# Asteroid Mapping Affirmative

[Asteroid Mapping Affirmative 1](#_Toc296543585)

[Asteroid Mapping Glossary 2](#_Toc296543586)

[Asteroid Mapping 1ac 3](#_Toc296543587)

[Asteroid Mapping 1ac 4](#_Toc296543588)

[Asteroid Mapping 1ac 5](#_Toc296543589)

[Asteroid Mapping 1ac 6](#_Toc296543590)

[Asteroid Mapping 1ac 7](#_Toc296543591)

[Asteroid Mapping 1ac 8](#_Toc296543592)

[Asteroid Mapping 1ac 9](#_Toc296543593)

[Inherency Extensions: No/Limited Mapping Now 10](#_Toc296543594)

[Significance Extensions: Asteroid Strike is Likely 11](#_Toc296543595)

[Significance: Asteroid Strike is Likely 12](#_Toc296543596)

[Harms Extensions: Asteroids Risk Extinction 13](#_Toc296543597)

[Harms: Case Outweighs Nuclear War 14](#_Toc296543598)

[Harms: Case Outweighs Nuclear War 15](#_Toc296543599)

[Harms: Case Outweighs Nuclear War 16](#_Toc296543600)

[Time Frame is Irrelevant 17](#_Toc296543601)

[Time Frame is Irrelevant 18](#_Toc296543602)

[Harms: Even Small Asteroids Bad 19](#_Toc296543603)

[Harms Extensions: Cooling 20](#_Toc296543604)

[Harms Extensions: Famines Impacts 21](#_Toc296543605)

[Harms Extensions: Ozone Depletion Impact Extensions 22](#_Toc296543606)

[Harms Extensions: Species Extinction 23](#_Toc296543607)

[Economy Add-on 24](#_Toc296543608)

[Space Junk Add-On (1/2) 25](#_Toc296543609)

[Solvency: Advance Warning Allows for Deflection 26](#_Toc296543610)

[Solvency: Deflection is Easy 27](#_Toc296543611)

[Solvency Extensions: Deflection is Safe/Will be Non-Nuclear 28](#_Toc296543612)

[Solvency Extensions: US Leadership Key 29](#_Toc296543613)

[Politics Link Answer 30](#_Toc296543614)

[Asteroid Bomb DA Answers 31](#_Toc296543615)

[Asteroid Bomb DA Answers 32](#_Toc296543616)

[Space Militarization Disad Answers 33](#_Toc296543617)

[Disaster Relief Counterplan Answers 34](#_Toc296543618)

# Asteroid Mapping Glossary

Some terms you may run into that you might be unfamiliar with:

Apophis: An asteroid potentially headed on a collision course with Earth twice in the next few decades.

NASA: The National Aeronautic and Space Administration, the agency of the federal government in charge of space exploration and development.

NEO: Near Earth Object. Essentially, an asteroid, a comet, piece of debris, etc, that might hit the Earth. NASA worries about all of these.

Nuclear winter: The theory that a nuclear war would generate enough smoke and dust to choke out sunlight, risking extreme cooling. In the context of an asteroid collision, scientists fear that the asteroid itself could kick up enough dust to block out sunlight. Many theorize that an asteroid collision killed the dinosaurs.

Tunguska: an asteroid that hit a remote region of Siberia in 1908. Scientists fear that if another asteroid hit a populated city on Earth today, that the damage would be immense.

# Asteroid Mapping 1ac

## Contention 1: Current NASA efforts to fund asteroid mapping are woefully inadequate.

Matthew T. Dearing, 2011 (BA from Illinois Wesleyan University with a BA in physics magna cum laude with research honors). “Protecting The Planet Requires Heroes, Money, And Citizen Scientists.” The Citizen Science Journal. Accessed April 12, 2011 at <http://www.science20.com/citizen_science_journal/protecting_planet_requires_> heroes\_money\_and\_citizen \_scientists-78070

The hunting and tracking of NEOs are certainly already in progress by NASA. Their mandated goal is to identify 90% of all NEOs with diameters larger than 1 km by 2020. Of course, it’s difficult to accurately determine what number to take 90% of to know if the goal has ever been reached. But, the current statistics on known NEOs is updated by NASA on their Discovery Statistics page. As of April 11, 2011, the total count of all near-earth objects of all sizes has reached 7,890 and kilometer-sized “large” NEOs at 824. Major observatories from around the world are participating in the ongoing hunt for NEOs and partner with NASA on their observations. One of the early programs was developed at the University of Arizona’s Lunar and Planetary Laboratory called The Spacewatch Project. Just over twenty years ago they discovered the first NEO with automated observing technology, and they have booked many other important “firsts” in this growing field. Several years ago, but now closed to the public since 2006, Spacewatch hosted a citizen science program where registered volunteers could visually review digital images of the night sky to try to identify fast moving objects appearing in consecutive CCD views. With 43 discoveries of new objects in two years from 52 volunteer reviewers, this program was a great example of connecting scientists with interested participates to collaboratively accomplish something very important to the rest of humanity. Much of the searching and monitoring is now largely automated. In a very recent example of new, automatic detection, NASA’s Meteoroid Environment Office established a set of fish-eye-style all-sky cameras that record anything that blazes through our night sky. Software then inputs the images, triangulates the object’s trajectory and calculates its previous orbit. (Check out a live view from the cameras.) However, all of these efforts still need to expand. NASA is effectively using breadcrumbs to fund the programs, and although they are partnering with willing observatories, the massive amount of observational time required to guarantee we will catch Earth-bound objects well in advance is enormous.

## Thus our plan:

Plan: The United States federal government should substantially increase funding for observatories to map asteroids and Near Earth Objects with the goal to identify 90% of all NEOs with diameters larger than 1 km by 2020.

## Contention 2: Earth is overdue for an asteroid collision

## The odds of an asteroid strike on earth are high now

Gregg Easterbrook, 2008 (fellow at the Brookings Institution), 2008. The Atlantic. “The Sky Is Falling.” Retrieved

April 12, 2011 at <http://www.theatlantic.com/magazine/archive/2008/06/the-sky-is-falling/6807/>.

Breakthrough ideas have a way of seeming obvious in retro­spect, and about a decade ago, a Columbia University geophysicist named Dallas Abbott had a breakthrough idea. She had been pondering the craters left by comets and asteroids that smashed into Earth. Geologists had counted them and concluded that space strikes are rare events and had occurred mainly during the era of primordial mists. But, Abbott realized, this deduction was based on the number of craters found on land—and because 70 percent of Earth’s surface is water, wouldn’t most space objects hit the sea? So she began searching for underwater craters caused by impacts rather than by other forces, such as volcanoes. What she has found is spine-chilling: evidence that several enormous asteroids or comets have slammed into our planet quite recently, in geologic terms. If Abbott is right, then you may be here today, reading this magazine, only because by sheer chance those objects struck the ocean rather than land. Abbott believes that a space object about 300 meters in diameter hit the Gulf of Carpentaria, north of Australia, in 536 A.D. An object that size, striking at up to 50,000 miles per hour, could release as much energy as 1,000 nuclear bombs. Debris, dust, and gases thrown into the atmosphere by the impact would have blocked sunlight, temporarily cooling the planet—and indeed, contemporaneous accounts describe dim skies, cold summers, and poor harvests in 536 and 537.

## We’re overdue for our next big asteroid hit—the impact is billions of deaths:

A. Ghayur, 5/3/2007 (Lecturer, University Institute of Information Technology,

<http://www.aero.org/conferences/planetarydefense/2007papers/P5-1--Ghayur--Paper.pdf>)

I. Introduction 694 was the year when a man envisioned a bone chilling scenario after witnessing a Near Earth Object (NEO); “What if it would return and hit the Earth?” The man is now a world renowned scientist, Dr. Edmond Halley, and the object now one of the most famous comets, the Halley’s Comet has returned numerous times without any incident. Human civilization has come a long way since the Dark Ages of mid twentieth century, however, it is only now that the mankind is realizing the veracity of the apocalyptic scenario – a heavenly body colliding with earth – the Hellish nightmare which troubled Dr. Halley. Although the chances of Halley’s Comet plummeting into earth are nearly nonexistent, the chances nevertheless of another NEO **colliding head on with earth are very much there**. The **battle-scared face of moon and the numerous impact craters on earth** are a living testament to it. But all this evidence proved insufficient to turn any heads until 1994 when Shoemaker-Levy Nine **crashed into Jupiter.** The **earth-sized storms created on Jupiter surface** sent alarms through the echelons of bureaucracy and politics and suddenly a nonexistent apocalyptic nightmare had become a **very much possible scenario**. 1 Today, we are sitting in the midst of ever increasing human population on this planet Earth, which in turn is sitting amidst ever increasing number of identified NEOs. **We are already overdue for our next big hit;** last one occurring 65 million years ago at Chixilub. **Any impact of that scale would result in deaths and displacement of billions, if not more**.

# Asteroid Mapping 1ac

## Unlike their speculative disad impacts, it is statistically inevitable that Earth will be struck by asteroids and comets:

Clark R. Chapman, 2004 (Southwest Research Institute, March 4, 2004, <http://www.b612foundation.org/papers/Chapman_hazard_EPSL.pdf>.)

Even after discovery of the Chicxulub impact structure in Mexico and its temporal simultaneity with the Cretaceous–Tertiary (K–T) boundary and mass extinctions [18], it has taken some earth scientists a while to recognize and accept **the statistical inevita-bility that Earth is struck by asteroids and comets**. Each impact, occurring on timescales of tens to hundreds of Myr, liberates tens of millions to billions of megatons (Mt, TNT-equivalent) of energy into the fragile ecosphere, which must have had dramatic consequences every time.

## Kilometer wide asteroids could create a nuclear winter—causing extinction:

Tom Blackwell, 8/29/2002 (National Post, Lexis)

Asteroids a kilometre-wide could cause catastrophic damage and **create years of nuclear winter** for a continent. Giant, 10-kilometre-wide rocks, like one that wiped out the dinosaurs 65 million years ago, **would "sterilize" the planet,** said Mr. Balam.

## In particular, the Apophis asteroid will present a unique danger to earth in the next twenty-five years.

Les Johnson, (Deputy Manager, NASA’s Marshall Space Flight Center), PARADISE REGAINED: THE REGREENING OF EARTH, 2010, 137.

According to NEO observers, an object dubbed Apophis is scheduled to make a very close pass of Earth in 2029, perhaps approaching within 35,000 kilometers. Although the chances of this few-hundred-meter-wide object colliding with Earth in 2029 are minimal, it will be back in 2036. If Apophis is an extinct comet, gravitational tides caused by Earth may produce a tail during the close approach. And if the reaction to the hot gases emitted by the tail is just right (perhaps we should say "just wrong"), Apophis's solar orbit could be very slightly altered so as to put it on a collision course with Earth on its return seven years later. If the impact of a NEO of Apophis's size occurred on land, a state or small county would be obliterated. If it occurred at sea, the resulting tsunami would drown millions.

## By 2020, we will face more than 5,000 potentially hazardous asteroids.

Thomas D. Jones, 2008 (staff writer) 2008. “Asteroid deflection: Planning for the inevitable” Aerospace America, October, Accessed April 12, 2011 at <http://www.aiaa.org/aerospace/images/articleimages/pdf/> View%20from%20Here1.pdf

AS NASA’s Spaceguard Survey searches for the last few dozen undiscovered large NEOs (1 km or larger in diameter, capable of a civilization-ending impact on Earth), more and more small, worrisome NEOs are turning up as by-products of the survey. For example, 2007 VK184, a 130-m-wide asteroid, will pass close to Earth four times between 2048 and 2057; it has a 1-in-29,000 chance of striking the planet. If it does, the impact will release the energy equivalent of 150 megatons of TNT. Such a titanic blast would destroy an area the size of a small state; even an ocean impact could cause hundreds of billions of dollars in tsunami damage. Of course, Earth’s long history has often been punctuated by much larger cosmic collisions. The Eltanin impact in the eastern Pacific 2.5 million years ago inundated the South American coastline with towering waves. Very large collisions, such as the KT event 65 million years ago, have caused mass extinctions and dramatically altered the course of life on Earth. The effects of a 1-km asteroid strike on today’s fragile, interconnected Sandia National Laboratories researcher Mark Boslough explains the downward energy transport in his team’s supercomputer simulation of the 1908 Tunguska impact. The asteroid projectile might have been as small as 40 m. Pan-STARRS, whose first unit is operational in Hawaii, will be composed of four individual optical systems, each with a 1.8 m diam mirror observing the same region of sky simultaneously. Each mirror will have a 3-deg field of view and be equipped with a CCD digital camera with 1.4 billion pixels. dozen years—close to what Congress directed NASA to do in 2005 (a search program still unfunded). The Gates Foundation earlier this year put $30 million toward the telescope’s construction, and the University of Arizona has just completed casting the main mirror. Over the next 15 years, these NEO search systems will lead to the discovery of over 500,000 asteroids, large and small, in the inner solar system. Of these, several thousand will be categorized as potentially hazardous asteroids, or PHAs, defined as objects that come within 0.05 astronomical units of the Earth (about 7.48 million km) and measure at least 150 m in diameter. As of August, there were 211 known PHAs, and 140 of those were larger than 1 km—capable of causing global devastation. By 2020, we may be staring at a PHA catalog that numbers more than 5,000!

## There is a high risk of an asteroid collision that could end life on the planet. Previous assumptions of a low probability are fundamentally flawed.

Gregg Easterbrook, 2008 (fellow at the Brookings Institution), 2008. The Atlantic. “The Sky Is Falling.” Retrieved

April 12, 2011 at <http://www.theatlantic.com/magazine/archive/2008/06/the-sky-is-falling/6807/>.

These standard assumptions—that remaining space rocks are few, and that encounters with planets were mainly confined to the past—are being upended. On March 18, 2004, for instance, a 30-meter asteroid designated 2004 FH—a hunk potentially large enough to obliterate a city—shot past Earth, not far above the orbit occupied by telecommunications satellites. (Enter “2004 FH” in the search box at Wikipedia and you can watch film of that asteroid passing through the night sky.) Looking at the broader picture, in 1992 the astronomers David Jewitt, of the University of Hawaii, and Jane Luu, of the Massachusetts Institute of Technology, discovered the Kuiper Belt, a region of asteroids and comets that starts near the orbit of Neptune and extends for immense distances outward. At least 1,000 objects big enough to be seen from Earth have already been located there. These objects are 100 kilometers across or larger, much bigger than whatever dispatched the dinosaurs; space rocks this size are referred to as “planet killers” because their impact would likely end life on Earth. Investigation of the Kuiper Belt has just begun, but there appear to be substantially more asteroids in this region than in the asteroid belt, which may need a new name.

# Asteroid Mapping 1ac

## The Probability of an asteroid hitting the earth this century is near 100%.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

4) 45 m diameter NEOs will typically not reach the surface, but could kill thousands with blast and heat since they release an amount of energy equivalent to 1,000 Hiroshima-size weapons. They are believed to impact on the average every 100 years, so the probability of an impact this century is near 100%. The Tunguska NEO of 1902 was an example of this class, though the Meteor Crater in Arizona, USA is also one.

## Contention 3: An asteroid collision would devastate the planet.

## A large asteroid would destroy life on Earth.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

A million MT impact, even though ~100 times less energetic than the K-T impact, would probably destroy civilization as we know it. The dominant immediate global effect would be sudden cooling, lasting many months, due to massive injection of dust into the stratosphere following impact. Moreover, the ozone layer would be destroyed. Agriculture would be largely lost, worldwide, for an entire growing season. Combined with other effects (e.g. a firestorm the size of India), it is plausible that billions might die from collapse of social and economic institutions and infrastructure. No nation could avoid direct, as well as indirect, consequences of unprecedented magnitude. Of course, because civilization has never witnessed such an apocalypse, predictions of consequences are fraught with uncertainty: is civilization inherently fragile or robust?

## A Near Earth Object strike could cause extinction and a nuclear winter.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

First, although it is possible that there will be little or no warning time, under most scenarios we will know well in advance when (and to a lesser extent where) the strike will occur. There are enormous implications for planning if the strike hits a major metropolitan area, which is likely to suffer the most casualties and economic losses, as opposed to a smaller city or rural area where immediate losses are lighter but there is less capacity to rebound. Second, while a NEO strike could be of any magnitude, there is potential for a global disaster, conceivably an extinction level event. Finally, because of potential after effects such as the equivalent of a nuclear winter, we cannot expect the postdisaster environment to return rapidly to its previously normal state.

## Even a small asteroid strike would cause worldwide famine.

Thomas D. Jones, 2008 (staff writer), 2008 Aerospace America, October, “ Asteroid deflection:

Planning for the inevitable.” <http://www.aiaa.org/aerospace/images/articleimages/pdf/View%20from%20Here1.pdf>

Of course, Earth’s long history has often been punctuated by much larger cosmic collisions. The Eltanin impact in the eastern Pacific 2.5 million years ago inundated the South American coastline with towering waves. Very large collisions, such as the KT event 65 million years ago, have caused mass extinctions and dramatically altered the course of life on Earth. The effects of a 1-km asteroid strike on today’s fragile, interconnected human society would probably cause global climatic disruptions, widespread crop failures, and worldwide famine.

## Famines are the root cause of global conflicts—their war scenarios ignore the underlying motivations for war.

Julian Cribb, 2010 (University of California) 2010. New York Times, August 24, 2010. ‘The Coming Famine’ http://www.nytimes.com/2010/08/25/books/excerpt-the-coming-famine.html?pagewanted=4&\_r=1

The character of human conflict has also changed: since the early 1990s, more wars have been triggered by disputes over food, land, and water than over mere political or ethnic differences. This should not surprise us: people have fought over the means of survival for most of history. But in the abbreviated reports on the nightly media, and even in the rarefied realms of government policy, the focus is almost invariably on the players — the warring national, ethnic, or religious factions — rather than on the play, the deeper subplots building the tensions that ignite conflict. Caught up in these are groups of ordinary, desperate people fearful that there is no longer sufficient food, land, and water to feed their children — and believing that they must fight “the others” to secure them. At the same time, the number of refugees in the world doubled, many of them escaping from conflicts and famines precipitated by food and resource shortages. Governments in troubled regions tottered and fell.

# Asteroid Mapping 1ac

## Even small asteroids could decimate the ozone layer.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

There has also been recent argumentation [J.W. Birks, P.J. Crutzen, R.G. Roble 2007. “Frequent Ozone Depletion Resulting from Impacts of Asteroids and Comets,” in “Comet/Asteroid Impacts and Human Society” (Eds. P. Bobrowsky, H. Rickman; Springer, Berlin) pp 225-245] that the ozone layer might be largely destroyed by NEOs as small as 0.5 km, smaller than previously estimated. Chapman has evaluated numerous impact scenarios 61, emphasizing their potential consequences on human society, which are even less well understood than environmental effects. The most comprehensive recent analysis of the risks of NEA impacts is that of the NASA NEO Science Definition Team (SDT) (See ref.22).

## The ozone layer is crucial to survival.

Life Science, 2011. “Elite Clean Energy, Two Ozone Layers?” April 13, 2011. Accessed April 13, 2011 at http://globalwarmingwars.net/elite-clean-energy-two-ozone-layers.html.

The Ozone layer in the stratosphere is very crucial to survival. It absorbs ultraviolet radiation, and allows for survival. Ultraviolet radiation is linked with skin cancer, premature skin aging, and cataracts. It is also know to hurt crops, and kill modest organisms such as plankton. As a make any difference of reality, in the 1970s scientist claimed that this ozone layer was becoming depleted. Scientist believed that the ozone layer was becoming destroyed by chlorofluorocarbons. A compound that was utilised in air conditioners, solvents and aerosol sprays bottles.

## It is beyond dispute that the Earth will be hit again—this risks human extinction and mass species extinction:

LIEUTENANT COLONEL JOHN C. KUNICH, 1997 (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

Irrespective of the ultimate resolution of these controversies, it is **beyond dispute that planet Earth has experienced hundreds of collisions with large objects from space.** Moreover, there is no reason to presume that these events are forever relegated exclusively to the distant past. Comparatively small-scale, yet still phenomenally destructive strikes have occurred quite recently. For example, on June 8, 1908, a pale blue fireball appeared in the Siberian sky, moving rapidly northward. The object exploded about 6 kilometers above the forest, creating a column of flame and smoke more than [\*122] 20 kilometers high. n13 Although no crater was formed, the blast caused the destruction of more than 2,000 square kilometers of Siberian forest in the Tunguska region. This immense area was flattened and burned by the superheated air and the shock wave that literally was felt around the world. It is believed that the source of this devastation was a stony asteroid about 80 meters in diameter, hurtling toward Earth at Mach 45. When it entered the atmosphere at this incredible velocity, it created a shock wave in front of it, which resulted in a pressure gradient that eventually blew the asteroid apart. n14 With this recent, relatively minor incident in mind, the probable consequences of more major collisions will be explored. Currently, astronomers estimate that at least **200 asteroids are in orbits that cross the Earth's orbit,** and the number of such known asteroids is rapidly increasing as detection methods improve. n15 Most of these asteroids are larger than 500 meters in diameter (several times larger than the Tunguska asteroid) and would cause massive damage if they were to collide with this planet. In [\*123] addition, long-period comets, n16 although less numerous than asteroids, pose a significant threat due to their greater velocities relative to Earth. n17 The history of life on Earth includes **several devastating periods of mass extinction** n18 during which the vast majority of species then in existence became extinct within a relatively short span of time. n19 The best known of these mass extinctions found the dinosaurs tumbling all the way from their throne as the kings of all living things to the bone pile of archeological history. n20 No less significant, however, were the extinction spasms that wiped out approximately 70 and 90 percent of marine species, respectively. n21 Even the species that survived often experienced catastrophic reductions in their populations. Several scientific studies have linked **mass extinctions to collisions between Earth and large objects from space**. The hypothesis that these extinction spasms were caused by these collisions and their aftermaths is supported (1) by the discovery of the now well-documented large impact event at the [Cretaceous/Tertiary] boundary...; (2) by calculations relating to the catastrophic nature of the environmental effects in the aftermath of large impacts; (3) by the discovery of several additional layers of impact debris or possible impact material at, or close to, geologic boundary/extinction events; (4) by evidence that a number of extinctions were abrupt and perhaps catastrophic; and (5) by the accumulation of data on impact craters and astronomical data on comets and asteroids that provide estimates of collision rates of such large bodies with the Earth on long time scales.

# Asteroid Mapping 1ac

## Species extinction risks human extinction:

California Academy of Sciences, last modified 8/21/2004 (http://www.calacademy.org/research/library/biodiv.htm)

Currently, more than 10,000 species become extinct each year and while precise calculation is difficult, it is certain that this rate has increased alarmingly in recent years. The central cause of species extinction is destruction of natural habitats by human beings. **Human survival itself** may **depend upon reversing this accelerating threat to species diversity**. Among the millions of undescribed species are important new sources of food, medicine and other products. When a species vanishes, **we lose access to the survival strategies** encoded in its genes through millions of years of evolution. We lose the opportunity to understand those strategies which may hold absolutely essential options for **our own future survival as a species**. And we lose not only this unique evolutionary experience, but emotionally, we lose the unique beauty, and the unique spirit, which mankind has associated with that life form.

## And, a hit on the ocean is no safer: It would devastate world ecosystems:

JUSTIN L. KOPLOW, 2005 (J.D., Georgetown University Law Center, Georgetown International Environmental Law Review, Winter 2005, 17 Geo. Int'l Envtl. L. Rev. 273; Lexis)

Yet, more likely, as the Earth is over seventy percent water, the asteroid would hit one of Earth's oceans. The impact would produce tsunamis of up to one hundred meters in height; n14 waves that, if from an Atlantic Ocean impact, would break against the Shenandoah Mountains. n15 The impact would generate wind and heat resulting in massive storm fronts that would flood large parts of the world and **alter world ecosystems with catastrophic loss of life**. n16

## Our case massively outweighs any disad: A single asteroid collision is capable of doing more damage than all nuclear weapons in existence combined…

LIEUTENANT COLONEL JOHN C. KUNICH, 1997 (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

If you were standing on Kosrae Island off the New Guinea coast on February 1, 1994, you would have seen a blast in the sky as bright as the Sun. This was caused by a small meteor entering Earth's atmosphere at 15 kilometers per second (roughly 33,500 miles per hour). Fortunately for you and everyone else nearby, the meteor exploded at high altitude, over a sparsely populated region; the blast had the force of 11 kilotons of TNT. n1 This was not your first near-death experience. On March 23, 1989, an asteroid about 800 meters in diameter narrowly missed the Earth (by about 6 hours' difference in relative position). If this asteroid had struck the Earth, the impact would have released energy equivalent to about 40,000 megatons of TNT, or 2,000 standard-size hydrogen bombs. n2 On an even larger scale, on December 8, 1992, a large asteroid named Toutatis missed hitting this planet by only two lunar distances. This was a very lucky day for everyone on Earth, because Toutatis is nearly 4 kilometers in diameter. n3 If it had hit us, the force of the collision **would have generated more energy than all the nuclear weapons in existence combined-approximately 9 million megatons of TNT**. n4

## And…Extinction is categorically different from any other impact—even if they win a nuclear war kills 99 percent of the population, an asteroid strike still outweighs by an order of magnitude:

Jason G. Matheny, 2007 (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

Even if extinction events are improbable, the expected values of countermeasures could be large, as **they include the value of all future lives**. This introduces **a discontinuity between** the CEA of **extinction and nonextinction risks**. Even though the risk to any existing individual of dying in a car crash is much greater than the risk of dying in an asteroid impact, asteroids pose a much greater risk to the existence of future generations (we are not likely to crash all our cars at once) (Chapman, 2004 ). The "death-toll" of an extinction-level asteroid impact is **the population of Earth, plus all the descendents of that population** who would otherwise have existed if not for the impact. There is thus **a discontinuity between risks that threaten 99% of humanity and those that threaten 100%.**

# Asteroid Mapping 1ac

## Contention 4 is Solvency:

## Fully funding asteroid mapping technologies enables adequate asteroid deflection and damage mitigation efforts.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

The majority of new asteroids are detected by just a few dedicated centers, as discussed in Chapter 3. Modest funding could bring on line many additional dedicated observatories. This would not only contribute to the US (NASA) goal of identifying ninety percent of all asteroids one kilometer in diameter or larger by 2010, but would also help with plans to push the threshold of routine surveillance down to the order of 100 to 200 meter diameter NEOs. In addition to locating NEOs, there is a critical need to bring on line a capability to more precisely locate high threat objects. A significant contribution to the inability to implement response plans in an early and measured fashion is the inherent uncertainty in object location and propagation. The ability to precisely forecast the path of a NEO threat would remove ambiguity in whether the object is or is not going to impact Earth, a critical piece of information if a deflection scheme is to be employed, knowing that any deflection scheme could fail or only partially deflect the object. In addition, if an impact is inevitable, knowing the precise impact point and the nature of the asteroid would enable focused response and recovery planning.

## A $600 million dollar investment in telescopes would allow for NASA to meet its asteroid detection goals.

William BC Crandall 2011 (Founder Space Wealth), 2011. “Is Profitable Asteroid Mining A Pragmatic Goal?”

Online. Accessed April 14, 2011 at <http://spacewealth.org/files/Is-P@M-Pragmatic-2011-02-23.pdf>.

1. Detect Asteroids Programs intended to detect 90% of all potentially hazardous NEAs (>140 m) by 2020 are underway.49 Today, with 2,000 such asteroids detected (~10%), it seems unlikely that the 2020 goal will be met.50 A space-based telescope could get the job done by 2023.51 A ground-based telescope could do it by 2030.52 Congress just authorized an increase in detection funding, from $5.8 m to $20.3 m/year.53 The “most capable [terrestrial telescope] appears to be the Large Synoptic Survey Telescope (LSST),”54 which plans to begin science operations in 2016. The LSST is designed to monitor the NEA population for years.55 The 2010 Decadal Survey of Astronomy and Astrophysics ranked the LSST its highest priority terrestrial observatory. Completion costs are estimated to be around $500 million.56 An infrared telescope in a Venus-like orbit could detect ~90% of all NEAs larger than 140 meters in diameter in seven years, as well as “about 85% of all >100 m” NEAs, and “about 50% of all >50 m” NEAs.57 Such a telescope, using technology from two previous successful deep-space missions—Spitzer58 and Kepler59—was proposed in 2009, at a cost of $600 million.60

## High levels of confidence in asteroid projections are necessary to motivate governments to deflect an asteroid.

Matthew T. Dearing, 2011 (BA from Illinois Wesleyan University with a BA in physics magna cum laude with research honors). “Protecting The Planet Requires Heroes, Money, And Citizen Scientists.” The Citizen Science Journal. Accessed April 12, 2011 at <http://www.science20.com/citizen_science_journal/protecting_planet_requires_> heroes\_money\_and\_citizen \_scientists-78070

The discovery of new near-earth objects is obviously important since we have not yet found any guaranteed direct-hitting NEO. But, if it is out there, then it certainly needs to be found much sooner than latter. In addition, the continued monitoring of known objects is equally vital, if not more so, because not only can NEO trajectories change as they interact with the gravitational fields of other bodies, but many known objects are calculated with limited data, which increases the error in future predictions of possible close encounters. Additional observations and measurements need to be compiled each time a particular NEO passes close to Earth so that its current orbit may be more precisely determined thereby providing a more accurate prediction of future orbit trajectories. From a large-scale national budgetary perspective, a higher resolution in NEO orbit calculations is critical for NASA and other world-wide governmental bodies who are willing to participate in protecting the planet. If actual planet-defending programs are launched, it would be rather expensive if we move forward with low-confidence NEO orbit predictions such that we feel the need to blow up every NEO in the neighborhood. By providing as much observational data as possible, orbit predictions can become quite thorough, and governments–and their populations–will have the confidence to take action only on the very rare NEO of a significant size that is almost certainly inching its way toward Earth’s mesosphere.

# Asteroid Mapping 1ac

## Providing advance warning time is necessary to develop adequate international coordination and response to an incoming asteroid.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

It is clear from the media and the public’s response to false alarms and to news releases following major NEO workshops that, if a pending impact is forecast with reasonable and credible probability, there would be an immense and near-instantaneous global reaction. This is not necessarily a good thing. Without an adequate foundation prepared ahead of time, there is significant risk of “too many cooks spoiling the soup.” The “Peri-Event” period, after validation of a specific threat object and prior to impact or confirmation of successful deflection, will require intense international coordination and cooperation. Delays in reaching consensus on the approach to mitigate damage will reduce the options and increase the technical risk.

## U.S. leadership is essential to effective planetary defense.

Taylor Dinerman, 2009 (staff writer). “The new politics of planetary defense.” July 20, 2009. Online. Accessed April 12, 2011 at http://www.thespacereview.com/article/1418/1

Yet in the end, it is likely that the decision, if there is one, will rest with the President of the United States. He or she is the only world leader today with the wherewithal to deal with such a threat. If the US is have any claim to global leadership in the 21st century it will have to unambiguously take the lead in planetary defense. This is why any planning effort that leans to heavily on international institutions may endanger the whole planet. The process inside an organization like the UN would simply get bogged down in procedural and political questions. US leaders may find that the system would be paralyzed while, for example, nations argued over deflection or destructions methods or who would control and pay for them. Precious time would be lost while nations would consider their own best interests in supporting one approach or another. If the US is have any claim to global leadership in the 21st century it will have to unambiguously take the lead in planetary defense. It should do so in an open way and be ready to listen to everyone’s concerns and ideas. But if the Earth is to be effectively protected, the ultimate decisions will have to be American. In this case “global governance” could end up setting the stage for a disaster.

## Advanced planning for asteroid collisions is necessary to prevent ineffective and panicked reactions in a crisis.

Ivan Bekey, 2009 (International Academy of Astronautics), 2009, Dealing with the Threat to Earth From Asteroids and Comets, accessed April 12, 2011 at [http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups /SG%20Commission](http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups%20/SG%20Commission) %203/sg35/sg35finalreport.pdf

There is however a compelling argument for embarking on the establishment of a policy framework to address NEOs now. We need to use this finite window of opportunity, before a specific impact threat has been identified, to develop our policies in a balanced and objective manner. Experience has shown us that decisions made “in the heat of the moment” can be flawed, ill-judged, and compromised by subjective influences such as exposure to an impact threat (or lack of it). Mitigating the impact of a NEO will represent one of the greatest challenges ever posed to society, and the resulting technical solutions will be intrinsically coupled with wide ranging policy implications. We are obliged to ensure that a policy framework is set in place which will support these efforts rather than undermine them.

# Inherency Extensions: No/Limited Mapping Now

## NASA isn’t asteroid mapping now:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

Given the scientific findings, shouldn’t space rocks be one of NASA’s priorities? You’d think so, but Dallas Abbott says NASA has shown no interest in her group’s work: “The NASA people don’t want to believe me. They won’t even listen.” NASA supports some astronomy to search for near-Earth objects, but the agency’s efforts have been piecemeal and underfunded, backed by less than a tenth of a percent of the NASA budget. And though altering the course of space objects approaching Earth appears technically feasible, NASA possesses no hardware specifically for this purpose, has nearly nothing in development, and has resisted calls to begin work on protection against space strikes. Instead, NASA is enthusiastically preparing to spend hundreds of billions of taxpayers’ dollars on a manned moon base that has little apparent justification. “What is in the best interest of the country is never even mentioned in current NASA planning,” says Russell Schweick­art, one of the Apollo astronauts who went into space in 1969, who is leading a campaign to raise awareness of the threat posed by space rocks. “Are we going to let a space strike kill millions of people before we get serious about this?” he asks.

## Ignoring the space rock threat is part of NASA’s goals:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

After the presentation, NASA’s administrator, Michael Griffin, came into the room. I asked him why there had been no discussion of space rocks. He said, “We don’t make up our goals. Congress has not instructed us to provide Earth defense. I administer the policy set by Congress and the White House, and that policy calls for a focus on return to the moon. Congress and the White House do not ask me what I think.” I asked what NASA’s priorities would be if he did set the goals. “The same. Our priorities are correct now,” he answered. “We are on the right path. We need to go back to the moon. We don’t need a near-Earth-objects program.” In a public address about a month later, Griffin said that the moon-base plan was “the finest policy framework for United States civil space activities that I have seen in 40 years.”

# Significance Extensions: Asteroid Strike is Likely

## The odds of a dangerous space rock strike are one in 10 in the next century—the entire human race is at risk if we get it wrong:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

A generation ago, the standard assumption was that a dangerous object would strike Earth perhaps once in a million years. By the mid-1990s, researchers began to say that the threat was greater: perhaps a strike every 300,000 years. This winter, I asked William Ailor, **an asteroid specialist at The Aerospace Corporation,** a think tank for the Air Force, what he thought the risk was. Ailor’s answer: a **one-in-10 chance per century** of a dangerous space-object strike. Regardless of which estimate is correct, the likelihood of an event is, of course, no predictor. Even if space strikes are likely only once every million years, that doesn’t mean a million years will pass before the next impact—the sky could suddenly darken tomorrow. Equally important, improbable but cataclysmic dangers ought to command attention because of their scope. A tornado is far more likely than an asteroid strike, but humanity is sure to survive the former. The chances that any one person will die in an airline crash are minute, but this does not prevent us from caring about aviation safety. And as Nathan Myhrvold, the former chief technology officer of Microsoft, put it, “The odds of a space-object strike during your lifetime may be no more than the odds you will die in a plane crash—but with space rocks, it’s **like the entire human race is riding on the plane.”**

## It’s not a question of if, but when an asteroid hits us:

JUSTIN L. **KOPLOW, 2005** (J.D., Georgetown University Law Center, Georgetown International Environmental Law Review, Winter 2005, 17 Geo. Int'l Envtl. L. Rev. 273; Lexis)

Maybe that paradox is what makes such a story sell papers. Like any good urban legend, the "killer asteroid" story capitalizes on people's fears and perceptions as a story based sufficiently in reality to be believable, yet fantastic enough to titillate. Devastating acts of terrorism and the violence of war have made staggering losses of life suddenly conceivable. n4 The Hubble, once the out-of-focus butt of jokes, has become a tremendous scientific asset and recipient of a grass-roots campaign to prolong its use, lending credibility to the "killer asteroid" story. n5 As the Bush Administration has once again turned the national agenda to space and Mars exploration, space is again a hot topic. n6 But perhaps the greatest "hook" of all is simple experience. In a cosmos famed for its "billions and billions," n7 where Earth impacts and near misses are frequent and fantastic occurrences, one need only glance at the pock-marked moon for a nightly reminder of the likelihood of an asteroid impact. As the situation has accurately, but ominously, been stated, **the question of Earth impact is not one of "if," but "when."**

## Asteroid collisions are statistically inevitable:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

Several dozen scientists and technologists identified the nature of the impact hazard and potential solutions in an unpublished but available report. Even after discovery of the Chixchulub impact structure in Mexico and its temporal simultaneity with the Cretaceous-Tertiary (K-T) boundary and mass extinctions18, it has taken some Earth scientists a while to recognize and accept the statistical inevitability that Earth is struck by asteroids and comets. Each impact, typically spaced 50 to 100 My, liberates tens of millions to billions of megatons (MT, TNT-equivalent) of energy into the fragile ecosphere, which must have had dramatic consequences every time. Some skeptics still consider the Chixchulub impact to be only one of several contributing factors to the K-T extinctions [e.g.19]. They also point out that direct evidence firmly linking other, older mass extinctions to impacts is so far either more equivocal than for the K-T, or altogether lacking – but this is a natural result of the ongoing tectonic resurfacing of our planet. If the great mass extinctions can somehow be explained by forces that are much less sudden and powerful than impacts (e.g. episodes of volcanism or sea regressions), one must ask how the huge impacts that must have occurred failed to leave dramatic evidence in the fossil record.

## Probability of a 45m asteroid hitting this century is near 100%:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

4) 45 m diameter NEOs will typically not reach the surface, but could kill thousands with blast and heat since they release an amount of energy equivalent to 1,000 Hiroshima-size weapons. They are believed to impact on the average every 100 years, so the probability of an impact this century is near 100%. The Tunguska NEO of 1902 was an example of this class, though the Meteor Crater in Arizona, USA is also one.

## Asteroids are more numerous than previously thought, and their orbits aren’t stable:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

Other scientists are making equally unsettling discoveries. Only in the past few decades have astronomers begun to search the nearby skies for objects such as asteroids and comets (for convenience, let’s call them “space rocks”). What they are finding suggests that near-Earth space rocks are more numerous than was once thought, and that their orbits may not be as stable as has been assumed. There is also reason to think that space rocks may not even need to reach Earth’s surface to cause cataclysmic damage. Our solar system appears to be a far more dangerous place than was previously believed.

# Significance: Asteroid Strike is Likely

## Lots of near earth asteroids exist—potentially 20,000 hazardous asteroids & comets exist in the general vicinity of the Earth:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

Consider objects that are already near Earth, and the picture gets even bleaker. Astronomers traditionally spent little time looking for asteroids, regarding them as a lesser class of celestial bodies, lacking the beauty of comets or the significance of planets and stars. Plus, asteroids are hard to spot—they move rapidly, compared with the rest of the heavens, and even the nearby ones are fainter than other objects in space. Not until the 1980s did scientists begin systematically searching for asteroids near Earth. They have been finding them in **disconcerting abundance**. In 1980, only 86 near-Earth asteroids and comets were known to exist. By 1990, the figure had risen to 170; by 2000, it was 921; as of this writing, it is 5,388. The Jet Propulsion Laboratory, part of NASA, keeps a running tally at www.neo.jpl.nasa.gov/stats. Ten years ago, 244 near-Earth space rocks one kilometer across or more—the size that would cause global calamity—were known to exist; now 741 are. Of the recently discovered nearby space objects, NASA has classified 186 as “impact risks” (details about these rocks are at www.neo.jpl.nasa.gov/risk). And because most space-rock searches to date have been low-budget affairs, conducted with equipment designed to look deep into the heavens, not at nearby space, the actual number of impact risks is undoubtedly much higher. Extrapolating from recent discoveries, NASA estimates that there are perhaps 20,000 potentially hazardous asteroids and comets in the general vicinity of Earth.

## The impacts aren’t science fiction—we’ve had many near misses and it is certain that more asteroids are on the way:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

The prospect of large exogenous objects crashing into Earth is, **quite unfortunately, not science fiction.** As hinted at by the near-misses previously described, **it has happened many times during our planet's known history,** and there is **every reason to believe that it will happen again.** Clear scientific evidence currently exists of approximately 140 "hypervelocity impact craters" on Earth, and this number is increasing by about 3 to 5 new craters each year. n9 As indicated in the Table in the appendix to this article, these craters are found in virtually every part of the globe, with many located within areas in the United States and Western Europe that are now heavily populated.

# Harms Extensions: Asteroids Risk Extinction

## Asteroids are the greatest long-term risk to human life:

Henry **Fountain,** 2/7/20**03** (“Avoiding asteroid Armageddon: How do you stop an asteroid from hitting Earth? Hollywood envisions nuclear weapons, but scientists favor a gentler approach, “

<http://www.thefreelibrary.com/Avoiding+asteroid+Armageddon:+How+do+you+stop+an+asteroid+from...-a097550703>)

A comet or asteroid with an orbit or trajectory that comes near Earth's orbit, often drawn into such a path by the gravitational effect of the Earth and other planets. larger than a kilometer (0.6 miles) in diameter by 2008. Asteroids of this size are thought to strike Earth about once every million years. They are capable of producing destruction on a regional scale or worse, so they represent the biggest long-term risk to human life.

## The dinosaurs prove: asteroids can cause rapid extinction:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

Evidence accumulates that the greatest mass extinction of all, the Permian-Triassic event, **was exceptionally sudden** 53; one recent study that argues for a gradual P-T extinction is **invalidated by its faulty methodology**. It is possible that the K-T impact was **exceptionally efficient in causing extinction** (e.g., because of the composition of the rocks where it hit, or if it were an oblique impact or augmented by accompanying impacts). However, straightforward evaluations of the expected physical 54 and biological 55 repercussions of massive impacts suggest that any such impact should result in such extreme environmental havoc that **a mass extinction would be plausible**, although conditions may cause consequences to vary among impacts of similar magnitude 56. It is plausible that the difficulty of finding incontrovertible proof of the impact origin of earlier mass extinctions is because of the much poorer preservation and quality of the more ancient geological records.

## Comets can be civilization killers—we need to take them seriously:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

It has been argued that they physically disintegrate29, because if they became dormant, a significant number of objects with asteroidal appearance on long-period orbits should have been detected by the NEO surveys, which is not the case. Accordingly, the contribution of long-period comets to the threatening NEO population has recently (see ref. 22) been assessed to be very low (~1%). Nonetheless, there are many more comets of very large size, say greater than a few km, than asteroids, and since NEOs of such sizes **are the “civilization killers”** they need to be considered more seriously than has been done in the past.

## A large enough asteroid would cause extinction—the ozone layer would be destroyed, agriculture would be wiped out worldwide, and a firestorm the size of India would erupt:

Clark R. **Chapman, 2004** (Southwest Research Institute, March 4, 2004, <http://www.b612foundation.org/papers/Chapman_hazard_EPSL.pdf>.)

6.1. 2–3 km diameter civilization destroyer A million-megaton impact, even though 100 times less energetic than the K–T impact, would probably destroy civilization as we know it. The dominant immediate global effect would be sudden cooling, lasting many months, due to massive injection of dust into the stratosphere following impact. Agriculture would be largely lost, worldwide, for an entire growing season. Combined with other effects (a firestorm the size of India, destruction of the ozone layer, etc.), it is plausible that billions might die from collapse of social and economic institutions and infrastructure. No nation could avoid direct, as well as indirect, consequences of unprecedented magnitude. Of course, because civilization has never witnessed such an apocalypse, predictions of consequences are fraught with uncertainty.

# Harms: Case Outweighs Nuclear War

## The impact of a large asteroid strikes outweighs all of their disads—it risks damage that exceeds a full-scale nuclear war—all of the world is put at risk:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

The impact of a **sufficiently large object on land** may cause **a blackout scenario** in which dust raised by the impact prevents sunlight from reaching the surface [of the Earth] for **several months**. Lack of sunlight terminates photosynthesis, prevents creatures from foraging for food, and leads to precipitous temperature declines... Obviously even much [\*125] smaller impacts would have the potential to **seriously damage human civilization,** **perhaps irreparably**. n26 In addition to the dust raised from the initial impact, smoke and particulate matter from vast, uncontrollable fires may greatly exacerbate this blackout effect. A large space object generates tremendous heat, regardless of whether it is destroyed in the atmosphere or physically hits the surface of the Earth. n27 These fires can reach far beyond the impact area, due to atmospheric phenomena associated with the entry of a huge, ultra-high speed object. n28 A huge mass of dust, smoke, and soot lofted into Earth's atmosphere could lead to effects similar to those associated with the **"nuclear winter" theory,** n29 but on **a much larger, much more deadly scale.** Such effects are now widely believed to have been a major factor contributing to the mass extinction spasms. n30 These cataclysmic effects may have been **worsened still further** by other collateral phenomena associated with the impact. For example, **acid rain, pronounced depletion of the ozone layer, and massive injections of water vapor into the upper atmosphere may be indirect effects**, each with its own negative consequences for life on Earth. n31 It is true that destructive impacts of gigantic asteroids and comets are extremely rare and infrequent when compared with most other dangers humans face, with the [\*126] intervals between even the smallest of such events amounting to many human generations... No one alive today, therefore, has ever witnessed such an event, and indeed there are no credible historical records of human casualties from impacts in the past millennium. Consequently, it is easy to dismiss the hazard as negligible or to ridicule those who suggest that it be treated seriously. n32 On the other hand, as has been explained, when such impacts do occur, they are capable of producing destruction and casualties on a scale that far exceeds any other natural disasters; the results of impact by an object the size of a small mountain **exceed the imagined holocaust of a full-scale nuclear war**... Even the worst storms or floods or earthquakes inflict only local damage, while a large enough impact could have **global consequences and place all of society at risk**... Impacts are, at once, the least likely but the most dreadful of known natural catastrophes. n33

## The impact of extinction is a million times greater than merely regional nuclear wars:

Jason G. **Matheny, 2007** (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

Discussing the risks of "nuclear winter," Carl Sagan (1983) wrote: Some have argued that the difference between the deaths of several hundred million people in a nuclear war (as has been thought until recently to be a reasonable upper limit) and the death of every person on Earth (as now seems possible) is only a matter of one order of magnitude. **For me, the difference is considerably greater**. Restricting our attention only to those who die as a consequence of the war conceals its full impact. If we are required to calibrate extinction in numerical terms, I would be sure to include the number of people in future generations who would not be born. A nuclear war imperils all of our descendants, for as long as there will be humans. Even if the population remains static, with an average lifetime of the order of 100 years, over a typical time period for the biological evolution of a successful species (roughly ten million years), we are talking about some 500 trillion people yet to come. By this criterion, **the stakes are one million times greater for extinction** than for the more **modest nuclear wars that kill "only" hundreds of millions of people**. There are many other possible measures of the potential loss—including culture and science, the evolutionary history of the planet, and the significance of the lives of all of our ancestors who contributed to the future of their descendants. Extinction is the undoing of the human enterprise.

# Harms: Case Outweighs Nuclear War

## Even a small NEO strike outweighs a nuclear war:

Rusty **Schweickart, 2004** (April 7, Chairman of the Board, B612 Foundation, <http://www.spaceref.com/news/viewsr.html?pid=12482>)

First I'd like to thank you for the invitation to speak with you today about this emerging public policy issue of near Earth objects (NEOs) threatening life on Earth. One might have thought, just a few years ago, that the subject of asteroids was one for space wonks and wanna-be astronauts and astronomers. But today the realization is rapidly dawning on the media and the general public that asteroids are a subject of more than passing interest! More and more people are coming to know that some few of these asteroids do not silently pass the Earth, but indeed **crash in,** largely unannounced. On the rare occasions when this happens they can **wreak havoc of a magnitude unprecedented in human history**. At the upper limit impacts by large asteroids have caused global destruction leading to the **virtually instantaneous extinction of life** for most of the species living at the time. The dinosaurs were momentary witnesses to a billion megaton event of this kind 65 million years ago. At the lower limit of concern, but occurring much more frequently, we are dealing with events with an explosive force of 10-15 megatons. It is worth pointing out, however, that these **small, most frequent events** are **more powerful than the blast** from the **most powerful nuclear weapon in the current U.S. nuclear arsenal.**

## (--) Even if the probability of an extinction level event is low, it represents the value of all future lives:

Jason G. **Matheny, 2007** (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

In this century a number of events could extinguish humanity. The probability of these events may be very low, but the expected value of preventing them could be high, **as it represents the value of all future human lives**. We review the challenges to studying human extinction risks and, by way of example, estimate the cost effectiveness of preventing extinction-level asteroid impacts.

## (--) The risk calculus goes our way—doing nothing in the face of catastrophe abdicates our duty to protect the planet:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

What is the most prudent course of action when one is confronted with an extremely rare yet enormously destructive risk? Some may be tempted to do nothing, in essence gambling on the odds. But because the consequences of guessing wrong may be so severe as to mean the end of virtually all life on planet Earth, the wiser course of action would be to take reasonable steps to confront the problem. Ultimately, rare though these space strikes are, there is no doubt that they will happen again, sooner or later. To do nothing is to abdicate our duty to defend the United States, and indeed the entire world, and place our very survival in the uncertain hands of the false god of probabilities. Thus, the mission of planetary defense might be considered by the United States at some point in time, perhaps with a role played by the military, including the United States Air Force.

## (--) Even low order extinction events should be avoided because the stakes are so high:

Jason G. **Matheny, 2007** (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

More recent predictions of human extinction are little more optimistic. In their catalogs of extinction risks, Britain's Astronomer Royal, Sir Martin Rees (2003) , gives humanity 50-50 odds on surviving the 21st century; philosopher Nick Bostrom argues that it would be "misguided" to assume that the probability of extinction is less than 25%; and philosopher John Leslie (1996) assigns a 30% probability to extinction during the next five centuries. The "Stern Review" for the U.K. Treasury (2006) assumes that the probability of human extinction during the next century is 10%. And some explanations of the "Fermi Paradox" imply a high probability (close to 100%) of extinction among technological civilizations (Pisani, 2006 ).4 Estimating the probabilities of unprecedented events is subjective, so we should treat these numbers skeptically. Still, even if the probability of extinction is several orders lower, because the stakes are high, it could be wise to invest in extinction countermeasures.

# Harms: Case Outweighs Nuclear War

## (--) A two kilometer asteroid is twenty million times more powerful than the Hiroshima bomb:

JUSTIN L. **KOPLOW, 2005** (J.D., Georgetown University Law Center, Georgetown International Environmental Law Review, Winter 2005, 17 Geo. Int'l Envtl. L. Rev. 273; Lexis)

Of course, all of those secondary effects come after the initial concussive force of the impact itself. It has been estimated that an asteroid of two kilometers in diameter would impact the Earth at a speed of 30,000 kilometers per hour, with an explosive force of 320,000 megatons of TNT. n17 For reference, the Hiroshima atomic bomb was just 10 to 15 kilotons of TNT and it killed 60,000 people in the initial destruction alone. n18 The Hiroshima bomb created a ground zero temperature approaching 7000 degrees Fahrenheit, with blast winds of 980 miles per hour and serious damage done over 15,000 feet from ground zero. n19 Destruction inside one mile was total. A two-kilometer wide asteroid is twenty million times more powerful than the Hiroshima bomb, which is the most deadly weapon ~~man~~ has ever used in war.

# Time Frame is Irrelevant

## (--) Time-frame is irrelevant when facing the risk of extinction:

Jason G. **Matheny, 2007** (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

An extinction event today could cause the loss of thousands of generations. This matters to the extent we value future lives. Society places some value on future lives when it accepts the costs of long-term environmental policies or hazardous waste storage. Individuals place some value on future lives when they adopt measures, such as screening for genetic diseases, to ensure the health of children who do not yet exist. Disagreement, then, does not center on whether future lives matter, but on how much they matter.6 Valuing future lives less than current ones ("intergenerational discounting") has been justified by arguments about **time preference**, growth in consumption, uncertainty about future existence, and opportunity costs. I will argue that **none of these justifications applies to the benefits of delaying human extinction.** Under time preference, a good enjoyed in the future is worth less, intrinsically, than a good enjoyed now. The typical justification for time preference is descriptive—most people make decisions that suggest that they value current goods more than future ones. However, it may be that people's time preference applies only to instrumental goods, like money, whose value predictably decreases in time. In fact, it would be difficult to design an experiment in which time preference for an intrinsic good (like happiness), rather than an instrumental good (like money), is separated from the other forms of discounting discussed below. But even supposing individuals exhibit time preference within their own lives, it is not clear how this would ethically justify discounting across different lives and generations (Frederick, 2006 ; Schelling, 2000 ). In practice, discounting the value of future lives **would lead to results few of us would accept as being ethical**. For instance, if we discounted lives at a 5% annual rate, a life today would have greater intrinsic value than a billion lives 400 years hence (Cowen & Parfit, 1992 ). Broome (1994) suggests most economists and philosophers recognize that **this preference for ourselves over our descendents is unjustifiable** and agree that ethical impartiality requires setting the intergenerational discount rate to zero. After all, if we reject spatial discounting and assign equal value to contemporary human lives, whatever their physical distance from us, we have similar reasons to reject temporal discounting, and assign equal value to human lives, whatever their temporal distance from us. I Parfit (1984) , Cowen (1992) , and Blackorby et al. (1995) have similarly argued that time preference across generations **is not ethically defensible**.7

## (--) Even if the impact is a long time off…We need to act now to develop procedures for deflection well before the asteroid risk:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

Assuming this has been established ahead of time (prior to an identified threat), such actions could be enacted within days of the impact discovery. If a process or procedure has not been fully vetted prior to discovery, it could easily be weeks before international concurrence is obtained.

## (--) Given that we never know when an asteroid might strike—the long time frame arguments make no sense:

Clark **Chapman**, 3/3/20**03** (scientist at the Southwest Research Institute's Department of Space Studies, in Boulder, Colorado, <http://www.astrobio.net/debate/389/collision-course-for-earth>)

Clark Chapman: Joe Veverka makes a major error when he compares the time scale for a large asteroid collision with the time scale for the sun turning into a red giant. There is ZERO chance that the sun will turn into a red giant during the next century, or even the next billion years, according to our robust understanding of the physics of stellar evolution. But asteroids strike AT RANDOM. If asteroids struck like clockwork, a kilometer-sized body every few hundred thousand years for example, then the analogy might work. But there is roughly a one-in-several-thousand chance that a kilometer-sized asteroid will strike during the 21st century. One could even strike tomorrow. One might well question what level of risk we are willing to accept by doing nothing about one-kilometer asteroids. Joe should argue that he's willing to accept the risk, given other higher priority concerns. But he's wrong, and he hurts his case, to make the classic error people make about lightning strikes and hundred-year floods: "the next one can't happen again soon." It has nothing to do with a "waiting time" or being "over the event horizon."

# Time Frame is Irrelevant

## (--) You should assess probability and not time-frame when it comes to extinction level events:

Jason G. **Matheny, 2007** (Department of Health Policy and Management, Bloomberg School of Public Health, <http://jgmatheny.org/matheny_extinction_risk.htm>)

Discounting could be justified by our uncertainty about future generations' existence. If we knew for certain that we would all die in 10 years, it would not make sense for us to spend money on asteroid defense. It would make more sense to live it up, until we become extinct. A discount scheme would be justified that devalued (to zero) anything beyond 10 years. Dasgupta and Heal (1979 , pp. 261–262) defend discounting on these grounds—we are uncertain about humanity's long-term survival, so planning too far ahead is imprudent.8 Discounting is an approximate way to account for our uncertainty about survival (Ponthiere, 2003 ). But it is unnecessary—**an analysis of extinction risk** should equate the value of **averting extinction at any given time** with the expected value of humanity's future from that moment forward, **which includes the probabilities of extinction in all subsequent periods** (Ng, 2005 ). If we discounted the expected value of humanity's future, we would count future extinction risks twice—once in the discount rate and once in the undiscounted expected value—and underestimate the value of reducing current risks. In any case, Dasgupta and Heal's argument does not justify traditional discounting at a constant rate, as **the probability of human extinction is unlikely to be uniform in time**.9 Because of nuclear and biological weapons, the probability of human extinction could be higher today than it was a century ago; and if humanity colonizes other planets, the probability of human extinction could be lower then than it is today.

## Even if the risk of impact isn’t immediate: we should develop policies now to avoid panicked reactions in a crisis:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

There is however a compelling argument for embarking on the establishment of a policy framework to address NEOs now. We need to use this finite window of opportunity, before a specific impact threat has been identified, to develop our policies in a balanced and objective manner. Experience has shown us that decisions made “in the heat of the moment” can be flawed, ill-judged, and compromised by subjective influences such as exposure to an impact threat (or lack of it). Mitigating the impact of a NEO will represent one of the greatest challenges ever posed to society, and the resulting technical solutions will be intrinsically coupled with wide ranging policy implications. We are obliged to ensure that a policy framework is set in place which will support these efforts rather than undermine them.

# Harms: Even Small Asteroids Bad

## Even smaller asteroids can have devastating impacts:

JUSTIN L. **KOPLOW, 2005** (J.D., Georgetown University Law Center, Georgetown International Environmental Law Review, Winter 2005, 17 Geo. Int'l Envtl. L. Rev. 273; Lexis)

It is the asteroids between these poles -- too large to be fended off by Earth's atmosphere, but too small to pose a global threat (roughly leaving the fifty meters to one to two kilometer range) -- that are the province and concern of this paper. Such an asteroid "impacted" the Tunguska region of Siberia, Russia in 1908. Residents saw a pale blue light moving northward across the sky. n25 The object exploded about six to ten kilometers above the ground, creating a column of fire and smoke more than twenty kilometers tall and, although no crater was formed, flattening over 2000 square kilometers of forest land. n26 The object is now believed to have been a stony asteroid of approximately eighty meters in diameter. It entered Earth's atmosphere at an estimated Mach forty-five, creating a shock wave of superheated air that literally blew apart the asteroid and the ground region below it. n27 As the Tunguska asteroid shows, even smaller impacts can have catastrophic results. The concussive force of a Tunguska-sized asteroid is estimated at ten to fifteen megatons tons of TNT, still 1000 times more powerful than the Hiroshima bomb. n28 And 2000 square kilometers is roughly ten times the size of Washington, D.C. n29

## Intense acceleration and heat from the earth’s atmosphere causes smaller asteroids to explode while entering the earth’s atmosphere:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

Comets, asteroids, and the little meteors that form pleasant shooting stars approach Earth at great speeds—at least 25,000 miles per hour. As they enter the atmosphere they heat up, from friction, and compress, because they decelerate rapidly. Many space rocks explode under this stress, especially small ones; large objects are more likely to reach Earth’s surface. The angle at which objects enter the atmosphere also matters: an asteroid or comet approaching straight down has a better chance of hitting the surface than one entering the atmosphere at a shallow angle, as the latter would have to plow through more air, heating up and compressing as it descended. The object or objects that may have detonated above Canada 12,900 years ago would probably have approached at a shallow angle.

## Small asteroids can decimate entire countries—this can occur even with an upper-atmosphere detonation:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

A more recent event gives further cause for concern. As buffs of the television show The X Files will recall, just a century ago, in 1908, a huge explosion occurred above Tunguska, Siberia. The cause was not a malfunctioning alien star-cruiser but a small asteroid or comet that detonated as it approached the ground. The blast had hundreds of times the force of the Hiroshima bomb and devastated an area of several hundred square miles. Had the explosion occurred above London or Paris, the city would no longer exist. Mark Boslough, a researcher at the Sandia National Laboratory, in New Mexico, recently concluded that the Tunguska object was surprisingly small, perhaps only 30 meters across. Right now, astronomers are nervously tracking 99942 Apophis, an asteroid with a slight chance of striking Earth in April 2036. Apophis is also small by asteroid standards, perhaps 300 meters across, but it could hit with about 60,000 times the force of the Hiroshima bomb—enough to destroy an area the size of France. In other words, small asteroids may be more dangerous than we used to think—and may do considerable damage even if they don’t reach Earth’s surface. Until recently, nearly all the thinking about the risks of space-rock strikes has focused on counting craters. But what if most impacts don’t leave craters? This is the prospect that troubles Boslough. Exploding in the air, the Tunguska rock did plenty of damage, but if people had not seen the flashes, heard the detonation, and traveled to the remote area to photograph the scorched, flattened wasteland, we’d never know the Tunguska event had happened. Perhaps a comet or two exploding above Canada 12,900 years ago spelled the end for saber-toothed cats and Clovis society. But no obvious crater resulted; clues to the calamity were subtle and hard to come by.

# Harms Extensions: Cooling

## A detonation of a space rock in the upper atmosphere risks global cooling:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

A team of researchers led by Richard Firestone, of the Lawrence Berkeley National Laboratory, in California, recently announced the discovery of evidence that one or two huge space rocks, each perhaps several kilometers across, exploded high above Canada 12,900 years ago. The detonation, they believe, caused widespread fires and dust clouds, and **disrupted climate patterns so severely that it triggered a prolonged period of global cooling.** Mammoths and other species might have been killed either by the impact itself or by starvation after their food supply was disrupted. These conclusions, though hotly disputed by other researchers, were **based on extensive examinations of soil samples** from across the continent; in strata from that era, scientists found widely distributed soot and also magnetic grains of iridium, an element that is rare on Earth but common in space. Iridium is the meteor-hunter’s lodestar: the discovery of iridium dating back 65 million years is what started the geologist Walter Alvarez on his path-breaking theory about the dinosaurs’ demise.

## New ice age as devastating as a nuclear war:

**Chattanooga Times Free Press**, May 30, 20**04**; Lexis

"(T)he threat of a new ice age must now stand alongside nuclear war as a likely source of wholesale death and misery for [sic hu]mankind," one activist opined in a 1975 issue of National Wildlife.

# Harms Extensions: Famines Impacts

## Abrupt agricultural shortfalls trigger worldwide conflict:

William **Calvin, 1991** Whole Earth Review, 12/22/91; LEXIS

But non-Europeans are vulnerable too, and not just those along the. eastern shores of North America (and elsewhere around the world where repercussions of the Younger Dryas have been detected). Abrupt and widespread **agricultural shortfalls** in densely populated technological societies tend to **suggest lebensraum-style global conflict**. Affected populations will initially switch (as they have during brief droughts of the past) to themselves eating the feed grains that now produce meat at 20 percent efficiency - but remember how poorly an "economic response' worked for Ireland in the nineteenth-century famine. Another cold spike need not endure for 800 years to exhaust stockpiles and people's patience. Just imagine any country affected by the North Atlantic Current **contemplating starvation** - while possessing the **military technology needed to take over another country** (which will undoubtedly be described by the aggressors as 'irresponsibly squandering its agricultural potential while others starve").

## (--) An asteroid strike on land could trigger crop failures around the world:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

“A most dread portent took place,” the Byzantine historian Procopius wrote of 536; the sun “gave forth its light without brightness.” Frost reportedly covered China in the summertime. Still, the harm was mitigated by the ocean impact. When a space object strikes land, it kicks up more dust and debris, increasing the global-cooling effect; at the same time, the combination of shock waves and extreme heating at the point of impact generates nitric and nitrous acids, producing rain as corrosive as battery acid. If the Gulf of Carpentaria object were to strike Miami today, most of the city would be leveled, and the atmospheric effects **could trigger crop failures around the world.** What’s more, the Gulf of Carpentaria object was a skipping stone compared with an object that Abbott thinks whammed into the Indian Ocean near Madagascar some 4,800 years ago, or about 2,800 B.C. Researchers generally assume that a space object a kilometer or more across would cause significant global harm: widespread destruction, severe acid rain, and dust storms that would darken the world’s skies for decades.

## (--) An asteroid collision could destroy the world’s food chain—ending almost all life on Earth:

JUSTIN L. **KOPLOW, 2005** (J.D., Georgetown University Law Center, Georgetown International Environmental Law Review, Winter 2005, 17 Geo. Int'l Envtl. L. Rev. 273; Lexis)

In the 570-million-year period for which abundant fossil remains are available, there have been five great biological crises, during which many groups of organisms died out. The most recent of the great extinctions is used to define the boundary between the Cretaceous and Tertiary periods, about 65 million years ago. At this time, the marine reptiles, the flying reptiles, and both orders of dinosaurs died out, and extinctions occurred at various taxonomic levels among the marine invertebrates. Dramatic extinctions occurred among the microscopic floating animals and plants; both the calcareous planktonic foraminifera and the calcareous nannoplankton were nearly exterminated, with only a few species surviving the crisis... In brief, our hypothesis suggests that **an asteroid struck the earth**, formed an impact crater, and some of the dust-sized material ejected from the crater reached the stratosphere and was spread around the globe. This dust effectively **prevented sunlight from reaching the surface for a period of several years,** until the dust settled to earth. Loss of sunlight suppressed photosynthesis, and as a result most food chains collapsed and the extinctions resulted. n11 While Alvarez spoke of calcareous plankton, the public's childlike fascination with dinosaurs guaranteed that his scientific jargon could not keep the lid on such a radical hypothesis. Alvarez' article explains the disappearance of the dinosaurs, one of the great puzzles of the century, as rife with scientific and theological impact. The answer he proposed was just as fantastic as the question: sixty-five million years ago, an asteroid 180 kilometers wide hit the Earth with an explosive force five billion times more powerful than the atomic bomb dropped on Hiroshima, creating the tremendous Chicxulab crater, better known as the Gulf of Mexico. n12 The disaster of an asteroid impact on land would only partially stem from actual impact. As Alvarez theorized, the asteroid would **kick up dust and debris sufficient to choke out sunlight for years**. Photosynthesis could not occur and with the death of vegetation the world's food chains would break, effectively [\*278] **ending the majority of life on Earth**. n13

# Harms Extensions: Ozone Depletion Impact Extensions

## Ozone depletion threatens human survival:

**Turco, 2003** (<http://www.ioe.ucla.edu/academic/M1BReadings/Ozone%20Handout-03doc.pdf>)

Ozone is singled out as one of the most important constituents of the atmosphere. It is more important than carbon dioxide or methane. Ozone was the first atmospheric compound to be placed on the endangered list, the first chemical to be preserved by international treaty. The vice president of the United States, Albert Gore, wrote a book discussing ozone, warning of an impending environmental disaster if action were not taken to conserve it. We see stories in the media concerning skin cancer epidemics and “ozone holes.” Stratospheric ozone has been, and remains, **essential to life;** it is **imperative that we preserve the ozone layer for as long as we hope to survive on this planet.**

# Harms Extensions: Species Extinction

## (--) Asteroid collisions cause massive environmental damage and risk widespread species extinction:

Clark R. **Chapman, 2004** (Southwest Research Institute, March 4, 2004, <http://www.b612foundation.org/papers/Chapman_hazard_EPSL.pdf>.)

During the Phanerozoic, there must have been several K–T (or greater) impact events, roughly equaling the number of major mass extinctions recorded in the fossil record. Only the K–T bound-ary extinction is now accepted as being largely, or exclusively, due to impact (the formation of Chicxu-lub). Evidence accumulates that the greatest mass extinction of all, the Permian–Triassic event, was exceptionally sudden [54] and is associated with evidence for impact [55], but generally the search for evidence as robust as what proved the impact origin of the K–T has been unproductive. Perhaps the K–T impact was exceptionally efficient in effect-ing extinction (e.g., because of the composition of the rocks where it hit, or if it were an oblique impact or augmented by accompanying impacts). However, straightforward evaluations of the expected physical [56] and biological [57] repercussions of massive impacts suggest that **any such impact should result in such extreme environmental havoc that a mass extinction would be plausible**, although conditions may cause consequences to vary from impacts of similar magnitude [58].

# Economy Add-on

## A) Asteroids will devastate the economy: they have a far greater impact than other natural disasters:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

Differences Between Impact Threat and Other Natural Disasters The world does not lack for examples of natural disasters with global extent or local horrific impact. Earthquakes, floods, mudslides, and storms annually take hundreds of thousands of lives and impose significant economic and social costs1. In 2005 157 million people—seven million more than in 2004—required immediate assistance, were evacuated, injured or lost their livelihoods. Frequently, significant fractions of the deaths or other consequences of natural disasters are attributable to single events. The Indian Ocean tsunami accounted for 92 per cent of the deaths in 2004, and a South Asian earthquake accounted for 81 per cent of the deaths in 2005. Disasters in 2005 cost a total of $159 billion in damage, but of this, 78 percent were for losses caused by Hurricane Katrina in the United States. Consequences of an asteroid impact share many characteristics of natural disasters the world has experienced, but there are significant differences also: • Few natural disasters have the potential **for near instantaneous global devastation**. • The time, the effect, and to some degree the location of an asteroid impact can be forecast weeks to years in advance • The impact can be completely prevented These differences shape the international response to the unique characteristics of an asteroid impact.

## B) Economic Decline Causes Nuke War:

Walter Mead, NPQ's Board of Advisors, New Perspectives Quarterly, Summer 1992, p.30

What if the global economy stagnates-or even shrinks? In the case, we will face a new period of international conflict: South against North, rich against poor, Russia, China, India-these countries with their billions of people and their nuclear weapons will pose a much greater danger to world order than Germany and Japan did in the '30s.

## An asteroid impact could inflict hundreds of billions of dollars of damage:

Ivan **Bekey, 2009** (Dealing with the THREAT TO EARTH From ASTEROIDS and COMETS, International Academy of Astronautics, <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

If the encounter does not result in impact, either because the asteroid naturally missed the Earth

or because it was successfully deflected, there will still be a substantial recovery effort. Evacuees will

be able to return home, but it must be done in an orderly fashion. A lesson from the United States’ experience with Katrina is that not everyone will be anxious to go home. Restoring the economic viability of the evacuation zone may be a non-trivial task, if many of the inhabitants and much of the industry relocated. The entire infrastructure created in response to the crisis will need to be decommissioned or converted to other uses. All of these factors can have international dimensions if the evacuees relocated to other countries. If the encounter does result in an impact, the international community must be ready to respond quickly and effectively to a level of destruction that could easily eclipse anything seen in the global experience with natural disasters. While loss of life may be minimized by effective evacuation, the **loss of infrastructure alone could measure upward of hundreds of billions of dollars.**

# Space Junk Add-On (1/2)

## Planetary defenses can be used against space debris and would not be considered weapons:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

n96 It is conceivable that a planetary defense system also could be used to destroy certain exceptionally large ~~man~~made pieces of space debris that would pose a threat upon reentering the atmosphere. SkyLab is a notable example of manmade space debris that, at least potentially, was dangerous once its useful life was over. Even the largest such objects are dwarfed by the comets, meteors, and asteroids that would be the usual targets of a planetary defense system, so it is very likely that the system would lack sufficient precision to be used against them. If this is the case, the system would be ineffective as a defense against such comparatively small objects. But if the system could be used effectively against manmade space debris, the fact that the debris is no longer under any human control and is not directed offensively against any target would allow the planetary defense system to be employed against the debris without jeopardizing its classification as a non-weapon, consistent with the arguments set forth previously. Discarded, useless, used-up pieces of space debris are different in kind from ICBMs or other missiles that SDI, for example, was intended to target. Use of a planetary defense system against such debris is thus akin to its use against comets, meteors, and asteroids; in each instance, the target is not of military value and is not under any recent human control, if at all.

## -Human space junk threatens satellites

**Bird 03**

(American Business Law Journal March 22, 2003 SECTION: No. 3, Vol. 40; Pg. 635; ISSN: 0002-7766 HEADLINE: Procedural challenges to environmental regulation of space debris. BYLINE: Bird, Robert C, l/n)

Human-made space debris, the focus of this paper, poses the primary risk to human activities. (13) Natural debris usually escapes Earth's orbits where spacecraft and satellites are commonly found. (14) Human-made debris, on the other hand, tends to remain in Earth's orbits during its lifetime. (15) Human-made space debris also confines itself to the orbits most needed by spacecraft and satellites, clogging them much quicker than natural debris. (16)

## US economy dependent on satellites

**Dowd 02**

(World and I May 1, 2002 SECTION: No. 5, Vol. 17; Pg. NA ; ISSN: 0887-9346 HEADLINE: Taking the high ground - The U.S. Military Marches Into Space. BYLINE: Dowd, Alan W, l/n)

Space already plays a crucial role in the U.S. economy, and America's dependence on space will only deepen in the coming decades. Whether we recognize it or not, what happens in space affects our very way of life. "More than any other country," Rumsfeld argues, "the United States relies on space for its security and well-being."9 The United States has more than eight hundred active satellites and probes orbiting the earth at any given moment. Fully a quarter of them have no military purpose at all. Instead, they circle the earth to relay everything from Nike ads to the Nikkei average; improve the use and development of farmland; guide ships, planes, and trucks to their destinations; synchronize financial networks; support police and fire departments; and connect a people and an economy that move at ever- increasing speed.

## Economic decline leads to nuclear war

**Mead 1992** (Sir Walter Russell, *New Perspectives Quarterly*, p. 30 Summer)

If so, this new failure – the failure to develop an international system to hedge against the possibility of worldwide depression – will open their eyes to their folly. Hundreds of millions – billions – of people around the world have pinned their hopes on the international market economy. They and their leaders have embraced market principles – and drawn closer to the West – because they believe our system can work for them. But what if it can’t? What if the global economy stagnates – or even shrinks? In that case, we will face a new period of international conflict: South against North, rich against poor. Russia, China, India – these countries with their billions of people and their nuclear weapons will pose a much greater danger to world order than Germany and Japan did in the ‘30s.

# Solvency: Advance Warning Allows for Deflection

## Asteroid search programs give us enough time to deflect an asteroid:

Thomas D. **Jones, 2008** (Aerospace America, October,

<http://www.aiaa.org/aerospace/images/articleimages/pdf/View%20from%20Here1.pdf>)

Deciding to deflect Search programs will **usually give us years, if not decades, of impact warning**. But how should we use this vital, and worrisome, information? At the outset, we can prepare evacuation and disaster mitigation plans to cope with an unexpected or unavoidable impact.

## Planetary defense systems will have months to detect, track, and destroy an asteroid:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

The origin of the targets presents another enormous difference. Threatening space objects would begin a course of intercept with the Earth from literally millions of miles away. In contrast, ICBMs originate on Earth itself, and possess a trajectory that barely even enters outer space. The ICBMs' flight path is infinitesimal compared to that of space objects. This means that a planetary defense system has the luxury of much more time--perhaps several months--to detect, track, characterize, and destroy its target.

## NEO impacts can be predicted and prevented:

Rusty **Schweickart, 2004** (April 7, Chairman of the Board, B612 Foundation, <http://www.spaceref.com/news/viewsr.html?pid=12482>)

While many lives are lost every year in natural disasters of one kind or another, there are few natural disasters that can reliably be predicted, much less prevented. Throughout human experience we have been faced with comforting and compensating the devastated after the disaster is over. With near Earth asteroid impacts, however, we are confronted with a massive natural disaster that can be both predicted AND prevented, and the public will come to understand that this is the case.

## Early warning means deflection tech will be ready in time:

**British National Space Centre, 2000**

(British National Space Centre, Report of the Task Force on Potentially Hazardous Near Earth Objects, http://www.spacecentre.co.uk/neo/report.html)

A number of possible mechanisms have been considered for deflecting or breaking up potentially hazardous Near Earth Objects; most would require the use of a spacecraft with some means of transferring energy or momentum to the object, for example by kinetic energy transfer (by heavy projectiles carried on the spacecraft or by causing a collision between asteroids), by chemical or nuclear explosives, or even by mounting "sails" on the object to harness the Sun's radiation pressure. Some of these mechanisms are more realistic than others. Given warnings of decades or centuries, new technological developments would almost certainly emerge. The Task Force believes that studies should now be set in hand on an international basis to look into the practical possibilities of deflection.

# Solvency: Deflection is Easy

## Deflection is easy: a slight course change can alter the asteroid’s orbit:

Gregg **Easterbrook, 2008** (<http://www.theatlantic.com/doc/200806/asteroids>)

Fortunately, it’s likely that just causing a slight change in course would avert a strike. The reason is the mechanics of orbits. Many people think of a planet as a vacuum cleaner whose gravity sucks in everything in its vicinity. It’s true that a free-falling body will plummet toward the nearest source of gravity—but in space, free-falling bodies are rare. Earth does not plummet into the sun, because the angular momentum of Earth’s orbit is in equilibrium with the sun’s gravity. And asteroids and comets swirl around the sun with tremendous angular momentum, which prevents them from falling toward most of the bodies they pass, including Earth. For any space object approaching a planet, there exists a “keyhole”—a patch in space where the planet’s gravity and the object’s momentum align, causing the asteroid or comet to hurtle toward the planet. Researchers have calculated the keyholes for a few space objects and found that they are tiny, only a few hundred meters across—pinpoints in the immensity of the solar system. You might think of a keyhole as the win-a-free-game opening on the 18th tee of a cheesy, incredibly elaborate miniature-golf course. All around the opening are rotating windmills, giants stomping their feet, dragons walking past, and other obstacles. If your golf ball hits the opening precisely, it will roll down a pipe for a hole in one. Miss by even a bit, and the ball caroms away.

## Deflection technologies can work together:

**Schweickart 2007 (**(Rusty, former astronaut head of B612 Foundation, The Sky Is Falling. Really. March 16,http://www.nytimes.com/2007/03/16/opinion/16schweickart.html?\_r=1)

The good news is that scientists feel we have the technology to intercept and deflect many asteroids headed toward Earth. Basically, if we have early enough warning, a robotic space mission could slightly change the orbit of a dangerous asteroid so that it would subsequently miss the planet. Two potential deflection techniques appear to work nicely together — first we would deflect the asteroid with kinetic impact from a missile (that is, running into it); then we would use the slight pull of a “gravity tractor” — a satellite that would hover near the asteroid — to fine-tune its new trajectory to our liking.

## The technology exists to move away threatening asteroids from Earth:

Clark R. **Chapman, 2004** (Southwest Research Institute, March 4, 2004, <http://www.b612foundation.org/papers/Chapman_hazard_EPSL.pdf>.)

Yet, contrasting with the irrational per-ceptions of the impact hazard, it potentially can be mitigated in much more concrete ways than is true of most hazards. An impact can be predicted in advance in ways that remain imperfect [70] but are much more reliable than predictions of earthquakes or even storms, and the components of technology exist—at affordable costs given the consequences of an actual impact—to move any threatening object away and avoid the disaster altogether. In contrast with the dinosaurs, human beings have the insight and capa-bility to avoid extinction by impacts.

## We have the technology to safely deflect asteroids from Earth:

Clark **Chapman**, 3/3/20**03** (scientist at the Southwest Research Institute's Department of Space Studies, in Boulder, Colorado, <http://www.astrobio.net/debate/389/collision-course-for-earth>)

Don Yeomans: As mentioned in last week's debate, an asteroid or comet larger than a kilometer colliding with the Earth would be a very rare event. One would only expect a collision of this type to occur every several hundred thousand years. Nevertheless, it has happened before and it could happen again in the near future. In the unlikely event that a sizable near-Earth object (NEO) is found to be on an Earth-threatening trajectory, would we have the technology to deflect the object in time so that it would pass harmlessly past the Earth? Clark Chapman: I think pieces of the technology are there. We have rockets that can launch the deflection hardware, and there are well-tested means to deliver and operate this hardware in the vicinity of a low-gravity body. In fact, one spacecraft already has landed on an asteroid - the NEAR-Shoemaker spacecraft landed on the asteroid "Eros" on Valentine's Day, 2001. What has not been done is to put all the technological tools in our toolbox together and make them work in the strange, unintuitive physical world of an asteroid. Also, much more thinking is necessary about the diversity of asteroid properties. We have sufficiently energetic tools to push on an asteroid and move it, but we need to consider how we might attach any deflection mechanism to an NEA and push it in the direction we want. Not every one-kilometer NEA will be easy to divert. Such a body is very massive, and a long lead-time of perhaps decades would be necessary to succeed, even without employing new or potentially dangerous technology. But, **fundamentally, we probably could do it,** provided there was sufficient motivation: namely, an asteroid headed our way, destined to collide with Earth some years or decades hence.

# Solvency Extensions: Deflection is Safe/Will be Non-Nuclear

## Key capabilities to deflect asteroids are already in the pipeline:

Rusty **Schweickart, 2004** (April 7, Chairman of the Board, B612 Foundation, <http://www.spaceref.com/news/viewsr.html?pid=12482>)

Mounting a mission to assure the public that when we discover an asteroid "with our name on it" we can deflect it from a life threatening impact on Earth does not require the development of additional new technologies. The key capabilities required are already "in the pipeline" of the existing Prometheus Program. No new NASA money is required, nor is a change in NASA's mission called for. What is required is that the B612 mission be incorporated within the Prometheus Program... a matter of policy.

## 98% of asteroids can be deflected with non-nuclear means:

Larry **Klaes,** 3/21/20**07** (staff writer, <http://seti.sentry.net/archive/bioastro/2007/Mar/0159.html>)

In contrast, Schweickart argues that the so-called "nuclear standoff" option should be used only as a last resort. He contends that 98 percent of the potential threats can be mitigated by using **less extreme measures**. For example, he favors the development of a "gravity tractor" - a spacecraft that would Hover near an asteroid for years at a time, using subtle gravitational attraction to draw the space rock out of a worrisome path. To kick it up a notch, Schweickart said a threatening NEO could first be hit with a kinetic impactor - say, a scaled-up version of the Deep Impact bullet that hit Comet Tempel 1 back in 2005 - and then the orbital track could be fine-tuned using the tractor. Navigational sensors aboard the tractor would check to make sure the NEO was on a completely safe path. "**This combination is obviously the way to go,**" he said.

## Nuclear weapon deflection fails—softer forms of deflection are superior:

Henry **Fountain**, 11/19/20**02** (staff writer, <http://www.nytimes.com/2002/11/19/science/space/19ASTE.html>)  
But it is becoming clear that a longtime assumption of many scientists and of Hollywood filmmakers that a nuclear weapon is the best way to save the planet from a threatening asteroid is no longer in such favor. Increasingly, those scientists who study asteroid hazards say that a subtler, quieter, slower approach might be called for. These scientists are turning T. S. Eliot on his head: it's not that the world will end with a whimper rather than a bang, they say. It's that it may not end that way. **A nuclear detonation**, some scientists say, could **break the asteroid** into several large pieces, **increasing, rather than eliminating, the threat**. And a blast some distance from an asteroid, designed to shove it into a slightly different orbit, might not work either; the asteroid **might soak up the energy like a sponge**. "I'd say forget that," said Dr. Keith A. Holsapple, a professor at the University of Washington who studies the effects of simulated nuclear explosions**. By contrast, most of the alternative approaches** would build up force gradually, gently nudging, rather than shoving, the asteroid. They would rely on the same basic Newtonian principle that for every action there is an equal and opposite reaction only written small, with tiny actions creating tiny opposite reactions that, given enough time, could shift an asteroid's orbit **enough to change a hit into a close call**.

## Nuclear weapons are only needed in rare cases—much simpler, non-nuclear methods solve for asteroid deflection:

Clark R. **Chapman, 2007** (Senior Scientist, Southwest Research Institute Dept. of Space Studies, Critique of "2006 Near-Earth Object Survey and Deflection Study: Final Report", <http://www.b612foundation.org/papers/NASA-CritChap.doc>)

The most serious problem with the substance of the Report is that it uses an absurd metric to assess the relative merits of approaches to NEO deflection and thus arrives at the problematic conclusion that the use of nuclear weapons is the preferred approach for deflecting any kind of NEO that would otherwise strike the Earth. While it is certainly a fact of physics that nuclear weapons are the only potentially available technology for dealing with an exceptionally large (>> 1 km) asteroid or comet, or for dealing with a smaller NEO if the warning time is unusually short (years rather than decades), these are very rare cases. **Much simpler, non-nuclear methods**, some based on technology that has **already flown in space**, are quite sufficient for handling the overwhelming proportion of plausible NEO impact scenarios...despite being downweighted by the misbegotten criteria applied in this Report.

# Solvency Extensions: US Leadership Key

## (--) The rest of the world is expecting the US to take the lead on the question of asteroids:

Lt Col Martin E. B. **France, 2000** (Air & Space Power Journal, Planetary Defense:

Eliminating the Giggle Factor, <http://www.airpower.maxwell.af.mil/airchronicles/cc/france2.html>)

A key component of the Shoemaker Report, as in the earlier Spaceguard Survey, was its international character. However, it seems that most nations interested in the NEO threat are **still awaiting America’s lead.** Russia, for example, has the technology and interest (Tunguska) among its astronomy and military communities to play a significant role in the Spaceguard Survey, but economic circumstances have precluded them from taking the initiative. Australia has recently backed away from its fledgling telescope program, which played a critical role in confirming NEOs first seen by other telescopes from its unique location in the southern hemisphere, and international attempts to encourage the Australian government to bring its program back into operation have failed.23 The United Kingdom, home of some of the most enthusiastic NEO watchers, formed a "Task Force on NEOs" led by Dr. Harry Atkinson. This group of four scientists has limited funding and is only tasked with making recommendation to Her Majesty’s Government by mid-2000 on how the UK should best contribute to the international effort on NEOs.24 Additionally, Spaceguard is a loose, voluntary consortium of international observatories and interested parties that serves to relay NEO identification to concerned groups and fellow participants.

# Politics Link Answer

## (--) No link--asteroids don’t get media interest nor is their an established constituency involved:

Taylor **Dinerman,** 7/20/20**09** (staff writer, <http://www.thespacereview.com/article/1418/1>)

Under the Bush Administration, a threat analysis matrix was used that divided possible conflicts according to probability and effects. Low-level global terrorism, for example, was regarded as highly likely to occur often but its effects were not seen as been in the same class with, say, a nuclear blast in downtown New York. This was the basis on which some of the early thinking that was done to study what might happen if an asteroid posed a risk to hit the Earth. The threat of a catastrophic celestial hit against planet Earth **carries little political weight**, due to **a lack of media interest** and the fact that the problem **does not fit into any of the normal government structures**.

# Asteroid Bomb DA Answers

## No link: since the US already has nuclear weapons: the asteroid bomb is meaningless:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

For nations that already have nuclear arsenals, **asteroid weapons might be of only academic interest**. Depending on the relative difficulty of acquiring a nuclear arsenal or equivalent weapons of mass destruction, the idea might be of more practical interest to other nations. The decision process and motivations that might lead some nation to acquire such weapons were discussed in Chapter Six.

## An asteroid bomb is useless as a weapon: the long lead-time needed for diverting the asteroid makes it meaningless for deterrence:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

Timing The above discussion made it clear that the lead time for deciding to employ a specific asteroid as a deterrent will **be at least months**. Some preparations could be made years in advance that might eliminate some of the delay: surveying candidate asteroids, prepositioning propulsion capabilities, perhaps even modifying likely as teroid orbits to improve their availability. For use as a nuclear equivalent deterrent, such preparations might even be necessary. The history of nuclear deterrence would make such a lengthy response delay seem unreasonable. After all, in the time it would take to prepare and deliver an asteroid strike, an opponent might be able to force the asteroid wielder to relinquish its belated asteroid response. Thus, even with the best of preparations to shorten delays,

the owner of an asteroid deterrent must convince potential opponents of the inevitability of its response. It helps that an asteroid on a collision path with the earth presents some physical basis for a perception of inexorability—particularly if the identity and location of the asteroid are not readily and quickly available to the defender. **But the real difficulty would be human**: conveying the **credibility of a commitment** to an irreversible, devastating response, even though a substantial delay that would allow time for second thoughts, recriminations, political changes, and opponent responses. In some cultures with longer memories and long-held grudges, a few months’ commitment to purpose might be trivial.

## Doesn’t turn the case: extinction causing asteroids are useless as weapons—no one would believe their deterrent value:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

By the time very small meteoroids impact the ground, they have slowed to several hundred or a few thousand miles per hour. These meteoroids are too small for this discussion. Very large asteroids or

comets penetrate the atmosphere as if it were not there and strike the ground with full force. At the larger end of this scale (diameter ≥1 km) are asteroids, whose effects are too great to be useful for strategic deterrence. **Threats of a mass extinction event are not likely to be credible.**

## No Link: Other options are simply smaller & cheaper than developing the asteroid bomb:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

Aside from the limited range of possible effects and the great uncertainty about the precision of an effect, one clear argument against asteroids as weapons is that **smaller, cheaper means of acquiring an equivalent to a nuclear deterrent are available.** The preceding com-parison with the Manhattan Project highlights the fact that the infrastructure costs for asteroid weapons are **at least an order of magnitude greater** than the cost for developing and producing nuclear weapons.

# Asteroid Bomb DA Answers

## An asteroid bomb will remain in the realm of science fiction:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

With some patience, waiting perhaps a month or two, suitable asteroids could be routinely found that would produce weapon effects equivalent to nuclear weapons with yields ranging from tens of kilotons to many megatons. With some effort, they could be diverted to weapon using technology (and extensive supporting infrastructure) similar to that for exploiting lunar materials, generating solar power with satellites, or defending against asteroids. However, at best, it **would take months** after a decision to use one as a weapon to reach the desired conclusion. Because much cheaper, more responsive weapons of mass destruction are readily available, this one is likely to **remain safely in the realm of science fiction**.

## No link: asteroids are useless as weapons: can’t control the effects precisely enough—

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

In summary, the suitability of weapon effect depends on the combination of size and materials. Precise control of the effects in an impact area would be very challenging. An object large enough to cause

a big explosion would generally have a high enough β to suffer only minor angular changes in its trajectory due to atmospheric effects. But even for such objects, precisely predicting the extent of destruction would require understanding their internal composition, including possible internal fracture statistics or heterogeneity, to predict the altitude of breakup and the extent of blast effects from the breakup. The breakup of the Brenham stony-iron meteorite, for example, produced some specimens that are essentially iron metal and others that are mixtures of iron and olivine, a variety of stone.

## No link: the tech necessary to create an asteroid weapon would be astronomically expensive: no reason why we’d spend the money to do it:

Robert **Preston, 2002** (RAND Corporation, Space Weapons Earth Wars,

<http://www.rand.org/pubs/monograph_reports/MR1209/MR1209.appc.pdf>)

Industrial-scale rocket propulsion is the fundamental technology necessary for turning asteroids into weapons. None of its elements are unknown. Proof of principle is well understood. Conceptual design studies are available in the literature on space and lunar colonization, although particular devices of the right size would need engineering development. Only the scale of the enterprise gives pause and invites comparison with World War II’s Manhattan Project. As the nation mobilized for war, total U.S. defense outlays went from about $2 billion a year to a peak of about $80 billion a year over five years (Clinton, 1997). The country spent about $2 billion in total (about $20 billion in 1996 dollars) to develop the scientific basis of atomic weapons and the industrial processes and infrastructure for extracting and refining the needed materials (Purcell, 1963, p. 13; JSC, 1998).9 Because of the sense of urgency, the project pursued parallel development paths—four paths for materials extraction, two paths for weapon design—without waiting for success in prerequisite elements of the program before committing resources to dependent elements. Yet for all its unprecedented scale, extravagant urgency, and remarkable success, the Manhattan Project was relatively modest compared to what would be required for asteroid weapons.

# Space Militarization Disad Answers

## (--) Turn: the plan stops the use of nuclear weapons in space: that would anger people far more.

## (--) No link: no proof other nations would view gravity tractors and solar sails as an attempt to weaponize space.

## (--) Case outweighs: failure to act risks multiple scenarios of extinction

## (--) Non-unique: space is already weaponized:

Baker **Spring, 2005** (Kirby Research Fellow in National Security Policy, “Slipping the Surly Bonds of the Real World: The Unworkable Effort to Prevent the Weaponization of Space” <http://www.heritage.org/research/nationalsecurity/hl877.cfm>)

Fact #1: Space is already weaponized. As catalogued earlier, the U.S. and other states possess a wide array of capabilities to use space to defend themselves and mount offensive opera­tions. No careful parsing of definitions can reverse this reality.

## (--) Turn: US space leadership key to benign uses of space—squandering the lead turns space over to more hostile powers:

Baker **Spring, 2005** (Kirby Research Fellow in National Security Policy, “Slipping the Surly Bonds of the Real World: The Unworkable Effort to Prevent the Weaponization of Space” <http://www.heritage.org/research/nationalsecurity/hl877.cfm>)

Through its persistence and creativity, the Unit­ed States now finds itself in a favorable position rel­ative to other states regarding the use of space for military purposes. Its lead, however, should not be taken for granted. If the United States rests on its laurels and squanders this advantage, it will cer­tainly regret it. Indeed, much of the rest of the world would likely regret it as well. The likelihood is that today’s emerging space powers—China, Iran, and North Korea, to name several—are not likely to be the benign force that the United States is today and will be in the future.

## (--) Turn: gaining the lead in space is critical to stopping a space arms race:

Baker **Spring, 2005** (Kirby Research Fellow in National Security Policy, “Slipping the Surly Bonds of the Real World: The Unworkable Effort to Prevent the Weaponization of Space” <http://www.heritage.org/research/nationalsecurity/hl877.cfm>)

Fact #4: Dissuasion is an option for confront­ing a space arms race. Both the 2001 Quadrennial Defense Review of the Bush Administration and the 2002 Nuclear Posture Review describe the concept of dissuasion. Dissuasion is a means for avoiding an arms race by convincing would-be enemies of the U.S. that they have little hope of competing effectively in such races in important areas. The concept is based on the well-founded assumption that these would-be enemies will engage in an arms race if they con­clude they can win it. Given the existing advantages the U.S. has in military space technologies and capabilities, as well as the inherent importance to the military of main­taining access to space and protecting valuable space assets, dissuasion is a concept readily adapt­able to military space. **If the U.S. military squan­ders its lead in military space capabilities,** it will **invite the arms race that arms control advocates say they wish to avoid**.

## Planetary defenses aren’t disallowed under the Outer Space Treaty:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

This customary international law, as well as the subsequent practice of the Parties, strongly supports the partial demilitarization view. If this view is indeed accepted, then planetary defense activities would be allowed under Article IV of the Outer Space Treaty, because they are defensive and non-aggressive in nature.

## Outer Space Treaty allows for planetary defenses:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

However, for purposes of planetary defense, which position prevails (the partial or total demilitarization view) may not finally be dispositive. If, as part of a planetary defense system, telescopes, sensors, and even some type of projectiles are established in orbit around Earth, or installed or tested on the moon or other "celestial bodies," it can be effectively argued that these are not weapons and are not military devices, because their sole purpose is to detect and defend against threatening natural objects from space. If this argument is accepted, then the first paragraph of Article IV of the Outer Space Treaty would clearly permit planetary defense in outer space, because no weapons would be involved. Likewise, the restrictions on weapons and military activities in the second paragraph would not apply, and planetary defense would be permissible on the moon or other celestial bodies. The asteroids, comets, and meteors that would be targeted are non-living, completely natural objects with no aspects of human input or control in their genesis or direction. Such objects are very different from humans and their manmade or man-directed products (such as buildings, bridges, and military equipment) that are the targets of weapons and military devices. Clearly, given the potential disasters a strike of a large natural space object could spawn, the detection and mitigation of these horrors is a classic, if not the ultimate example of "peaceful," i.e., non-aggressive action "for the benefit and in the interests of all countries."

# Disaster Relief Counterplan Answers

## (--) Permute: do both—creates double-solvency

## (--) No proof disaster relief efforts solve: our argument is that the asteroid will literally eliminate the human race overnight—extend our 1ac extinction level evidence.

## (--) Any after the fact disaster relief efforts are completely insufficient: the asteroid must be deflected or destroyed:

LIEUTENANT COLONEL JOHN C. **KUNICH, 1997** (Staff Judge Advocate, 50th Space Wing, Falcon Air Force Base, Colorado, Air Force Law Review, 41 A.F. L. Rev. 119; Lexis)

Mitigation, or response, could take several forms, depending in part on the nature and magnitude of a given threat, once it has been detected and evaluated. One possible response would be evacuation of the impact zone, to minimize loss of life. A closely related response is preparation to minimize the resultant damage due to fires, tidal waves, earthquakes, acid rain, and other after-effects, and to provide medical care to the victims. These forms of response, though important, would be **grossly inadequate when dealing with a truly massive threat** such as those discussed previously. In the event of a massive strike from space, the resultant apocalyptic disasters would render such efforts as fruitless as rearranging the deck chairs while the Titanic sinks. **The only meaningful response** to a massive strike is some form of direct intervention. Direct intervention may entail deflection or destruction of the approaching space object to prevent or mitigate any impact with Earth. The means for achieving this fall partially within the realm of existing military capabilities, and partially within the ambit of technologies superficially similar to some proposed/experimental aspects of the Strategic Defense Initiative (SDI).