so, to forecast markets for space resources because their realization may be even farther away.

Private corporations can’t do the plan they will not make enough money

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)

In the 12-year period following a positive economic feasibility study, we must further characterize major asteroids with fly-by missions and space-based remote sensing. The **stakeholders should demonstrate spacecraft assembly in LEO by humans, robotic mining systems in a microgravity environment, and in-situpropellant generation** (Recommendation VII). **With these capabilities, sample return from large NEOs can occur to prove composition and demonstrate rendezvous techniques. In this period,** **the majority of funding must come from government and incentive based investments** (such as the X-Prize model**) as the initial ROI of commercial asteroid mining is too long for private sector investment.** Stakeholders must resolve appropriation issues in this period, prove the possibility of sterile delivery of materials to Earth and conduct public outreach.

AT: privatization CP- still expensive

Mining asteroids is expense no matter who’s mining

Richard Gertsch\*\* and Leslie Gertsch†, 2000, Rock Mechanics and Explosive Research Center, University of Missouri - Rolla, Rolla, MO 65401, Mining Engineering Dept. and Center for Space Mining, Colorado School of Mines, Golden, CO 80401, ECONOMIC ANALYSIS TOOLS FOR MINERAL PROJECTS IN SPACE, http://www.kemcom.net/EconAnal.pdf , ES

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 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. Time Value of Money. 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.

AT: privatization CP- government key- no markets

Government is superior because there is no current market in space

Charles L. Gerlach 2005 INTERNATIONAL SPACE DEVELOPMENT CONFERENCE, National Space Society, Washington, DC, May 19–22, 2005, Profitably Exploiting Near-Earth Object Resources, , Gerlach Space Systems LLC, CEO of Gerlach Space Systems LLC (GSS), former law professor, graduate of Harvard College and Harvard Law School.

While untested and fraught with engineering challenges, NEO mining has the potential to dramatically change the dynamics of many segments of the natural resources industry. It transforms the dynamics and economics of almost every aspect of resource production. Robotic mining of near-Earth objects has several potential advantages over traditional terrestrial mining. Based on what we have learned about asteroid geology and operating in micro-gravity environments, we can conceive of radically new approaches to mining on an asteroid that may ultimately become much more cost-effective than more traditional mining operations. These advantages and all of the other attractive features of NEOs as targets for mining operations would appear to justify the risk and investment required to take the first steps. 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.

**AT: privatization CP- government key to space economy**

Government space agencies are needed for the creation of a space economy using asteroid mining

Crandall et al 2011 (William BC, MBA founder of Space Wealth, “Is Profitable Asteroid Mining a Pragmatic Goal”, [http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf](http://spacewealth.org/files/Is-P%40M-Pragmatic-2011-02-23.pdf), 2/23/11, accessed 7/2/11)CNW

Economic resources in space are of three types: Location, energy, and matter. Some near-Earth locations already support profitable industrial engagements. Low-Earth and geosynchronous-Earth orbits host hundreds of revenue-generating satellites (worldwide industry revenues in 2008: >$140 billion).19 Beyond Earth’s atmosphere, solar radiation is abundant; it powers most satellites. Orbiting space-based solar power systems (SBSP) may be able to deliver huge quantities of clean, sustainable energy to Earth.20 But to date, nothing from the vast reaches beyond Earth orbit has ever been involved in an economic exchange. To incrementally expand our current off-planet economy, the next resource is clear: Near-Earth asteroids. To take this next step, we need our space agencies to make asteroid mining a priority, and demonstrate how it can done.

Agencies should support SBSP, but it should not be a top priority for two reasons. First, SBSP already attracts interest from commercial firms and defense-related institutions.21 Second, even if SBSP supplied 99% of the world’s electricity, we’re still just in Earth orbit. We haven’t begun to tap the mineral wealth of the inner solar system.

We need out space agencies to reach out—with robots, certainly; perhaps with humans— to find, get hold of, and bring back an economically significant chunk of matter, and sell it on the open market. We need them to prime the pump for economically and ecologically sustainable, post-Earth-as-a-closed-system, industrial societies.

Our space agencies need to enable a revolutionary transformation in the material culture of our home planet. They need to design and launch positive economic feedback systems that utilize off-planet resources. Space agencies need to develop the skills and knowledge required to draw material resources through extraterrestrial supply chains, and put them to use in terrestrial systems of production. Once learned, space agencies need to transfer these skills and understandings to individuals in industry. Civil space agencies also need to help design, publish, and promote the inner-solar-system knowledgebases also need to help design, publish, and promote the inner-solar-system knowledgebases that will prepare today’s students for profitable extraterrestrial careers.22

AT: privatization CP- no investors

**Private Space mining impossible: investors won’t buy into long ROIs**

Gertsch and Gertsch 05 (Richard and Leslie are research associate professor of mining engineering at Michigan Technological University and professor at Earth Mechanics Institute of the Colorado School of Mines Space Resources Roundtable *ECONOMIC ANALYSIS TOOLS FOR MINERAL PROJECTS IN SPACE* Sep. 21, 2005. Google Scholar) TS

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 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.

Solvency Deficit on Privatization – they won’t take the risk.

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.)

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AT: privatization CP- government key- colonization

The libertarians are wrong- history shows that government is a necessary part of colonization

Hickman 1999 (John, phD and associate professor of government and international relations @ Berry college, “The Political Economy of Very Large Space Projects”, <http://jetpress.org/volume4/space.htm>, JOURNAL OF EVOLUTION AND TECHNOLOGY, Volume 4, November 1999, accessed 6/29/11)CNW

The unspun truth about European colonization in the Americas, and in Asia and Africa, is that the state played a central role in all colonial enterprises. European colonies often emerged out of trading ventures organized as joint stock companies chartered by the colonizing state and in which the crown invested both its prestige and its capital. Colonial territory was conquered and defended by soldiers and sailors paid either by the colonizing state or the local colonial state. Plantations and mines were often directly owned by the local colonial state. Trading monopolies and tax privileges granted by the colonizing state to the local colonial state were used to attract capital investment. Indeed, conceptual distinctions between public and private economic activity which seem so clear today were much less clear in the heyday of colonialism. The unspun truth about the “winning” of the western frontiers of the United States and Canada make for even poorer libertarian dramas. Notwithstanding all the hardy pioneers in their covered wagons, the western frontier of the United States was really “won” by the U.S. Army and the construction of the railroads which were capitalized by enormous Federal land grants.[[5]](http://jetpress.org/volume4/space.htm%22%20%5Cl%20%22ft5) Similarly, the western frontier of Canada was “won” by cash grants, subsidies, loans, and the guarantee of bond issues by the Canadian government to finance the construction of the railroads.

Government action is needed for colonization because of the amount of capital

Hickman 1999 (John, phD and associate professor of government and international relations @ Berry college, “The Political Economy of Very Large Space Projects”, <http://jetpress.org/volume4/space.htm>, JOURNAL OF EVOLUTION AND TECHNOLOGY, Volume 4, November 1999, accessed 6/29/11)CNW

The crucial difference between governments and private firms is not that governments are better at managing very large projects, but that they are better at financing very large projects. Sovereign national governments may print currency, sell or mortgage public assets, or levy taxes on property and persons within their territories. Governments may borrow from private lenders or other governments against future tax revenues or guarantee payment of loans made between private lenders and private borrowers against future tax revenues. Governments may issue bonds backed by nothing more than their promise to redeem at face value. Governments are not liquidated when they are bankrupt. Governments may offer a wide range of direct and indirect subsidies as incentives for private investment. In effect, governments exercise the kind of power over the movements of money that is tailor made for expensive development projects. Given the problems inherent in trying to finance very large space projects with entirely private borrowing or investment, it makes sense to look to government for direct and indirect assistance. If the construction of any very large space development project is to be attempted in the next century, three objectives or tasks involving the use of government will have to be achieved. The first objective would be to persuade a sponsoring space-faring power or powers with the economic wherewithal, presumably the United States, European Union, or Japan, to absorb as much of the initial costs of the project, including exploration, technology development, planning, and infrastructure construction, as politically possible. The old fashioned term “power” is used here because the European Union is not a nation-state. It is not necessary that the power make a firm commitment to complete the entire project so long as it pays for some of the up front costs. Offsetting any of the costs at the beginning of the project would be valuable. However, project promoters should be able to exploit sunk costs arguments to appeal for additional assistance from the sponsoring power. If the sponsoring power could be persuaded to continue funding the project until completion through grants or low interest loans then the capitalization barrier is breached. Given the enormous sums of capital involved in the proposals for most very large space development projects, full funding from the sponsoring power seems unlikely. Yet each additional contribution would not only reduce the total amount of capital borrowing but would help to persuade private lenders that the project is credit worthy (Sweetman 1999:77).

AT: privatization CP- government key- capital

Only government has the access to manpower and capital needed for space development

Hickman 1999 (John, phD and associate professor of government and international relations @ Berry college, “The Political Economy of Very Large Space Projects”, <http://jetpress.org/volume4/space.htm>, JOURNAL OF EVOLUTION AND TECHNOLOGY, Volume 4, November 1999, accessed 6/29/11)CNW

A better historical analogy for establishing permanent human communities in space is actually provided by one of the greatest civil engineering project of this century--the construction of the Panama Canal. As would be true with any very large space development project, constructing the Panama Canal required that tough new engineering and science problems had to be overcome in an unforgiving environment, a labor force had to be imported and supported, and sufficient capital had to be invested despite the fact that private investors could not or would not provide the financing necessary to complete the task. After twenty years of failed efforts by private French firms to dig a canal across the isthmus of Panama and the failure of a private American firm to dig a canal through Nicaragua, it was the United States government that successfully completed the construction of the Panama Canal.[[6]](http://jetpress.org/volume4/space.htm%22%20%5Cl%20%22ft6) Financing by the United States government and management by U.S. Army engineers succeeded where the private sector failed. Engineering problems more difficult than those which were encountered in constructing the Suez Canal were solved, yellow fever and malaria were effectively controlled, a new sovereign nation-state was created, and world commerce was facilitated.[[7]](http://jetpress.org/volume4/space.htm%22%20%5Cl%20%22ft7) Not bad for government work. Very large space development projects should be understood as massive public works projects constructed to provide the environmental and economic requirements for permanent human settlement beyond Earth. If these new human settlements are to attract and keep the kind of people needed, then they will have to be livable communities. Making them livable will provide plenty of scope for private firms to profit from the provision of goods and services. But private firms will not do the heavy lifting necessary to finance the construction of the very large space project within which and around which such a livable community may grow.

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AT: privatization CP- companies fail- capital

Private industry cannot attain the capital needed for large scale space programs

Hickman 1999 (John, phD and associate professor of government and international relations @ Berry college, “The Political Economy of Very Large Space Projects”, <http://jetpress.org/volume4/space.htm>, JOURNAL OF EVOLUTION AND TECHNOLOGY, Volume 4, November 1999, accessed 6/29/11)CNW

Attempting to persuade investors to risk enough capital to finance the construction of a very large space development project would run up against the same capitalization problems now faced by entrepreneurs seeking capital for ordinary space development projects such as launching communication satellites. Investors and lenders seek to maximize economic returns from capital while avoiding risk. The cost of capital is higher for riskier investments. Persuading investors and lenders to part with their capital requires making credible promises that they will receive better returns than they would have received from making alternative investments during the same time period commensurate with risk. While investors often accept higher levels of risk than do lenders, they do so in the expectation of even better returns. Ordinary space development projects confront not only the risks that their businesses might not make money and that the technology might fail to work as projected, but also that they might not attract enough investment because the necessary capital investment is too “chunky.” In other words, the “up-front” capital investment necessary to proceed with even an ordinary space development project tends to be relatively large and to take a relatively long time period before generating cash flows or profits (Simonoff 1997: 73-74; U.S. Department of Commerce 1990: 55-60; McLucas 1991). It is important for the subsequent discussion that the reader note that many investors typically understand the phrase “long time period” to mean “5 years” (Marshall and Bansal 1992: 99-100).

If attracting capital for projects using proven technologies like communications satellites remains difficult, imagine the difficulty of attracting sufficient capital to construct a mining facility on the Moon or terraforming Mars or Venus. Such projects are extraordinarily “chunky” in that they would require massive amounts of capital to be invested “up front” and would take long or very long time periods before generating economic returns. The total amount of capital available for investment in anything is finite and the private investors and lenders who control most of it normally enjoy multiple investment opportunities. Investors and lenders are typically reluctant to concentrate their risks on a single project. Investors and lenders are also reluctant to lock up their capital in very long time investments or loans because this increases their opportunity costs.

AT: privatization CP- companies fail- capital

Private industry cannot solve for large space development- difficulty in acquiring the needed capital

Hickman 1999 (John, phD and associate professor of government and international relations @ Berry college, “The Political Economy of Very Large Space Projects”, <http://jetpress.org/volume4/space.htm>, JOURNAL OF EVOLUTION AND TECHNOLOGY, Volume 4, November 1999, accessed 6/29/11)CNW

The lesson is that, ceteris paribus, very large space development projects are probably too unattractive as investments for private investors and lenders. For the current generation of space development enthusiasts, indoctrinated in the principles of neo-classical or free market economics popularized in the Reagan years, this is a very disquieting conclusion. Many exhibit a fierce libertarianism. They share an ideological conviction that private enterprise and unfettered markets are capable of overcoming almost any technological or economic obstacle.[[4]](http://jetpress.org/volume4/space.htm#ft4) Government appears less as the driving force for space exploration than as the political and bureaucratic obstacle to technological innovation and the commercial development of space. Given the disappointing performance of NASA in the 1970's and 1980's, convictions such as these are hardly surprising (Kay 1995:161-171). Space development enthusiasts watched as government funding for NASA programs declined steadily while important opportunities for commercial launch capability and space industrialization in near Earth space were lost. Yet the “lessons” drawn about from the disappointments of the 1970's and 1980's are probably the wrong lessons for space development. Government participation in the economic development of space is essential. Why else would promoters combine libertarian denunciations of the government’s role in space development with political demands for indirect subsidies in the form of tax credits for space commerce and the privatization of public assets in the form of the International Space Station (Lehrer 1999). Complaints about the role of government in space development would be more convincing if private sector efforts in space had produced comparable results. Government space programs can point to records of successfully launching interplanetary probes and spacecraft with human crews. Even after all the excuses have been made, the record of private sector accomplishments in space is unimpressive. Of course, identifying space sector efforts as “private” is somewhat problematic because many employ technology developed with government funds, or employ castoff parts and borrowed facilities from government programs, or anticipate that the government will be their primary buyer.

The fundamental problem in opening any contemporary frontier, whether geographic or technological, is not lack of imagination or will, but lack of capital to finance initial construction which makes the subsequent and typically more profitable economic development possible. Solving this fundamental problem involves using one or more forms of direct or indirect government intervention in the capital market.

AT: spending

Space marketing from terrestrial resources pays for itself.

Ross. 01. ( Shane D. Ross is an assistant professor at Virginia Tech in the Department of Engineering Science and Mechanics. “Near-Earth Asteroid Mining” 12-14-01. [http://76.75.200.144/settlement/asteroids/NearEarthAsteroidMining(Ross2001).pdf](http://76.75.200.144/settlement/asteroids/NearEarthAsteroidMining%28Ross2001%29.pdf). TQ)

Other space-based commerce may come online within the next few decades, including manufacturing, solar power stations, and space tourism. There is interest in space-based production of high value pharmaceuticals, semiconductors, ultra-pure crystals for many applications, and generally anything requiring large-scale material purity. The concept of satellite solar power stations (SSPS) is again receiving active consideration: the Japanese have considered an equatorial orbit SSPS pilot plant, orbiting at 1100 km altitude, of mass 200 tonnes 1 (Nagatomo, M. [1996]). Japan’s National Space Development Agency, which hopes to launch an experimental version of an SSPS between 2005 and 2007, has asked two teams of private companies to submit design proposals by the end of January 2002. 2 The feasibility of space tourism is also being promoted. Market research in the United States, Japan, Canada and Germany has shown that as many as 80% of people younger than 40 would be interested in commercial space travel. A majority would be willing to pay up to three months’ salary for the privilege. Ten percent would pay a year’s salary. 3 It is estimated that at a launch cost of $200/kg the space tourism industry will grow rapidly to several billion dollars per year (Collins et al. [1994]). Hotels in orbit will be needed to cater for 10,000 person accomodations after some years. The Japanese Shimizu Corp., an engineering and construction ﬁrm, has developed a plan for such an orbiting hotel, of mass 6000 tonnes. They have pledged to have their 64-room hotel aloft by 2020, with a lunar unit to follow . As a result of these and other activities, we can expect a future market for mass in LEO, i.e., metals for construction, volatiles to make propellants for stationkeeping and transportation, and unprocessed mass for shielding against cosmic radiation. The size and rate of this future in-orbit market for materials could exceed 1000 tonnes per year by 2010, growing exponentially to tens of thousands of tonnes per year if any large scale activity develops rapidly (Sonter [1997]

Space Resources are worth a lot, effectively covering the cost of mining.

Crandell et. al , 11 (William C. Crandell. MBA, Founder of Space Wealth, “Is Profitable Asteroid Mining: A Pragmatic Goal?,” Space Wealth, 23 February 2011. [http://www.spacewealth.org/files/Is-P@M-Pragmatic-2010-08-23.pdf](http://www.spacewealth.org/files/Is-P%40M-Pragmatic-2010-08-23.pdf). TQ)

Some space resources have outstanding commercial value. These should be the focus of civil space agencies intent upon satisfying fundamental economic needs. Such as platinum, now at ~$1,500/oz.25Platinum group metals (PGMs) are great catalysts. Used in automotive catalyticconverters, which are required by national governments worldwide,26 PGM supplies are quite limited. Some models point to terrestrial depletion withindecades.27 Platinum group metals are also critical as catalysts in hydrogen fuel cells,which are key toa possible post-carbon, “hydrogen economy.”28 In 2008,TheNational ResearchCouncilidentified PGMs as the “most critical” metals for future U.S. industrial development.29Platinum group metals are abundant in certain types of near-Earth asteroids (NEAs).NEAs that are mineralogically similar to one of the most common types of “observed fall”meteorites (H-type, ordinary chondrites), offer PGM concentrations (4.5 ppm)30 that arecomparable to those found in profitable terrestrial mines (3-6 ppm).31 Other meteorites suggest that some asteroids may contain much more valuable metal.32The PGM value of a 200 m asteroid can exceed $1 billion, or possibly $20 billion.33Over 7,000 NEAs have been detected.34 Close to a fifth of these are easier to reach than the moon; more than a fifth of those are ≥200 m in diameter: Over 200 targets.35 If theCongress enacts the nearly four-fold increase in detection funding President Obama hasrequested ($5.8 m to$20.3 m/year),36 we could find >10,000 200m NEAs in a decade.37But detection is just a start. The costs to locate, extract, and process asteroid ore are notwell understood.38 Before significant private capital is put at risk, we need to learn more.

AT: spending

Asteroid Mining is key to the economy mining resources offsets the amount than a mission

Alibay No Date

( Farah Alibay et.al graduate from the Massachusetts Institute of Technology, SURVEY, CAPTURE, RELOCATION AND EXPLORATION OF A NEAR-EARTH OBJECT, PG 13 QJ)

**The retrieval of a NEO would be the first step toward many more ambitious goals for space exploration. The technologies and processes developed to move a NEO into lunar orbit could later be applied to divert a NEO or other potentially hazardous object from an impact trajectory with Earth.** Furthermore, asteroids have long been considered an ideal source of materials for the construction of large space structures, including human habitats (O'Leary, Gaffey, Ross, & Salkeld, 1979) and space elevators (Price, 2001). Bringing a NEO to the vicinity of Earth and in a stable orbit, would make it far more accessible over a long period of time. As highlighted earlier, NASA may even be able to offset some of the cost of the mission by partnering with commercial entities for activities such as mining or space tourism after scientific exploration of the NEO has concluded. In particular, **NEOs are believed to contain high levels of precious metals and semiconductors, in quantities greater than are estimated to exist on Earth (Ross, 2001). It has been estimated that a 500km diameter asteroid could be worth more than $20 trillion, which would more than offset the development and operational costs of the proposed mission** (Stiles, 2010). If this type of flagship mission were to be successfully executed, it could also open the door to a whole new type of space exploration where NEOs could be used as in-situ resources**. Metals and minerals from asteroids could provide the raw materials for space structures, whilst the comets could provide water and fuel for interplanetary spacecrafts (Lewis, 1996).**

**High Spending now key to low costs later.**

Forgan and Elvis 11. [Duncan Forgan (University of Edinburgh) and Martin Elvis (Harvard Smithsonian Center for Astrophysics); “Extrasolar Asteroid Mining as Forensic Evidence for Extraterrestrial Intelligence”; 3-29-11. <http://arxiv.org/PS_cache/arxiv/pdf/1103/1103.5369v1.pdf>. TQ)

While there might not be a good short-term economic case for governments to fund TAM missions, there are long-term economic and political motivations (see Gerlach 2005 for a thorough review). If the initial high capital barrier can be overcome, and proﬁts can be generated, then manufacturing future technologies will become much cheaper as the precious metals become less precious. The expertise gained by designing and undertaking TAM missions can then be brought to bear on other challenges in space exploration. Given the hazards involved in TAM for atmosphere-breathing species, it is reasonable to assume that much of the process will become automated and autonomous, ushering in a new era of robotics with advanced decision-making and goal-seeking software (which has obvious implications for post-biological evolution). With a large surplus of raw materials and a skilled robotic workforce, large, permanent space habitats can be constructed, for example in geostationary orbit. This may allow the construction of the long-considered “space elevator” (cf Aravind 2007), greatly reducing the cost of space-travel in general. With much cheaper space exploration, the ﬁnancial risks are reduced for other large-scale space projects, facilitating capital investment and Man’s continued development into a space-faring species. Governments which invest at early stages in these projects will receive proﬁtable advantages over their competitors, including early access to raw materials, new technologies and highly skilled personnel, each a boost to any nation’s economy. These beneﬁts may not outweigh the current ﬁnancial disadvantages, but dwindling resources and rising costs on Earth will gradually improve the prospect of developing TAM missions until they become an obvious choice. Exactly how the initial capital will be raised will be the most important and difﬁcult obstacle - private investors will baulk at the prospect of entirely funding TAM, but as with other large scale projects such as the Panama Canal (which was also faced with technological challenges and capital problems) the action of governments can make all the difference, especially if they can be encouraged into competition with each other (Hickman, 1999)

AT: Obama good- link turn- tangible benefits

Arguments about space being unpopular are about exploration missions, the plan will boost faith in all space projects by returning tangible goods.

Space Wealth, 2011, Is Profitable Asteroid Mining a Pragmatic Goal? 23 February 2011, Space Wealth is dedicated to the proposition that profitable asteroid mining (P@M) is a pragmatic goal. The organization works to bring asteroid researchers, data, and publications together, in order to promote extraterrestrial resource development, http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf, ES

To reach such ambitious goals, space agencies must be economically as well as politically sustainable. 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!” may not long survive. As we emerge from the “Great Recession” and enter the long “Lean Years” under the darkening cloud of a growing fiscal crisis, 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.” 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.” 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. Today we face new hungers, new dangers. It now appears likely that terrestrial sources of certain metals—which are required for ecologically sustainable technological societies—may not be able to satisfy 21st Century global demand. At this historic juncture in space development, the U.S. has a terrific opportunity to re-launch its civil space agency as an economically vital, extraterrestrial branch of the USGS, creating fantastically detailed maps of—and greatly improving our access to—the mineral wealth of the solar system. Rather than ask, “Where should we try to send humans next?” NASA should ask, “What can we do to create economic value, off planet, for the taxpayers who are investing in our efforts?”

**AT: robots CP**

Space mining requires human overseers to ensure reliability

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)

 Mining multiple resources calls for sophisticated mining and processing techniques. On Earth, mining is messy, with dirt and stones clogging up machines and human help needed to keep things running. Microgravity complicates mining efforts—on asteroids loose stones won’t fall to the ground. “You’re going to generate a giant billiard game that takes place inside a dust cloud,” explained Richard Gertsch, assistant professor at Michigan Technological University, Houghton. He and his wife, Leslie, also an assistant professor at the school, suggest one simple solution: encase the entire asteroid in a giant plastic sack. “You just bake out the volatiles,” Leslie explained, and chop away steadily at the remaining rock**.** Most schemes would likely require human overseers. “The control methodology is the biggest technological hurdle,” said Mark Sonter, a mining engineer based in Australia. Without observing a mining operation on site, he asked, how could you even predict the way machinery will behave—a necessary precursor to programming it. Richard Gertsch warned that automated mining might prove prohibitively expensive. **“**You essentially have to have 100 percent reliability**,”** he said. If the equipment breaks down, the mission’s over. “To squeeze out that last 1 or 2 percent of reliability costs a lot of money,” he added. “I don’t know how you’d budget for that.” In contrast, Gertsch says, manned missions have known parameters, which can be budgeted for. Telepresence has been suggested as a way humans could oversee mining. Virtual reality would recreate the site on Earth. Last year a NASA study questioned the necessity of going after mammoth NEOs in order to get water or other materials from space. Titled “AsterAnts: A Concept for Large-Scale Meteoroid Return and Processing,” the study suggested sending out swarms of mass-produced probes, each of them powered by solar sails. Like ants gathering crumbs, the probes would attach themselves to 1-meter-wide NEOs and return them to the Alpha Space Station for processing.

Random Cards

**Mining key to ecological sustainability**

**Mining NEAs need to become a priority: K2 ecological sustainability**

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

Economic resources in space are of three types: Location, energy, and matter. Some near-Earth locations already support profitable industrial engagements. Low-Earth and geosynchronous-Earth orbits host hundreds of revenue-generating satellites (worldwide industry revenues in 2008: >$140 billion).19 Beyond Earth’s atmosphere, solar radiation is abundant; it powers most satellites. Orbiting space-based solar power systems (SBSP) may be able to deliver huge quantities of clean, sustainable energy to Earth.20 But to date, nothing from the vast reaches beyond Earth orbit has ever been involved in an economic exchange. To incrementally expand our current off-planet economy, the next resource is clear: Near-Earth asteroids. To take this next step, we need our space agencies to make asteroid mining a priority, and demonstrate how it can done. We need our space agencies to reach out—with robots, certainly; perhaps with humans— to find, get hold of, and bring back an economically significant chunk of matter, and sell it on the open market. We need them to prime the pump for economically and ecologically sustainable, post-Earth-as-a-closed-system, industrial societies. Our space agencies need to enable a revolutionary transformation in the material culture of our home planet. They need to design and launch positive economic feedback systems that utilize off-planet resources. Space agencies need to develop the skills and knowledge required to draw material resources through extraterrestrial supply chains, and put them to use in terrestrial systems of production. Once learned, space agencies need to transfer these skills and understandings to individuals in industry. Civil space agencies also need to help design, publish, and promote the inner-solar-system knowledgebases that will prepare today’s students for profitable extraterrestrial careers.22 We need our civil space agencies to do these things, because we need the metals that are available in asteroid ore to support our technological societies on Earth, so that they may become ecologically sustainable over the decades and centuries to come.

UQ for rare earth- low access

Low Access to minerals now – Raises prices as well as decrease U.S reliability.

Parthemore 11 – (Christine Parthemore. MA from Georgetown’s Security Studies Program, Director of the Natural Security Program, “Elements of Security: Mitigating the Risks of U.S. Dependence on Critical Minerals,” <http://www.cnas.org/files/documents/publications/CNAS_Minerals_Parthemore.pdf>. TQ.)

Reliable access to critical minerals is a matter of both economic and geostrategic importance to the United States. Although concern about access to minerals waxes and wanes, it is rising now due to increasing demand, new competitors capturing large market shares and other trends that defy easy prediction. These same trends can interfere with foreign and defense policy goals and give mineral suppliers easy leverage over the United States and other countries reliant on global supply chains. Despite renewed attention to critical minerals, America’s dependence on these minerals is often misunderstood and miscast in the public debate. Recent tensions with China concerning the supply of rare earth elements, for instance, should challenge U.S. policymakers not because the United States’ import dependence is inherently problematic (which it is not) or because rare earth minerals are scarce (which they are not). Rather, rare earths deserve attention because U.S. supply options are limited: Supplies are concentrated mostly in the hands of one supplier with its own rising demand, and the United States currently has no good options for recycling rare earth minerals or substituting more easily obtained minerals. While China is nearly the sole producer and exporter of rare earths today, it does not possess a permanent “corner” on this market. Indeed, China holds only about half of known world reserves – not a terribly high concentration. 1 The loss of a single major supplier such as China may therefore increase the costs of rare earth minerals, but may not affect their long-term availability. The issue, then, is more appropriately understood in terms of managing short-term risks such as disruptions and ensuring that the U.S. government’s most important defense and energy needs can be met.

China is cutting supplies of rare earth metals, threatening many industries and the military

Foster 2011 (Peter, China correspondent for the telegraph focusing on politics and economics, “Rare earths: why China is cutting exports crucial to Western technologies”, <http://www.telegraph.co.uk/science/8385189/Rare-earths-why-China-is-cutting-exports-crucial-to-Western-technologies.html>, 3/19/11, accessed 6/29/11)CNW

Known in China as 'industrial vitamins', rare earths are an essential component in green technologies such as electric cars, solar panels and wind turbines. Rare earths are not only essential for civilian life; the world's hi-tech armies also need rare earths for a host of applications from toughening tank armour to guiding smart-bombs and powering night-vision goggles.

Given their global application, it may come as a surprise to know that 95 per cent of world rare earths production is controlled by a single country – China. Last year China's ministry of commerce announced drastic cuts in the amount of rare earths it would make available for export. Quotas were cut by more than 70 per cent for the second half of 2010 to only 8,000 tons, compared with 29,000 tons for the same period the previous year, at a time when global demand for rare earth elements (REEs) was picking up fast.

UQ for rare earth- US has supplies

The US has the capabilities to create a new supply of rare earth metals domestically

Hsu 2010 (Jeremy, Tech News Daily contributor, “U.S. Sitting on Mother Lode of Rare Tech-Crucial Minerals”, <http://www.technewsdaily.com/us-sitting-on-mother-lode-of-rare-tech-crucial-minerals-0281/>, 3/8/10, accessed 6/30/11)

U.S. Rare Earths practically stumbled upon its first rare earth deposit at Lehmi Pass, on the border between Idaho and Montana, about 15 years ago. The company founders coveted the area's reserves of thorium — an alternative nuclear fuel — and took little interest in the rare earths that were only used, at the time, in lighter flints and tracer bullets for the [military](http://www.technewsdaily.com/army-turns-to-smartphone-apps-to-win-wars-0274/).

Their view changed over the years as rare earths became practically irreplaceable in [high-tech products](http://www.technewsdaily.com/10-profound-innovations-ahead-0135/) used by millions of people today. The company only recently changed its name to U.S. Rare Earths after staking out another deposit at Diamond Creek, Idaho.

"The fact is, the Diamond Creek property is today, the most accessible, undeveloped rare earth resource with significant [heavy rare earths] that there is in North America," said Jack Lifton, an independent consultant who works with U.S. Rare Earths.

Recent USGS figures estimate that the U.S. holds rare earth ore reserves of up to 13 million metric tons. By contrast, the entire world produced just 124,000 metric tons in 2009 — but it would take both time and money for the U.S. to become self-sufficient in producing rare earths.

The US already has access to large amounts of rare earth metals, they just need to be exploited

Science Daily 2010 (“Rare Earth Elements in US Not So Rare, Report Finds”, <http://www.sciencedaily.com/releases/2010/11/101117184451.htm>, 11/18/10, accessed 7/1/11)CNW

Approximately 13 million metric tons of rare earth elements (REE) exist within known deposits in the United States, according to the first-ever nationwide estimate of these elements by the U.S. Geological Survey.

This estimate of domestic rare earth deposits is part of a larger report that includes a review of global sources for REE, information on known deposits that might provide domestic sources of REE in the future, and geologic information crucial for studies of the availability of REE to U.S. industry.

The report describes significant deposits of REE in 14 states, with the largest known REE deposits at Mountain Pass, Calif.; Bokan Mountain, Alaska; and the Bear Lodge Mountains, Wyo. The Mountain Pass mine produced REE until it closed in 2002. Additional states with known REE deposits include Colorado, Florida, Georgia, Idaho, Illinois, Missouri, Nebraska, New Mexico, New York, North Carolina, and South Carolina.

UQ for rare earth- underwater mining solves

Multiple companies are already interested in underwater mining, operations should start within the next few years

The Economist 2009 ( premier international news publication,Seabed mining The unplumbed riches of the deep And why they’ll wait a while longer before being disturbed, <http://www.economist.com/node/13649273>, 5/14/09, accessed 6/29/11)CNW

Two other companies have shown serious interest in seabed mining. One is Neptune Minerals, an Australian-based company that applied for a mining licence in 2008 for two deposits in about 1,250 metres of water near the Kermadec islands off New Zealand. It has also been granted exploration licences in territorial waters off Papua New Guinea, the Federated States of Micronesia and Vanuatu. But it is nowhere near mining commercially. The other company is Nautilus Minerals, a Canadian firm whose Solwara 1 project in Papua New Guinea’s territorial waters contains 60,000-100,000 tonnes of copper, and gold too. It was due to start production next year, but most operations are now on hold.

Undersea mining can begin in 2013

Hill 2010 (Mathew, reporter for miningweekly.com,“Nautilus says could start undersea mining in 2013”, <http://webcache.googleusercontent.com/search?q=cache:http://miningweekly.com/article/nautilus-says-could-start-undersea-mining-in-2013-2010-09-07>, 8/7/10, accessed 6/29/11)CNW

BARRIE, Ontario (miningweekly.com) - Construction for the world’s first deep-sea mining project, off the Papua New Guinea (PNG) coast could begin by year end with first production in early 2013, an executive at TSX- and Aim-listed Nautilus Minerals said on Tuesday.

 \The company first aims to sign an agreement with a strategic funding partner, and will begin development on the $383-million Solwara 1 “almost immediately” thereafter, business development vice-president Scott Trebilcock said.

Underwater mining for manganese nodules solves for rare earth and copper shortages

Dillow 2010 (Clay, reporter for popsci.com, [With Limited Deposits of Rare Earth Metals on the Surface, Eyes Turn to the Seafloor](http://www.popsci.com/technology/article/2010-11/limited-deposits-rare-earths-surface-eyes-turn-seafloor), <http://www.popsci.com/technology/article/2010-11/limited-deposits-rare-earths-surface-eyes-turn-seafloor>, 11/12/10, accessed 6/29/11)CNW

China’s monopoly on the global supply of rare-earth elements has been of particular worry lately as tensions between [China and Japan](http://www.popsci.com/technology/article/2010-09/china-has-halted-rare-earth-exports-japan-reports-times), and then between [China and the West](http://www.popsci.com/technology/article/2010-10/officials-claim-chinese-rare-earths-embargo-expands-include-us-and-europe), recently led to something of an unofficial embargo on the prized minerals. The faux embargo has since lifted, but it left every industrialized nation not named China feeling economically vulnerable. Nations from [Japan](http://www.popsci.com/science/article/2010-11/amid-strained-trade-relations-china-japan-strikes-rare-earths-deal-vietnam) to [the U.S.](http://www.popsci.com/science/article/2010-09/boeing-joins-search-us-reserves-dwindling-rare-earth-elements) to Europe have since scrambled to find independent supply chains.

But it’s the rising prices of more common metals like copper and nickel, rather than rare earths, that are driving some visionaries to look to the seafloor. Scattered at the bottom of the oceans are vast numbers of potato-sized rocks called manganese nodules that contain harvestable amounts of copper, cobalt, nickel, and their namesake manganese.

Previously it wasn’t economically viable to build giant machines to scour the seafloor for nodules, but with commodities like copper and nickel gaining value that economic model might change. Advances in robotics have made the idea of fleets of seafloor mining far more viable (remember those ‘bots that tied off the BP well?), and now that it’s been established that manganese nodules also contain rare earths, that model improves further.

Key to further exploration- multiple warrants

Volatiles from asteroids have a huge market and helps sustain future space development

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

The key longer-term markets are those logical on-orbit markets that will inevitably emerge but which lack the infrastructure to be viable today. These potential orbital markets for NEO resources may be worth hundreds of billions within twenty to thirty years, but as noted above, it will be necessary to invest in orbital substantial new infrastructure before these markets truly become viable. Volatiles. Volatiles may be the easiest products to extract and process, and the potential future orbital market could be enormous. Specific markets include water for use by the [ISS] International Space Station and for future manned missions, rocket fuel for use in orbital tugs and other spacecraft, and feedstock to supply orbital fuel depots for refueling a wide range of craft in Earth orbit. As noted above, an infrastructure for processing and delivering NEO-derived fuel to orbit would fundamentally alter the economics of space travel beyond LEO. Early uses of asteroidal volatiles may be to provide in situ production of carbon monoxide for use in metal refining and potentially to produce rocket fuel for returning processed resources to Earth. Steam rockets using water derived from NEOs have been proposed58 and advances in steam rocket technology might make this option feasible.59

Key Internal Link to Solving for exploration is Mining.

Zaburunov, ’90. (Steven A. Zaburunov. Writer and Editor. From Engineering & Mining Journal. “Mines in space: what is NASA doing?” July, 1, 1990. <http://business.highbeam.com/436960/article-1G1-9292969/mines-space-nasa-doing> TQ)

Space exploration, development, and exploitation will require vast quantities of bulk materials. Not just transistors, titanium, and TV cameras, but water for life support and some sort of fuel for the space vehicles. These two items, water and fuel, are the first priority for long-term exploration and development of the solar system. Without them, interplanetary travel will remain in the realms of science fiction. But it is not a question of whether or not we can develop the resources of space right now, it is just a question of how long it will take to find a way. And if ways are to be found, the mining and metallurgical industries will need to be actively involved.

**Moral obligation for space expansion**

We have a moral obligation to pursue space exploration.

Schwartz 11 (James S. J., Graduate Student, Wayne State University, Environmental Ethics, Our Moral Obligation to Support Space Exploration, Philpapers.org, NC)

The moral obligation to support space exploration follows from our obligations to protect the environment and to survive as a species. It can be justified through three related arguments: one supporting space exploration as necessary for acquiring resources, and two illustrating the need for space technology in order to combat extraterrestrial threats such as meteorite impacts. Three sorts of objections have been raised against this obligation. The first are objections alleging that supporting space exploration is impractical. The second is the widely held notion that space exploration and environmentalism are at odds with one another. Finally, there are two objections to using space resources that Robert Sparrow has raised on the topic of terraforming. The obligation to support space exploration can be defended in at least three ways: (1) the "argument from resources," that space exploration is useful for amplifying our available resources; (2) the "argument from asteroids," that space exploration is necessary for protecting the environment and its inhabitants from extraterrestrial threats such as meteorite impacts; and (3) the "argument from solar burnout," that we are obligated to pursue interstellar colonization in order to ensure long-term human survival.

**Asteroid mining key to exploration- sparks interest**

Mining Asteroids would attract new generations to space and get the US back on track for space

Abundant Planet 09 (Abundant Planet, organization enabling profitable profit mining, **Review of United States Human Space Flight Plans Committee at** NASA Headquarters, ***Review of United States Human Space Flight Plans Committee, August 3, 2009, http://www.nasa.gov/pdf/383154main\_53%20-%2020090803.7.toAugustineCommittee-2009-08-03.pdf,*** AG***)***

The Cold War, which gripped the country in terrible fear, is over. In 1957, one month after Sputnik, Air Force Chief of Staff Thomas Dresser White declared that “for the first time since 1814, the U.S. homeland was in mortal danger.”1 This fear persuaded the president, congress, and the nation to pay a terrific price for a victory in space. When Kennedy set the nation on a course to the moon, the United States had suffered a series of space defeats: The U.S. was not the first to orbit a satellite, was not the first to orbit an animal, was not the first to orbit a human, and was not the first to send probes by and to the moon. The nation was clearly behind,2 felt threatened,3 and believed that winning a race to the moon was worth a very high price. By taking the lead in this symbolic contest4 for “prestige,”5 the U.S. showed the world, and its people, that it could apply scientific knowledge, manage complex technology, and coordinate large engineering teams to solve problems of unprecedented scope. But Cold War rivals are now actively working to reduce nuclear arsenals.6 The nation’s concerns have shifted from mutually assured destruction to problems that are far more complex and intertwined: achieving stable economic growth along with environmental sustainability. So what are we doing in space today? What will attract new generations? How about securing access to new sources of essential minerals and renewable energy?