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# Case Ans

## \*\*Probability Low Now\*\*

### The probability of a damaging asteroid strike is highly unlikely.

RTT News, ’11 (RTT News, 6/7/11, “Asteroid On The Way: Mark Your Calendar, But No Cause For Alarm,” 6/21/11, LexisNexis, MLK)

Near-earth-objects, or NEOs for short, refer to comets and asteroids passing close to Earth and have always fascinated astronomy buffs and laymen alike. Later this year, an asteroid will pass by the Earth at a distance of only a few hundred thousand kilometers - extremely close in cosmic terms. But while this will provide a prime sky-watching event, as well as a rare scientific opportunity, experts assure us that there is no danger from the object. Movies like "Armageddon" and "Deep Impact" have trained us to think of large space objects as a potential source of disaster, and in fact, NEOs could pose a problem someday. The general scientific consensus, according to famed British physicist Stephen Hawking, is that there will be a complete annihilation of our planet if it is hit by a comet or asteroid greater than 20 kilometers in diameter. But the probability of an object that size colliding with Earth is extremely low and it is estimated that large impacts occur only once every 100 million years. It is widely believed that the last major asteroid impact on Earth took place some 65 million years ago, with many scientists believing that the collision resulted in the extinction of the dinosaurs. But there have been some damaging NEO strikes in more recent history. On June 30, 1908, a small asteroid (about 50 meters in diameters) exploded mid-air over Tunguska, Siberia, and devastated more than half a million acres of forest.

### The soonest impact POSSIBLE 800 years away—the affirmative over-exaggerates.

Symansky ’08 (Paul Symansky, Electrical Engineer at SymTech Laboratories and Boston College graduate, 2/28/08, “Asteroids: A realistic, but very remote threat,” 6/22/11, LexisNexis, MLK)

Scientists have many possible deflection strategies at their disposal should they deem one of these celestial chunks of rock dangerous. The most important task at this point, however, is simply making that determination and watching the skies. With the exception of Apophis, which still only represents less than a 3 percent chance of impact, if it were to pass through that gravitational keyhole, no asteroid presents an immediate threat. In fact, the soonest projected impact possibilities are more than 800 years away. More people are injured in automobile accidents than have ever been injured or killed by asteroids, so while the threat is real, it is also very remote.

### The AFF exaggerates the risk of sizable collusion; the limited research allows for many different trajectories, the aff however will only use the worst case scenarios.

NASA 01 Sep 2005, IMPACT RISK ASSESSMENT: AN INTRODUCTION, 6/21/11, <http://neo.jpl.nasa.gov/risk/doc/sentry.html>, AS

When interpreting the [Sentry Impact Risk Page](http://neo.jpl.nasa.gov/risk/), where information on known potential NEA impacts is posted, one must bear in mind that an Earth collision by a sizable NEA is a very low probability event. Objects normally appear on the Risk Page because their orbits can bring them close to the Earth's orbit and the limited number of available observations do not yet allow their trajectories to be well-enough defined. In such cases, there may be a wide range of possible future paths that can be fit to the existing observations, sometimes including a few that can intersect the Earth.

## Risk of NEO strike is low

###  N/U Newer data shows NEOs won’t hit- science proves

(The Washington Post, 2000) November 7, 2000, “Risk to Earth From Object In Space Is Lowered; Lab Recalculates Threat of Impact”, Lexis Nexis, 6/21/11, CF

Scientists at the Jet Propulsion Laboratory have downgraded the threat of an object now speeding toward Earth and say there is no chance it will hit the Earth in 2030, but a 1 in 1,000 chance it could hit the Earth on Sept. 16, 2071. Last week, scientists with NASA's Near-Earth Objects Program Office at JPL and the International Astronomical Union announced there was a 1 in 500 chance that an object could hit the Earth in 2030. But additional observations have improved predictions of the object's path and suggest it will pass no closer to the Earth than 2.7 million miles on that date--11 times the distance from the Earth to the moon. "As we noted, the most likely scenario was that we will find additional observations that would render this prediction invalid," said Don Yeomans, manager of the NASA office. "If there are 499 chances it won't hit and one that it will, new data will almost every time render it invalid." This is the second embarrassing collision retraction in recent years. In 1998, scientists at the Minor Planets Center in Cambridge, Mass., gained worldwide headlines when they announced that a mile-wide asteroid had a small chance of hitting the Earth in 2028. The prediction was retracted a day later when more calculations were made. In that case, the corrections came from JPL. The incident led the International Astronomical Union to create new guidelines for announcing such potential Earth-dooming events. Astronomers would only make an announcement after reaching a consensus that there was some risk to the planet and would announce their findings within 72 hours of making them. Yeomans followed those rules, but new observations made Friday were not given to JPL until after the announcement. Yeomans and his crew will continue to study the object called SG344, which is either a small asteroid about 200 feet in diameter or a spent Apollo-era rocket booster. A 35-foot piece of hardware like that would burn in the atmosphere and pose no threat to Earth.

### N/U- Asteroids do not pose an immediate threat

(Mercury, 2009) Hobart Mercury, July 21, 2010, Nationwide News Pty Limited, “Good heavens, it's a jam-packed universe”, Lexis Nexis, 6/21/11, CF

WORRIED about Earth-threatening asteroids? One of NASA's newest space telescopes has spotted 25,000 never-before-seen asteroids in just six months. Ninety-five of those are considered ``near Earth'', but in the language of astronomy that means within 48 million kilometres. Luckily for us, none poses any threat to Earth any time soon. Called WISE for Wide-field Infrared Survey Explorer, the telescope completed its first full scan of the sky on Saturday and has begun another round of imaging. What's special about WISE is its ability to see through impenetrable veils of dust, picking up the heat glow of objects invisible to regular telescopes. ``Most telescopes focus on the hottest and brightest objects in the universe,'' said Richard Binzel of the Massachusetts Institute of Technology. ``WISE is especially sensitive to seeing what's cool and dark, what you could call the stealth objects of the universe.'' Mission team members are elated with the discoveries of the $369 million project, which was launched in December. By the end of the year, researchers expect to have a cosmic census of millions of newfound objects that should help answer questions about how planets, stars and galaxies form. Besides all those asteroids, WISE has also sighted 15 new comets. It has spied hundreds of potential brown dwarfs -- stellar objects that are bigger than a planet but much smaller than a star -- and confirmed the existence of 20 of them, including some of the coldest ever known. The telescope also detected what is thought to be an ultraluminous galaxy, more than 10 billion light years away and formed from other colliding galaxies. ``We're filling in the blanks on everything in the universe from near-Earth objects to forming galaxies,'' said project scientist Peter Eisenhardt of the NASA Jet Propulsion Laboratory, which is managing the mission. ``There's quite a zoo.'' WISE's 40.64cm telescope was built by Utah State University's Space Dynamics Laboratory. It circles the Earth 483km high and takes snapshots every 11 seconds over the whole sky. Since the sky survey began, the JPL team has reported the new near-Earth objects to the International Astronomical Union's Minor Planet Centre, which keeps track of all small solar system objects. WISE is discovering near-Earth asteroids that are on average larger than what is found by existing telescopes, which should help scientists better calculate their potential threat, said Harvard astronomer Timothy Spahr, who directs the Minor Planet Center.

## No Apophis Threat

### No risk of Apophis strike

**Kelly 1-1-10** (Cathal, staff reporter, Toronto Star, http://www.thestar.com/sciencetech/science/article/744789--bumping-asteroid-from-earth-could-cost-more-than-80b)

The Apophis asteroid, around three football fields in size, was first spotted heading toward Earth five years ago. It was suggested then there was a 2.7 per cent chance it would strike our planet in 2029. That alarming estimate has been seriously downgraded since, but it continues to hold the attention of expert observers. Apophis will first pass us at close range in just under 20 years. It may almost graze the Earth, missing by only 30,000 kilometres, less than the distance between Earth and the moon. **At this point, astronomers have ruled out the possibility that it will hit us**. However, there is a very small chance that it will pass through a 600 metre-wide "gravitational keyhole" as it swings by. That would alter its course and cause it to slingshot back and hit the Earth in 2036. New NASA calculations released in October rate the chance of impact during the second pass at 1 in 250,000. That still doesn't sound terribly alarming, but as Dr. William Ailor, of California's Aerospace Corporation, said Wednesday, "That's a pretty high probability if you're betting the planet." In April, Ailor chaired the biannual Planetary Defense Conference of the world's leading asteroid experts. "There are still issues around how great does the risk have to be before you start planning a (defence) mission like this. But ultimately, everyone agrees that we will have to do this sooner or later," Ailor said. Donald K. Yeomans, manager of NASA's Near-Earth Object Program Office, says the time to make a decision on Apophis will be in late 2012 and early 2013, when it makes another close approach, within about 14 million kilometres of Earth. "The additional optical and radar data taken then will almost certainly remove any possibility of an Earth collision in April 2036. To my mind it would make sense to wait until 2013, refine the orbit and in the very unlikely event that the impact probability increases, then begin planning possible deflection options," Yeomans said.

### Apophis is not likely to hit earth—one in twelve million odds.

Sudakov ’09 (Dmitry Sudakov, translator and writer for Pravda.ru, 12/30/09, “Russia To Send Asteroid Apophis Back into Deep Black Space,” 6/24/11, http://english.pravda.ru//science/tech/30-12-2009/111499-asteroid\_apophis-0/?mode=print, MLK)

NASA specialists, though, believe that the collision is extremely unlikely. “I don’t remember exactly, but it seems that by 2032 Apophis will ram into Earth,” Perminov said. As a matter of fact, Apophis will be flying in close vicinity to Earth in 2036. Mr. Perminov also said that his organization had already received a number of projects to break the flight path of the asteroid. The head of Roscosmos said that it could be possible to build a special purpose spaceship which would allow to avoid the collision and preserve the asteroid without any nuclear explosions. Russian specialists will choose the strategy to save planet Earth from Apophis and then invite world’s leading space agencies to join the project. Asteroid Apophis, named in honor of the Ancient Egyptian God of Chaos, was discovered in 2004. The asteroid is expected to near Earth several times from 2029 to 2036. NASA scientists initially said that the asteroid posed a serious danger to the Earth, but they later revised their predictions. Additional observations provided improved predictions that eliminated the possibility of an impact on Earth or the Moon in 2029. However, a possibility remains that during the 2029 close encounter with Earth, Apophis will pass through a gravitational keyhole, a precise region in space no more than about 600 meters across, that would set up a future impact on April 13, 2036. Additional observations of the trajectory of Apophis revealed the keyhole will likely be missed and on August 5, 2006 Apophis was lowered to a Level 0 on the Torino Scale. As of October 7, 2009, the impact probability for April 13, 2036, is calculated as 1 in 250,000. An additional impact date in 2037 was also identified; the impact probability for that encounter is calculated as 1 in 12.3 million.

## Impact is Hype

### Low-Risk asteroid impacts are hype – smallest chances do not justify large scale expenditures.

James T. Bennett 2010 Eminent Scholar and William P. Snavely Professor of Political Economy and Public Policy at George Mason University, and Director of The John M. Olin Institute for Employment Practice and Policy “The Chicken Littles of Big Science; or, Here Come the Killer Asteroids!” The Doomsday Lobby: Hype and Panic from Sputniks, Martians, and Marauding Meteors Springerlink

Chapman and Morrison have pondered NEOs for many years now, and they admit the inherent ambiguities. Clark Chapman concedes that “there is deep disagreement over whether we should also protect against the impacts that happen every decade or so, like Tunguska” — though the last Tunguska happened not a decade but a century-plus ago. “Even these small events can kill people, but they are a thousand times less likely to do so than are quakes, floods and the other things that kill people all the time.”123 David Morrison says, “It’s truly an apocalyptic vision that you have here,” but he concedes that “there are very human reactions as to whether this one-in-a-million-per-year risk [which may be an exaggerated number itself] is worth worrying about or not.”124 Clark Chapman adds that “such oncein100 million year events are so rare that, despite their apocalyptic horror, they need be of no concern to public officials.”125 (Note the sharp difference in estimates of the chances of a civilization-ending collision.) If a one-in-a-million — or 65 million, or one trillion — year doomsday comet suddenly raced in from the Oort Cloud, there is simply no defense known or even contemplated against it. We would be out of luck. Yet as a team of researchers wrote in Reviews of Geophysics, asteroid and comet collisions “are so infrequent that they are normally disregarded on the timescale of human evolution.”126 Prudence dictates that we not entirely ignore the incredibly remote possibility that such a collision could happen at any time during the next 40 million years, but that same prudence should keep us from panic, and prevent us from public expenditures that cannot be justified by any wisdom this side of sheer Hollywood-sized hysteria. Even without a rogue asteroid banging into the Earth, life as we know it will be impossible on the planet in a billion or more years, when the Sun swells 250 times its current size, into a “red giant” star that will swallow our home planet.127 If you wish to worry about that, fine. Same for those who stay up nights pulling out their hair over the prospect of an Armageddon asteroid. But the rest of us — at least those of us who do not make our living in the NEO detection field — have quite enough else to worry about, including a swelling budget deficit whose size may soon dwarf the rockiest chunks in the Asteroid Belt.

### Extinction claims are overblown.

James T. Bennett 2010 Eminent Scholar and William P. Snavely Professor of Political Economy and Public Policy at George Mason University, and Director of The John M. Olin Institute for Employment Practice and Policy “The Chicken Littles of Big Science; or, Here Come the Killer Asteroids!” The Doomsday Lobby: Hype and Panic from Sputniks, Martians, and Marauding Meteors Springerlink

The largest conceivable impact is from a body 5 or more kilometers in diameter. It would bring, they say, the end of the world as we know it, as the fires and flooding and blocking of sunlight would plunge the Earth into blackness and death and result in “mass mortality, mass extinctions.”118 One cannot read of this hell without a shiver, and without thinking that perhaps we ought to give the defenders of Earth whatever they want, damn the cost. That the authors project such an event to occur once every 10–30 million years gets sort of lost in the sheer terror that the description evokes. And yet no matter how often Garshnek, Morrison, and Burkle insist that “the NEO threat can be considered a public health threat,” they are forced to concede that an “impact threat may not be immediately apparent since a moderatetomajor impact has not occurred within human history or memory.”119 Well, yes, that does pose an obstacle to taking this threat seriously. The authors may insist that doing nothing is a selfish attitude reeking of “let it be a problem for future generations to deal with,” but there are many, many, many “future generations” packed into 30 million years. Skeptics of an enhanced Earth protection plan, they charge, are failing to ask themselves if “human civilization [is] worth saving. If everything we have been a part of in our lifetime and historically evolved from [is] worth preserving?”120 If you would vote against, say, doubling the NEO detection budget, or adding asteroid-impact evacuation planning to the portfolio of the Department of Homeland Security, you are indifferent to the entirety of human history, human culture, human creation. You are a first-class boor.

### There evidence is biased to generate funding

**Veverka ‘3** (Joe, professor of astronomy at [Cornell University](http://www.cornell.edu/), Great Impact Debates Much Ado About Nothing? 2/17 <http://www.astrobio.net/index.php?option=com_debate&task=detail&id=378>)

Joe Veverka: Regarding the advocacy groups I mentioned, there are at least three different, well-established advocacy groups whose future and welfare depends on focusing the public's attention on the "threat from space." (The term "advocacy group" is a polite one. A much more accurate but cruder term can be found in Jean Giraudoux's play '[The Mad Women of Chaillot](http://www.reviewplays.com/mad_woman_of_chailot.htm).') The first advocacy group is the media. If all else fails, stories about comets and asteroids destroying New York or Tokyo sell newspapers and magazines and make for popular TV fodder.  Second, there is a strong advocacy group among astronomers. They want more resources devoted to studying comets and asteroids. Publicizing the "threat from space" has certainly proven an effective means for generating government support for the study of NEOs. Finally, there is an evolving engineering/industrial/military advocacy group that promulgates the "threat from space" because members of this group want public support to build and provide the defenses that will shield us from this "peril."

### Their authors are biased – they imagine NEO threats to justify their jobs.

James T. Bennett 2010 Eminent Scholar and William P. Snavely Professor of Political Economy and Public Policy at George Mason University, and Director of The John M. Olin Institute for Employment Practice and Policy “The Chicken Littles of Big Science; or, Here Come the Killer Asteroids!” The Doomsday Lobby: Hype and Panic from Sputniks, Martians, and Marauding Meteors Springerlink

The entire disaster management industry — for instance, the supremely competent FEMA bureaucrats who responded with such alacrity to Hurricane Katrina — smells opportunity in the Armageddon from the skies scenario. Writing in Space Policy, that same David Morrison of NASA’s Ames Research Center, Victoria Garshnek of Global Human Futures Research Associates, and Frederick M. Burkle, Jr. of the Department of Emergency Medicine at the University of Hawaii insist that the “asteroid/comet impact hazard is a realistic threat to the human population.” Proceeding from this highly questionable opening sentence, the authors discuss “the NEO impact hazard as a public health issue.”116 They concede that public health agencies can do little about Earth-demolishing monster rocks, and the meteorites that rain like dust on the Earth every hour of every day pose no hazard. The problem, as they see it, lies with the intermediate-size bodies with diameters between a few dozen meters to hundreds of kilometers.

### Inventor of Torino scale says it causes unnecessary panic

(The Scotsman, 2004) December 28, 2004, The Scotsman Publications Ltd.,“WHY FRIDAY 13TH, 2029 MAY BE EARTH'S UNLUCKIEST DAY,” Lexis Nexis, 6/22/11,CF

Astronomers expressed concern last year that reports of potential asteroid collisions with the Earth were causing un-necessary panic. The inventor of the Torino scale, named after the Italian city where it was devised in 1999, was so upset by coverage of asteroid scares that he has proposed toning down the scale's wording. Dr Rick Binzel, of the Massachusetts Institute of Technology, said the definition of category one, under which most asteroids are initially classed, should be changed from "requiring careful monitoring" to "normal".

## No Extinction

### No risk of extinction level asteroid

Schweickart & Graham ‘8(Thomas and Russell, NASA's Flimsy Argument for Nuclear Weapons Scientific American Magazine, NASA's Flimsy Argument for Nuclear Weapons <http://www.scientificamerican.com/article.cfm?id=nasas-flimsy-argument-for-nuclear-weapons>)

Nuclear explosives would be needed only for deflecting the largest NEOs, which are the least common and most easily detectable objects. Scientists are not concerned about a collision with an extremely large NEO—say, 10 kilometers in diameter—because all these objects have been discovered and none currently threatens Earth. Big things are easy for astronomers to find; the smaller objects are what we have to worry about./Of the estimated 4,000 NEOs with diameters of 400 meters or more—which includes all objects that might conceivably require nuclear explosives to divert them—researchers have so far identified about 1,500. And if NASA meets the search goals mandated by Congress, it will locate 98 percent of these objects and calculate 100-year projections of their orbits by 2020. As NASA continues to find big NEOs, the calculations of risk change accordingly. A decade ago, before astronomers began to systematically locate NEOs larger than 400 meters in diameter, they estimated that we faced a statistical risk of being struck by such an object once every 100,000 years. But now that researchers have identified and are tracking about 37 percent of these NEOs, the frequency of being hit by one of the remaining large objects has dropped to once in 160,000 years. Unless NASA finds a large NEO on an immediate collision course by 2020 (a very unlikely event), the frequency of a collision with one of the 80 still undiscovered objects (2 percent of 4,000) will drop to once every five million years. Thus, the probability that nuclear explosives might be needed to deflect an NEO is extremely small. And even this minuscule probability will diminish to the vanishing point as researchers improve nonnuclear interception technologies. After 2020 the need to keep nuclear devices on standby to defend against an NEO virtually disappears. As a result, the decision to move toward the worldwide elimination of nuclear weapons can be made strictly on the basis of human threats to global security. Extraterrestrial dangers need not be considered.

### No risk of extinction by asteroids

DAVID MORRISON 2010 Director, Carl Sagan Center for Study of Life in the Universe, SETI Institute Senior Scientist, NASA Ames Research Center “Impacts and Evolution: Protecting Earth from Asteroids” http://www.amphilsoc.org/sites/default/files/1540404.pdf

The survey results have already transformed our understanding of the impact risk. For asteroids

with diameter of 5 km or more, which is roughly the threshold for an extinction event, our knowledge is complete today. Astronomers have already assured us that we are not due for an extinction-level impact from an asteroid within the next century. Barring a very unlikely strike by a large comet, we are not about to go the way of the dinosaurs. Thus, the rest of this paper focuses on the more frequent impacts by asteroids with diameters from 5 km down to the atmospheric cut-off at about 50 m diameter, spanning the range from global catastrophic disasters at the top end down to local endurable disasters at the lower end of the energy range.

### We’ve already mapped the sky and concluded that there’s no big asteroid on a collision course

**Brooks ‘8** (Michael, New Scientist, “don’t panic,” 7-26, lexis)
How about cosmic threats? Though the danger from asteroid impacts remains, we are getting close to charting all the potential world-destroying rocks. "We now know there is no asteroid out there remotely like the one that ended the Cretaceous period," says David Morrison, NASA's leading expert on asteroid threats. "We are not going to go the way of the dinosaurs."

### Zero probability of extinction level event, including from comets

**Chapman ‘7** (Clark, fellow at Southwest Research Institute, Ch. 7: The Asteroid Impact Hazard and Interdisciplinary Issues, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

Projectiles made of strong metals are not so readily broken up when they penetrate the atmosphere (although smaller ones are greatly slowed down); but only a few percent of NEAs are metallic. Projectiles made of fluffy, icy, and/or under-dense materials (e.g. comets), penetrate the atmosphere less readily. They explode at higher altitudes, or it takes a larger one to reach the ground at cosmic velocities. Actual live comets (as distinct from dead ones described above as constituting a small fraction of NEAs) contribute to the impact hazard at the level of ~1% (SDT 2003), although the very largest objects that could threaten Earth (> 3 km diameter) would be comets; all NEAs of such sizes have been discovered and are not an immediate threat.

**Timeframe is millions of years**

**Hewitt ‘7** (Kenneth, Cold Regions Research Center and Department of Geography and Environmental Studies at Wilfrid Laurier University, Chapter 24: Social Perspectives on Comet/Asteroid Impact (CAI) Hazards: Technocratic Authority and the Geography of Social Vulnerability in *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, SpringLink)

However, the task of addressing and situating the dangers among modern risk profiles and priorities has hardly begun. Their place in international disaster measures remains to be decided. In particular, there has been very limited input of social understanding, or even recognition that such threats could have important social dimensions. There is often a sense, in the literature on CAI hazards, that the most destructive impact processes and events with globally catastrophic potential are all-important. It has been claimed that the destructive potential of CAI far exceeds that of any other natural forces or disasters in recent, if not all, human history (Morrison and Teller 1994). In such visions experience with known risks and disasters may appear to be of little help. Human diversity, social concerns and changes can seem irrelevant – except for their likely annihilation or a precarious biological survival. And it does seem there is a potential for catastrophic, global impacts that would overwhelm any existing social response capacities. Apparently, however, these are the least likely events. They are thought to recur at intervals not less than **100 000 years, possibly millions or tens of millions**. Obviously this is longer than the history of civilizations, if not Homo sapiens.1

### Planet killers don’t exist

Cambier & Mead ‘7(Doctors Jean-Luc & Frank, Air Force Research Laboratory, On NEO Threat Mitigation, Oct. http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA474424&Location=U2&doc=GetTRDoc.pdf)

We could also point out a 4th class of threats at the extreme range of size, i.e. very large objects for which there are no known counter-measures (they are of course well above the extinction-class). These “planet-killers” (such as the collision event which would have created the Moon) fortunately disappeared from the solar system or are well-known4; being no-longer a threat, they are relegated to the realm of **fiction** (e.g. [4]).

### No risk of extinction-level strike

Morrison ‘2(Dr. David, senior scientist at the NASA Astrobiology Institute, Hearings on the threat of near-Earth asteroids (NEAs) before the Subcommittee on Space and Aeronautics, House Committee on Science, October 3, 2002. http://impact.arc.nasa.gov/gov\_threat\_2002.cfm)

It is only during the past decade that we have come to appreciate that impacts by asteroids and comets (often called Near Earth Objects, or NEOs) pose a significant hazard to life and property. Comet impacts constitute only about 10% of the risk, so the focus of my remarks is on the more common impacts by Near Earth Asteroids, or NEAs. The most catastrophic of these are the extinction level events that can create a severe global environmental disaster. The impact of an asteroid about 10 miles in diameter (as large as the Washington beltway) 65 million years ago not only ended the existence of the dinosaurs, it wiped out more than 99% of all life on Earth. Fortunately for us, such mass extinction events are extremely rare. We can already state with assurance that there are no asteroids this large with orbits that could pose a threat to us. We are safe (for the present) from such impacts, but not from the smaller NEAs that actually dominate the current risk.

## Mitigation Solves

### Disaster management mitigates impact

**Chapman ‘7** (Clark, fellow at Southwest Research Institute, Ch. 7: The Asteroid Impact Hazard and Interdisciplinary Issues, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

In the event that an oncoming NEA is discovered, but deflection is either impossible or unreliable, conventional disaster management approaches could be employed (or modified) to mitigate the consequences of a major impact. In some cases, regions around ground-zero or shorelines could be evacuated, food reserves augmented, and so on. If the impact were actually to happen, with or without warning, conventional approaches to rescue and recovery could be implemented to reduce casualties.

## No Small Asteroid

### No risk of small asteroid

**MacCracken ‘7** (Michael C., fellow at the Climate Institute, Ch. 16: The Climatic Effects of Asteroid and Comet Impacts: Consequences for an Increasingly Interconnected Society, in *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, SpringLink)

Depending on an impactor’s composition and the speed and angle of impact, objects with diameters of up to roughly 50[m] to 100 m typically create blast effects of up to of order 50 to 100 MT without impacting the surface. The Tunguska event of 30 June 1908, for example, created a shock wave that leveled the forest over an area of roughly 2000 km2 (Kolesnikov et al. 2007). This event is variously estimated to have resulted from an atmospheric explosion of 10 to 100 MT from an object estimated to be between about 60 and 100 m in diameter (Covey 2002; Yazev 2002). Based on astronomical evidence, such events are statistically expected to occur approximately every few centuries, with an event occurring over land roughly every 500 to 1000 years, which is not inconsistent with historical records.

### Small asteroid strike does not cause extinction

**Binzel & Thomas ‘9** (Richard, prof of planetary science at MIT and author of leading reference book on asteroids, & Cristina, graduate student, “Space Topics: Near Earth Objects, Sizing Up the Threat,” http://www.planetary.org/explore/topics/near\_earth\_objects/threat.html)

What distinguishes "local" impacts from "global" impacts are the responses of Earth's ecosystem and inhabitants. While the occurrence of a Tunguska-like or larger event over a major city would be an unprecedented human disaster, the consequences to the worldwide ecosystem and climate would be minimal. Assuming that the cosmic impact is not misinterpreted as a hostile nuclear attack set in motion by a real or imagined enemy, the remaining civilizations of the world would presumably remain stable and would be able to supply aid and comfort to the afflicted area.

### Low probability of a small asteroid strike hitting a populated area

**Sidle ‘7** (Roy, Slope Conservation Section, Geohazards Division, Disaster Prevention Research Institute, Kyoto University, Chapter 23: Hazard Risk Assessment of a Near Earth Object, in *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, SpringLink)

If this size of asteroid struck a major urban area, widespread property damage would occur and many lives would be lost (Tate 2000; Chapman 2004); however, such an impact would be **very improbable**. A recent analog for such an impact on uninhabited land is the 1908 Tunguska event in Siberia where a forested area of ≈ 1 300 km2 was completely destroyed by the blast and collision of a ≈ 60 m asteroid with damage extending outwards an additional 3 800 km2 (Morrison 1992). **The estimated probability of a 100 m asteroid striking a city is 1.4 x 10–8**; the probability of striking some inhabited area is more than 4 orders of magnitude higher, but such an impact may kill as many as 3 million people (Garshnek et al. 2000). For this size of asteroid, a 1–2 km crater would be produced if the impact occurred on land and ejected material would be spread up to a 10 km radius. Given present capabilities it is not possible to detect most of these relatively smaller NEOs (Chapman 2004). The defining characteristics of Level 2 NEOs are their modest frequency of occurrence, relatively local but potentially acute damages, and unpredictability.

### There are only 9 asteroids with the potential to strike earth and that possibility has been dismissed

**Task Force ‘2k** (British National Space Centre, Report of the Task Force on Potentially Hazardous Near Earth Objects, http://www.spacecentre.co.uk/neo/report.html)

4: Objects for which the first orbital calculations indicated that they might impact Earth during the next 50 years. Further work has dismissed this possibility or made it improbable. There are nine objects of widely varying size. For three of them (marked \* below) the possibility of impact was dismissed during the month or so after discovery as more observations were made and their orbits more accurately determined. For two of them (marked \*\*, above and below) intervening close approaches (see list 3 above) did not allow current observations to eliminate the possibility of a later impact; fortunately, an impact was eliminated following the recognition of observations on old photographs (which existed because these objects are large and therefore bright). In the four remaining cases at least two would probably be too small to do damage. For the other two the available observations are yet to be performed to allow an impact to be dismissed. However, even before that, the chances of the object 1998 OX4 hitting the Earth is thought to be only about 1 in 2,000,000, and the much smaller object 1995 CS, 1 in 200,000.The objects are arranged in order of earliest possible impact date.

### And, low probability of medium-sized asteroid strike: Timeframe is 5,000 years

**NASA ‘6** (“2006 Near-Earth Object Survey and Deflection Study” http://www.nasa.gov/pdf/171331main\_NEO\_report\_march07.pdf )

**The chance that an object 140 meters or larger will strike the Earth in any given year is about 0.0002 (about 1 every 5,000 years** on average). The random nature of the hazard means that it is equally probable that a 140-meter object will hit the Earth in the next 50 years (~1%) or that the Earth will experience no impacts of that size in the next 23,000 years (0.999823,000 ~ 1%). The occurrence or absence of past events has no influence on the likelihood of future impacts.

## No Impact to Small Asteroid

### No impact to small asteroid strike

**Dore ‘7** (Mohammed, Climate Change Laboratory, Department of Economics, Brock University, Ch. 29: The Economic Consequences of Disasters due to Asteroid and Comet Impacts, Small and Large, in *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, SpringLink)

With the NOAA classification of natural disasters, we now construct six scenarios, in order of increasing severity. A Near Earth Object (NEO) of say 30–35 meters diameter hits a populated area. It knocks out power for a few days and disrupts transportation of goods. This would be comparable to an average disaster causing less than $ 5 billion in damage costs. Most such disasters are below the FEMA threshold, and are handled by public assistance at the State level and by private insurance. The typical death toll may be between ten and one hundred. At the high end in this scenario may be something such as the 1989 San Francisco earthquake that killed 63 people, injured 3 757 and led to property damage of $ 5.9 billion. At this scale, recovery and return to some semblance of normality could take two weeks to a month to resettle people, and perhaps six months to rebuild damaged infrastructure. If this NEO struck a developing country, the damage costs might be lower, but the death toll higher; and there might be outbreaks of disease due to a fragile water and sanitation infrastructure. For example, the Bangladesh floods of 1998 cost $ 3 billion, but affected thirty million people. A NEO impact that damaged food production in a rural area of a developing country through collateral damage (e.g. impact on dams resulting in flooding), could cause severe hardship. These same Bangladesh floods of 1998 led to a food deficit of 2.2 million tonnes of rice, or 7% of the country’s output. In contrast, flooding in the Midwestern US in 1993 caused forty-eight deaths and damage of $ 27 billion.

### Small asteroid will strike over water and cause negligible damage

Gusiakov ‘7(V. K., Tsunami Laboratory, Institute of Computational Mathematics and Mathematical Geophysics Siberian Division, Russian Academy of Sciences, Ch.14: Tsunami as a Destructive Aftermath of Oceanic Impacts, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

Since evidence for asteroid impact on Earth exists, we have to conclude that there is a four-to-one chance that they hit oceans, seas or even large internal water reservoirs and therefore tsunami or tsunami-like water waves can be generated by an extra-terrestrial impact. There has been a general concern that the tsunami from a deep-water impact of a 1-km asteroid could contribute substantially to its overall hazard for the people living near coasts and would wash out all coastal cities of the entire ocean (Chapman 2003; Morrison 2003). However, a 1-km asteroid is quite close to the global disaster threshold (impact of a 2–3 km object) and tsunami could therefore contribute somewhat to other hazardous aftermaths of this natural catastrophe that would have a large enough potential to end our modern civilization era. Fortunately for humankind, it is indeed a very rare event, available estimates of its return period vary in the range of 100 000 to 1 000 000 years. Much more frequent are the Tunguska-class impacts (the size of an object being 100 m or less) with the return period being more relevant to the human time scale and spanning from several hundred to one thousand years. Unless the small asteroid is made of solid metal (iron or nickel), it would likely explode in the upper atmosphere with a TNT equivalent in the first tens of megatons. Available estimates, based mainly on nuclear tests results, show that tsunami from such an airblast should be from several tens of centimeters to one meter (Glasstone and Doland 1977), so the water impact of such a small, once-per-century asteroid could be in general less hazardous than an equivalent explosion above land.

### Low risk and small impact to small asteroid strike

**Morrison ‘7** (David, senior scientist at the NASA Astrobiology Institute, NASA Ames Research Center, Ch. 8: The Impact Hazard: Advanced NEO Surveys and Societal Responses, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

 Members of the 2003 NASA Science Definition Team (SDT) (Stokes 2003) focused on two classes of sub-kilometer impacts by stony asteroids that do pose a substantial hazard: land impacts yielding massive ground or air-burst explosions, and ocean impacts that produce tsunami waves that endanger exposed coastlines. The effects of land impacts can be derived by extrapolation of our knowledge of large nuclear explosions. The SDT analysis uses estimates of blast damage as a function of impactor size by Hills and Goda (1993). From about 50 to 150 m diameter, these are primarily airbursts, and the impactor disintegrates explosively before reaching the ground. Impactors larger than 150 m produce craters. At 300 m diameter, the area of severe damage is as large as a U.S. state or small European country. **Because of the highly uneven distribution of population on the Earth, most of these sub-kilometer impacts, which are near the lower size limit, will produce few if any casualties**, but much rarer impacts over heavily populated areas could kill tens of millions. Combining their explosion models with frequency-of-impact estimates and a model population distribution, the SDT concluded that the greatest hazard in the sub-kilometer realm is from NEAs 50–200 m diameter, with total expected equivalent annual deaths from sub-kilometer impacts at a few dozen – roughly two orders of magnitude less than the similar metric for larger (global-hazard) impacts at the start of the Spaceguard Survey, and still more than an order of magnitude less than that from the residual of undiscovered NEAs larger than one kilometer remaining in 2005.

## A2 – Ozone Depletion

### Minimal ozone depletion from small NEOs

**Birks et al. ‘7** (John, Department of Chemistry and Biochemistry and Cooperative Institute for Research in Environmental Sciences (CIRES), U of Colorado, Paul Crutzen Max-Planck-Institute for Chemistry, Raymond Roble, National Center for Atmospheric Research, Ch. 13: Frequent Ozone Depletion Resulting from Impacts of Asteroids and Comets, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

Both water vapor and NOx are rapidly transported downward to the stratosphere for all three impact cases. Figure 13.4 shows changes in the vertical distribution of these species during the first 50 days following large, medium and small impacts; the results for NOx and water vapor are extended to one year in Fig. 13.5. Large fractions of both water vapor and NOx have descended below 50 km (height of the normal stratopause), with concentrations peaking in the stratosphere after only three months. Changes in ozone concentrations are shown in Fig. 13.6 for all three cases out to day 50, and ozone depletions for the large impact are simulated for the first full year following impact in Fig. 13.5. For the large impact case, injection of NO and H2O causes large ozone depletions in the upper stratosphere that persist through the first year. Ozone depletions are summarized in Fig. 13.7 for the large, medium and small impact cases. By day 50 ozone depletion of the globally integrated ozone column (above 30 km) has been depleted by 58%, 9% and 1% for the large, medium and small impact cases. These depletions continue to increase beyond day 50 for the large and medium impact cases. Local depletions within the hemisphere of impact are much larger. Stratospheric ozone levels are expected to recover over a period of 2–3 years as water vapor and NOy are slowly removed to the troposphere.

## A2 Comets

### Low risk—active comets only represent 1% of the NEO threat

**Levasseur-Regourd ‘7** (A. Chantal, prof at Université P. & M. Curie (Paris VI), Aéronomie CNRS-IPSL, Ch. 10: Physical Properties of NEOs and Risks of an Impact: Current Knowledge and Future Challenges, in Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach, SpringLink)

The near Earth objects (hereafter NEOs) population consists of asteroids (or fragments thereof), which are rocky objects; it also includes cometary nuclei, consisting of ice and dust, which happen to eject gases and dust whenever they are sufficiently heated by the solar radiation, and of so-called defunct or dormant comets, which have lost all their ice or are coated by an insulating dust mantle. Asteroids most likely represent the main population. However, dormant and defunct comets could represent up to 18% of the total population, and active comets about 1% of the total population (Binzel et al. 2004).

### Jupiter’s gravity protects us from Oort Cloud comets

**Overbye ‘9** (Dennis, NYT Correspondent, “Jupiter: Our Cosmic Protector?” 7-25, <http://www.nytimes.com/2009/07/26/weekinreview/26overbye.html>)

But Jupiter helps protect us, he said, from an even more dangerous band of comets coming from the so-called Oort Cloud, a vast spherical deep-freeze surrounding the solar system as far as a light-year from the Sun. Every once in a while, in response to gravitational nudges from a passing star or gas cloud, a comet is unleashed from storage and comes crashing inward.

Jupiter’s benign influence here comes in two forms. The cloud was initially populated in the early days of the solar system by the gravity of Uranus and Neptune sweeping up debris and flinging it outward, but Jupiter and Saturn are so strong, Dr. Levison said, that, first of all, they threw a lot of the junk out of the solar system altogether, lessening the size of this cosmic arsenal. Second, Jupiter deflects some of the comets that get dislodged and fall back in, Dr. Levison said.

“It’s a double anti-whammy,” he said.

## A2: Nuclear Weapons Bad

### Comparative study concludes standoff nuclear explosion solve best

**Schaffer ‘7** (Mark, Charania and Olds, Associate Fellow AIAA, CEO and Engineer at SpaceWorks Engineering A.C and John, Evaluating the Effectiveness of Different NEO Mitigation Options, <http://www.aero.org/conferences/planetarydefense/2007papers/P2-1--Schaffer-Paper.pdf> )

This paper has outlined an effort to develop a process for comparing different NEO mitigation options using a consistent methodology and common analysis assumptions. To accurately model these techniques, an entire mitigation mission from Earth departure to mission completion is simulated. In order to determine the momentum the different options impart to the NEO, interactions with the NEO are approximated by combining published data about each technique with first-order estimates and Newtonian physics. To fairly compare these techniques, additional metrics are considered in the ranking of the different options: applicability to the composition and rotation properties of the NEO, technological readiness, degree of development difficulty, development cost, and deployment cost. The process developed here quantifies these different factors using expert analysis and then, along with the induced change in velocity, determines an Overall Evaluation Criterion (OEC) for each technique. Six different NEO mitigation options are evaluated relative to each other: kinetic impactor, standoff nuclear detonation, chemical rocket, gravity tractor, high Isp rocket, and mass driver. Direct comparisons between the techniques are made by applying identical starting conditions and mission parameters to each deflection option and comparing the OEC of each. The selected mitigation techniques are applied to three sample NEO cases: Apophis, D’Artagnan, and Athos. In the Apophis case, the kinetic impactor, standoff nuclear detonation, and gravity tractor rank highest while the high Isp rocket ranks the lowest. In both the D’Artagnan and Athos cases, the standoff nuclear detonation ranks the highest and the gravity tractor ranks the lowest. Overall, the standoff nuclear detonation is the best performer. Its very high effectiveness, generally applicability to most NEO cases, and low technology requirements allow it to score very highly in this study.

### Standoff nuclear blast solves and prevents fragmentation

**Shiga ‘9** (David, New Scientist, “Saving Earth from an asteroid strike,” 3-28, lexis)

We could blast the asteroid with a nuclear bomb, but that would risk shattering it into smaller pieces that could still threaten Earth. Or maybe we should try to force it off course by slamming into it with a heavy object - an unproven and therefore risky technique. Now there may be a third option: gently nudging the asteroid away from Earth without breaking it apart, either by exploding a nuclear device at a distance or zapping it with high-powered lasers. Astronomers have found thousands of asteroids that pass near Earth's orbit, and a few of these are on trajectories that give them a small chance of hitting Earth. The most worrying is a 270-metre-wide asteroid named Apophis, which has a 1 in 45,000 chance of hitting us in 2036. To investigate the best way to deflect this and other asteroids onto a harmless path, a team led by David Dearborn of the Lawrence Livermore National Laboratory in California has modelled the impact of a nuclear explosion on an object's trajectory. Their virtual asteroid was 1 kilometre in diameter and made of rocky rubble loosely bound together by gravity, which is considered by many planetary scientists to be the most likely composition for small asteroids. Thirty years before the asteroid was set to collide with Earth, a nuclear blast, equivalent to 100 kilotonnes of TNT, was set off 250 metres behind it. The nudge from the explosion increased its velocity by 6.5 millimetres per second, a slight change but enough for it to miss us. The technique also reduced the risk of a break-up - just 1 per cent of the asteroid's material was dislodged by the blast, and of that only about 1 part in a million remained on a collision course with Earth. Dearborn adds that the technology for this method is already established, unlike for the use of a heavy object to shove the asteroid onto a different path - the "kinetic impactor" strategy. "Should an emergency arise, we should know that [the technology] is available, and we should have some idea of how to properly use it," he says.

### NASA concludes negative

**Bucknam & Gold ‘8** (Mark, Deputy Dir for Plans in the Policy Planning Office of the Office of the US Secretary of Defense, Colonel USAF, PhD in War Studies from U of London, BS in physics, MS in materials science and engineering from Virginia Tech & Robert, Chief Technologist for the Space Department at the Applied Physics Laboratory of Johns Hopkins “Asteroid Threat? The Problem of Planetary Defence,” Survival vol. 50 no. 5 | 2008 | pp. 141–156)

NASA’s March 2007 report stated plainly that using stand-off nuclear explosions to deliver an impulsive force to a PHO would be **10–100 times more effective** than other means of deflecting PHOs. Nonetheless, other tools and techniques, including kinetic impactors, gravity tractors, focused solar and laser energy, and rockets to change a PHO’s orbital velocity were identified and analysed.

\*PHO = potentially hazardous object

### Fragmentation solves

IAA ‘9(International Academy of Astronautics, “Dealing with the Threat To Earth From Asteroids and Comets,” <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf>)

However Keith Holsapple 6 has shown that rather than the above, kinetic impacts at hypervelocity would likely create very large numbers of very small fragments possessing large transverse velocities. Accordingly the mass per unit area normal to the NEO’s trajectory would be very much reduced at the time of Earth impact, and the consequences of multiple impacts, each being much less massive than the original body, could then be very much more benign locally as well as globally. For example, if most fragments are smaller than 50 meters they will burn up in the atmosphere and not reach the Earth’s surface, with the net effect being a spectacular light show with little or no damage. Furthermore, even if a few remaining fragments of a 1 km diameter NEO have a diameter in the order of 100 meters, the global effects of their impact would certainly be less severe than the original impact of the whole body since their mass and energy are proportional to the cube of their diameter. Therefore, whether fragmentation is to be avoided at all costs or whether it can be used to advantage in the defense strategy is still very much an open issue. What is certain is that we must characterize the NEOs well so that we can optimize the mission and better predict the consequences of a mitigation attempt7.

### Nuclear weapons key to solve large asteroids.

**Bucknam & Gold ‘8** (Mark, Deputy Dir for Plans in the Policy Planning Office of the Office of the US Secretary of Defense, Colonel USAF, PhD in War Studies from U of London, BS in physics, MS in materials science and engineering from Virginia Tech & Robert, Chief Technologist for the Space Department at the Applied Physics Laboratory of Johns Hopkins “Asteroid Threat? The Problem of Planetary Defence,” Survival vol. 50 no. 5 | 2008 | pp. 141–156)

For objects larger than 1km, **only nuclear explosions could deliver enough of a push to achieve the necessary change in velocity,** especially if little time were available to effect the needed change. However, nuclear explosions and kinetic impactors risk breaking up a PHO, potentially making it more difficult to deal with. Because stand-off nuclear explosions would reduce the chances of fragmenting the object, they would be, generally speaking, preferable to nuclear blasts on or below the surface of a PHO. This benefit of using stand-off explosions would be purchased at the cost of a 10- to 100-fold reduction in the energy imparted to the object by a given explosion. Thus, multiple stand-off explosions might be needed to achieve the necessary change in PHO velocity. In extremis, attempting to fragment a PHO with a nuclear explosion might be the best available option – perhaps mitigating the inevitable catastrophe without preventing it.

### – Long Period Comets nuclear weapons key to solves

**Gerrard & Barber ‘97** (Michael & Anna, Asteroids and Comets: U.S. and International Law and the Lowest-Probability, Highest Consequence Risk, New York Univ. Environmental Law Journal, http://www1.law.nyu.edu/journals/envtllaw/issues/vol6/1/6nyuelj4.html)

A qualitatively different problem is posed by long-period comets, which are defined as comets with almost parabolic orbits and periods of revolution around the Sun exceeding 200 years; some have orbital periods of millions of years. [36](http://www1.law.nyu.edu/journals/envtllaw/issues/vol6/1/6nyuelj4n.html#fn36) Thus, any long-period comet that comes into view is likely being seen by humanity for the first time. They move much faster than asteroids and \*12 their trajectories are difficult to precisely predict because their paths are influenced not only by gravity, but also by the solar forces that generate their tails, thus creating uncertainty about whether they will hit Earth. They are likely to be spotted 250 to 500 days before impact, although some sightings can occur later. On January 30, 1996, Yuji Hyakutake spotted a comet with a nucleus of one to two miles just two months before its closest approach to Earth (about 9.5 million miles away). [37](http://www1.law.nyu.edu/journals/envtllaw/issues/vol6/1/6nyuelj4n.html#fn37) Comets that cannot be seen by optical telescopes because they come from the direction of the sun and are hidden by the glare may be found only a few days or hours in advance. These comets leave no time for deflection and very little time for deliberation and preparation; the only hope of defense would be to have nuclear-armed spacecraft ready for launch or in standby orbits. [38](http://www1.law.nyu.edu/journals/envtllaw/issues/vol6/1/6nyuelj4n.html#fn38) In the understated words of one NASA official, "[f]or the worst case, a large object discovered to be on a collision course with Earth in a matter of days, there is at present no response that has a high probability of success." [39](http://www1.law.nyu.edu/journals/envtllaw/issues/vol6/1/6nyuelj4n.html#fn39)

### Nuclear weapons are effective and will not fragment asteroids

**NASA ‘7** (National Aeronautics and Space Administration, Near-Earth Object Survey and Deflection Analysis of Alternatives, Report to Congress, March, http://www.nasa.gov/pdf/171331main\_NEO\_report\_march07.pdf)

In the impulsive category, the use of a nuclear device was found to be the most effective means to deflect a PHO. Because of the large amount of energy delivered, nuclear devices would require the least amount of detailed information about the threatening object, reducing the need for detailed characterization. While detonation of a nuclear device on or below the surface of a threatening object was found to be 10-100 times more efficient than detonating a nuclear device above the surface, the standoff detonation would be less likely to fragment the target. A nuclear standoff mission could be designed knowing only the orbit and approximate mass of the threat, and missions could be carried out incrementally to reach the required amount of deflection. Additional information about the object’s mass and physical properties would perhaps increase the effectiveness, but likely would not be required to accomplish the goal. It should be noted that because of restrictions found in Article IV of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, use of a nuclear device would likely require prior international coordination. The study team also examined conventional explosives, but found they were ineffective against most threats.

### Nuclear weapons most effective

**NASA ‘6** (“2006 Near-Earth Object Survey and Deflection Study” http://www.b612foundation.org/papers/NASA-finalrpt.pdf)

The use of nuclear explosives was found to be the most effective alternative in the near term. While an explosion on or below the surface of a threatening object is 10-100 times more effective than a detonation above the surface, the standoff detonation would be less likely to fragment the target. Nuclear options require the least amount of detailed information about the threatening object. A nuclear standoff mission could be designed knowing only the orbit and approximate mass of the threat, and most impulsive missions could be carried out incrementally to reach the required amount of deflection. Additional information about the object’s mass and physical properties would perhaps increase the effectiveness, but likely would not be required to accomplish the goal. The study examined conventional explosives, but found they were ineffective against most threats.

## A2 Lead Time

### Even if the NEO is big, we might not have any lead time

Bradleya et al 2010 Los Alamos National Laboratory Space Propulsion & Energy International Forum P. A. Bradleya, C. S Pleskoa, R. R. C. Clementa, L. M. Conlona, R. P. Weavera, J. A. Guzika, L. A. Pritchett-Sheatsa and W. F. Huebnerb 2010 Challenges of Deflecting an Asteroid or Comet Nucleus with a Nuclear Burst

Suppose we detect a PHO headed towards us. Chances are it will be in one of two categories. The first category of object likely to hit Earth would be a small, Tunguska-type body of order 10 to 100 meters in diameter. Because they are small, and hence very faint, they are difficult to detect with much warning time. It might be possible to deflect or destroy such a body in the future, but it would require the mitigation method to be ready and waiting for deployment on short notice. Even at 100 meters in diameter, the explosive energy would be about 100 Megatons and cause regional devastation. Such an object would not likely hit Earth more than once every few thousand years, and the chances of it hitting a populous area (out of the entire Earth) is even smaller (on the order of 1000 times smaller). The second category is that the PHO will be a larger object up to or greater than 1 km in size such as a comet nucleus headed towards us in a highly inclined orbit. If we are lucky, we will have several months to a couple of years lead-time. Although it did not come close to Earth, comet Kohoutek of 1973 would be an example of this class (Biermann, 1973). If we are not lucky, we will have very little advance warning, such as was the case for longperiod comet IRAS-Araki-Alcock of 1983 (Watanabe, 1987; Sekanina, 1988). It was discovered on 27 April 1983 and closest approach was two weeks later on 11 May 1983 at a distance of 0.0312 AU (about 4.7 million km or10 times the distance of the Moon from the Earth).

## Asteroid as Weapon

### Asteroid deflection tech could be used to cause an asteroid to hit Earth

Space Policy ‘2(“Book Review; Target Earth”, Volume 18, Issue 1, February, <http://abob.libs.uga.edu/bobk/ccc/cc021502.html>)

There is still the question as to what could or should be done if an impact threat is discovered. The MIT Project Icarus in 1967 calculated that six Saturn V launchers carrying 100 nuclear warheads would be needed to divert that asteroid if it became a hazard, as in its present orbit it conceivably could. Saturn V is no longer available but a similar effort could no doubt be mounted, given sufficient warning. The problem is the `Deflection Dilemma': if you can deflect asteroids or comets away from the Earth, that raises the possibility of deflecting them towards it. Duncan Steel's answer to that is not to build such a system until an actual threat is detected, but there's still the possibility of things sneaking up on us: one reason why we're still arguing about the nature of the Tunguska object in 1908 is that it approached from the direction of the Sun and wasn't seen until it entered the atmosphere. Watching for that would require eternal vigilance in space as well as on Earth, and we know how quickly governments tire of such things: the US administration turned off the science stations left by astronauts on the Moon only 5 years after Apollo, and cancelled the Search for Extraterrestrial Intelligence long before there was a realistic chance of success. But those of us who would like to see deflection systems developed now can take heart from a contribution to the 2001 Charterhouse conference on British rocketry by David Asher and Nigel Holloway. They made headlines with an outline of what it would take to bring down a 500-m asteroid on Telford and devastate England from the Scottish Borders to Devon. It
was worth attending just to witness the stunned silence in which veterans of Britain's nuclear weapons programme heard details of how a single asteroid, under malevolent control, could reduce the UK to rubble. As one 80-year-old remarked, "If it takes 12 years and 15 nuclear warheads to bring down an asteroid on us, why not just use the weapons in the first place?" On the more serious level of preventing the impacts, another old-timer remarked that the UK share of the events wouldn't pay for a new housing estate, let alone what it would cost to rebuild the country after such an occurrence. But the study demonstrates that using asteroids as weapons takes much more effort than simply turning them aside from Earth, so the Deflection Dilemma has lost much of its force.

## No Solvency - Deflection

### NASA doesn’t have enough resources to build alternative deflection

**Boyle ‘7** (Alan, winner of the [AAAS Science Journalism Award](http://www.aaas.org/aboutaaas/awards/sja/2002/boyle.shtml), the [NASW Science-in-Society Award](http://nasw.org/mem-maint/awards/02Boylebio.html), member of the board of the [Council for the Advancement of Science Writing](http://www.casw.org/), and staff writer for MSNBC.com, “Dueling Over Asteroids,” <http://cosmiclog.msnbc.msn.com/archive/2007/03/21/97410.aspx>)

NASA sees it a different way, however. The report said the gravity tractor concept and similar techniques would be the "most expensive" ways to divert an asteroid: "In general, the slow push systems were found to be at a very low technology readiness level and would require significant development methods," it said. Schweickart said NASA must have "misunderstood or mischaracterized" the gravity tractor concept. And he worried that the report may make things tougher for researchers working on kinder, gentler ways to head off killer asteroids. "It may be harder to continue with that research," he said. "The irony is that NASA ought to be doing that research. "But beyond that, there is also the issue that people are beginning to wrestle with this question on a much larger basis internationally," he said. "The idea that the only way you can protect Earth from these things is to compromise all your principles about nonproliferation would be shocking to anybody else. Almost anytime the United States is going to say anything about this, eyebrows are going to go up." Schweickart already has written a 13-page retort to the report, as well as a letter to NASA Administrator Michael Griffin asking him to reconsider the agency's policy. Both are available from the [B612 Foundation press page](http://www.b612foundation.org/press/press.html) as Word documents. Schweickart is also calling on NASA to release more of the background analysis that went into the final report. "I just felt that it was inappropriate that this stand unchallenged - not only unchallenged, but unsupported," he said. He feared that his anti-nuclear stand might make him "persona non grata" in NASA circles - but astronomer [Donald Yeomans](http://www.msnbc.msn.com/id/9890268), the head of NASA's [Near Earth Object Program Office](http://neo.jpl.nasa.gov/) at the Jet Propulsion Laboratory, said Schweickart's idea of combining kinetic impactors with gravity tractors had merit. "That's an interesting concept if you wanted to do non-nuclear," Yeomans told me. He pointed out that the NASA report was merely aimed at outlining the viable options for dealing with potentially threatening NEOs, and that the nuclear standoff explosion would be a "viable option for almost anything." (NASA isn't crazy about planting a nuke right on a NEO, a la ["Armageddon,"](http://www.msnbc.com/m/nw/a/m/mv_a.asp#Armageddon) because of the risk of breaking the object into hazardous pieces.) The kinetic impactor, perhaps combined with a gravity tractor or monitoring device, would be the most straightforward way to head off a NEO threat - and would probably be preferred for the smaller-scale threats. "You really don't have one technique that fits all - except for this standoff blast, perhaps - but I don't think anyone is comfortable with this nuclear option," Yeomans said. "I think nuclear is there and available, but it's sort of a last resort. That's my own opinion. ... It's politically a tough sell, and it gives most people the willies." One thing that nearly everyone agrees on is the need to devote more resources to hunting NEOs in the 460-foot-and-up range. The NASA report suggested two options for complying with Congress' requirements: either building a new ground-based telescope facility dedicated to the asteroid search, or putting a new infrared telescope into a Venus-like orbit. Unfortunately, NASA says it [can't afford either option](http://www.msnbc.msn.com/id/17473059/) for the time being.

## SQ Solves - Detection

### Detection is improving—we’ll discover thousands of potentially hazardous NEOs

Jones ‘8 (Thomas, fellow at the American Institute of Aeronautics and Astronautics, “Asteroid deflection: Planning for the inevitable,” Aerospace America, October, lexis)

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 human society would probably cause global climatic disruptions, widespread crop failures, and worldwide famine. Search and discovery At least we are looking: New wide-field telescopes with advanced instrumentation, capable of searching large swaths of the sky for faint objects, promise large improvements in our near-Earth object detection capabilities. One of these new systems is Pan-STARRS (Panoramic Survey Telescope and Rapid Response System), whose prototype element is now operating on Haleakala in Hawaii. When complete, Pan-STARRS will have 3-16 times the collecting power of current NEO survey telescopes. Using a massive array of state-of-the-art CCD detectors in the focal plane, it will detect objects 100 times fainter than those currently found by NEO surveys. Pan-STARRS should quickly complete a search, as directed by Congress in 1998, for 1-km (and larger) NEOs and will be able to find 99% of those objects bigger than 300 m across. Another planned system is LSST, the Large Synoptic Survey Telescope, to be sited in northern Chile. Beginning in 2014, the 8.4-m telescope will scan the entire visible sky every three nights using a 3.2-billion-pixel CCD camera the size of a small car. The LSST will be able to find 90% of the near-Earth asteroid population 140 m and larger within about a 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! 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. But our technology offers options: Spacecraft have rendezvoused with several NEOs, and we possess the means to deflect most asteroids on a collision course. The first step would be to attach a transponder to the NEO, so we can predict its future orbit precisely; refined tracking will eliminate the uncertainty surrounding most impact calculations. If deflection is necessary, we can hover near an asteroid and change its velocity slightly with a "gravity tractor" spacecraft. We can ram an oncoming NEO with a high-speed projectile, transferring momentum and altering the object's velocity. In the very rarest of cases (a large NEO or little warning time), we can use a nuclear explosive to vaporize the top millimeter of its regolith, with the resulting jet of gas and debris nudging the asteroid off course. Any efforts at NEO deflection must be international in scope. First, because of tracking uncertainties, a NEO's predicted impact point will lie along a thin line spanning most of a hemisphere (the projection of its orbital plane on Earth's surface). This risk corridor will span many nations until tracking accuracy improves, quite close to impact. Second, the process of deflecting a NEO will necessarily shift that impact point along the corridor, toward the Earth's limb, lowering impact risk for one nation but temporarily raising it for another, until the threat is eliminated entirely. Only an international consensus on deflection decisions will succeed; without it, a serious impact threat will generate controversy, prolonged argument, and political inaction--in short, paralysis. Of the several thousand PHAs we will face 10-15 years from now, several dozen will possess an uncomfortably **high probability** of striking Earth. With local or regional devastation a real possibility, the global community will face a decision, then, on whether to act to prevent an impact. What probability of a future impact will trigger a collective decision to deflect a NEO? We will seldom possess perfect knowledge about the threatening NEO. Indeed, because of the substantial lead time required to fund, plan, and execute an asteroid deflection campaign (the series of missions needed to assure a "miss"), our institutions may have to act before we are certain an impact will actually occur. Erring on the side of caution, we may be forced to make crucial, timely decisions about NEO deflection much more frequently than the occurrence of actual impacts. For example, given the potential devastation an impact might cause, we may decide to deflect an object even if it has just a 10%, or as little as a 1%, probability of hitting Earth. If the actual NEO impact frequency for a future Tunguska is 1 per 500 years, but we decide to act at a threshold of impact probability of 2% (1 in 50), then we will face such a decision once every 10 years. We clearly need an international process, in place and widely supported, enabling us to deal with a potential NEO threat consistently and promptly. Preparing to act Today, we can detect NEOs and predict their potential for collision with Earth. For the first time in our planet's 4.5-billion-year window of vulnerability to cosmic collisions, we have the technical capability to prevent such devastating events. The keys to succeeding in all cases are preparation, planning, and timely decision-making.

### We’re still monitoring the sky to detect incoming asteroids, so if we find a threat, we’ll deflect it

Johnson 12-10-09(John, staff reporter, LA Times, The dark side of space about to be illuminated, [http://www.latimes.com/news/nationworld/nation/la-sci-wise10-2009dec10,0,5846611.story](http://www.latimes.com/news/nationworld/nation/la-sci-wise10-2009dec10%2C0%2C5846611.story))

Making a better atlas is what Wright and his colleagues hope to do with NASA's Wide-field Infrared Survey Explorer, or WISE, space mission. Scheduled to launch Friday from Vandenberg Air Force Base in California, the $320-million spacecraft will photograph the entire night sky in infrared light. In the process, it will capture hundreds of thousands of previously unknown objects that are too cool and too dark to light up our nighttime sky. Like alleyway skulkers with hats pulled low over their eyes, these objects have been lurking around space for millions of years, yet hidden from view. These denizens of the dark are likely to include tens of thousands of asteroids between Mars and Jupiter -- some of which could turn out to be an eventual threat to Earth; dozens of failed stars known as brown dwarfs; possibly even a giant planet out beyond Pluto. Scientists say WISE could revise the familiar portrait of our solar system. "What we're doing with WISE is opening up the sky in a way that hasn't been possible before. It will transform the picture of our solar neighborhood," said Peter Eisenhardt, a scientist at the Jet Propulsion Laboratory in La Cañada Flintridge, where the mission is managed. "It will give scientists things to study for decades." Steinn Sigurdsson, an astronomer at Pennsylvania State University who is not affiliated with the mission, agrees that WISE offers "considerable prospects for significant discoveries." It's even possible, he says, that the mission could find planets around other stars. Of course, this isn't the first time anyone has thought of scanning the sky in wavelengths other than the narrow region of visible light. Radio telescopes like the Arecibo instrument in Puerto Rico search deep space for the long radio waves emitted by many galaxies. Other instruments try to capture the intensely short and dangerous gamma rays released by exploding stars. But some things, such as the process in which stars form from balls of hard-to-see interstellar gas, are much easier to study in the infrared, which can pick up very dim and relatively cool objects. "From my perspective, this is an incredibly exciting mission," said Andrea Ghez, an astronomy professor at UCLA who is not part of the WISE team. The forerunner to WISE was NASA's Infrared Astronomical Satellite. Launched in 1983, it probed the entire sky in the infrared, increasing the number of cataloged astronomical objects by a staggering 70%. It detected 350,000 new objects, including comets and wisps of invisible but warm dust clouds in almost every direction of space. But by using just 62 pixels to measure the heavens, that satellite was a dim flashlight compared to WISE. Each of WISE's four detectors will scan space with 1 million pixels, making the suite of instruments thousands of times more sensitive. After being launched by a Delta II rocket, WISE will settle into orbit about 326 miles above the Earth's surface. The heart of the 9-foot-tall spacecraft is a 16-inch-diameter telescope housed in a shroud of solid, frozen hydrogen called a cryostat. This floating ice chest is designed to keep the instruments so cold -- as low as minus 445 degrees Fahrenheit -- that the four detectors will not accidentally pick up heat from the mission's own electronics. The first class of objects likely to pop out of hiding is a type of failed star called a brown dwarf. Brown dwarfs didn't possess the sheer bulk necessary to sustain the nuclear fusion reaction that causes stars like our sun to burst into flames after collapsing from a ball of gas. Brown dwarfs don't shine, except in the infrared. Their temperatures, ranging from a downright icy minus 330 degrees to 1,300 degrees, are remnants of the heat generated by their gravitational collapse. According to Eisenhardt, many scientists believe there are as many brown dwarfs in any region of space as regular stars. Within 25 light-years of the sun, there are about 100 known stars, only six of which are brown dwarfs. That means there could be another 90 or so brown dwarfs in that area awaiting discovery. There is an even chance, Wright said, that one might be closer than the conventional star Proxima Centauri. Four light-years away, Proxima holds the record for our closest starry neighbor. "That would be a very exciting discovery," Eisenhardt said. Within our solar system, WISE will probably uncover as many as 100,000 new asteroids in the rocky junk pile between Mars and Jupiter. The several hundred thousand asteroids we know now consist mostly of those with surfaces that reflect light well. Further, the conventional way to measure an asteroid, Wright said, is to equate its size with its brightness. But some things just don't reflect as well as others, regardless of size. Because WISE will see temperature differences, it will provide a much better tool for judging size, Eisenhardt said. That doesn't mean the spacecraft will find a "doomsday asteroid" that poses a threat to Earth. What it does mean is that the mission will help scientists judge the size of any threatening asteroid, giving greater advance warning about the ones that could be the next weapon of extinction, like the one suspected of wiping out the dinosaurs.

### We’ll be prepared

Stone ‘8(Richard, editor for Science Magazine, National Geographic, “Target Earth,” 8-1, lexis)

The next time the sky falls, we may be taken by surprise. The vast majority of these smallish bodies, capable of wiping a city off the map, are not yet on our radar screens. "Ignorance is bliss, in that if you don't know about these things, you just go about your merry way," says Lu. Over the next decade, however, sky surveys like Tholen's should begin filling that gap, cataloging asteroids by the thousands."Every couple of weeks," says Lu, "we're going to be finding another asteroid with like a one-in-a-thousand chance of hitting the Earth." The goal is not just to foretell the date and time of a potential catastrophe. The goal is to forestall it. With years or decades of warning, a spacecraft, using its own minuscule gravity, might nudge a threatening asteroid off course. For objects requiring a bigger kick, a kamikaze spacecraft or a nuclear bomb might do the job. Vexing dilemmas would attend this showdown in space. How will governments decide to act? "This is a class of problem that the world isn't set up to deal with," says physicist David Dearborn, an advocate of a nuclear strike against an incoming asteroid. Two facts are clear: Whether in 10 years or 500, a day of reckoning is inevitable. More heartening, for the first time ever we have the means to prevent a natural disaster of epic proportions. [continued…] A new telescope is about to begin scanning the sky for these dim, elusive objects. From a peak on Maui, the Panoramic Survey Telescope and Rapid Response System, or Pan-STARRS, will scrutinize the night sky with a 1.4-billion-pixel camera that produces images so detailed a single one, if printed, would cover half a basketball court. Computers will scan the data, flagging statistical curiosities that astronomers can check the old-fashioned way, by taking a look. The Maui telescope is just a prototype; ultimately, Pan-STARRS will include an array of four cameras. "We'll have catalogs of all the things that go bump in the night," says Ken Chambers of the University of Hawaii, including perhaps 10,000 potentially hazardous asteroids. Within decades, the world's leaders may be forced to grapple with a momentous decision: whether and how to deflect an incoming object. Few experts are giving this much thought, says astronomer David Morrison of NASA's Ames Research Center: "The number would roughly staff acouple shifts at a McDonald's." Lu, the former astronaut, is one. Now an executive at Google, he is helping design a massive database for a successor to Pan-STARRS, the Large Synoptic Survey Telescope, which will scrutinize the sky in even more detail starting in 2014. Lu is also the coauthor of a scheme for using a spacecraft to coax an earthbound asteroid off its dangerous path. "We were originally thinking about how you would land on an asteroid and push it," he says. "But that doesn't work well." If the surface is crumbly, the lander might skid off. Moreover, asteroids twirl through space. "If you're pushing and the thing is rotating, the pushing just cancels out," Lu says.

### NEATT, SPACEWATCH AND NASA ALL WATCHING SKIES FOR DANGER

Symansky ’08 (Paul Symansky, Electrical Engineer at SymTech Laboratories and Boston College graduate, 2/28/08, “Asteroids: A realistic, but very remote threat,” 6/22/11, LexisNexis, MLK)

Thanks to our sophisticated astronomical tracking technology, however, we can be a step ahead of even the most menacing asteroids. The Near Earth Asteroid Tracking Team, SpaceWatch, and NASA are among several agencies valiantly watching the skies to hopefully catch an asteroid before it becomes a threat. One such discovery, the 2004 MN4 satellite, also known as 99942 Apophis or just Apophis, was projected to possibly hit Earth in 2029. Later observations and calculations showed that impact was unlikely to happen, but that if the asteroid were to orbit through a very small portion of space, its trajectory could be altered enough to pose a risk on April 13, 2036.

### European Space Agency satellites monitoring 100,000 NEOs solves in the SQ.

(The Scotsman, 2003,) The Scotsman Publications Ltd., “MINI-SATELLITES STUDY ASTEROID THREAT” Lexis Nexis, 6/22/11,CF

A FLEET of mini-probes could be sent to rendezvous with asteroids, under an ambitious British-led plan to investigate the threat of space objects hitting the Earth, it was revealed yesterday. The five micro-satellites - only 60cm long and weighing 120kg - would each target an asteroid of a type considered to be potentially dangerous. Each asteroid would be physically different and measure between 400 metres and 1,300 metres in diameter. A consortium led by QinetiQ, formerly the major part of the government's Defence Evaluation and Research Agency (DERA), has submitted the proposal to the European Space Agency. One attraction of the plan is its relatively low cost, by space mission standards - expected to be no more than GBP 100 million. The key objective would be to understand more about the threat posed by more than 100,000 Near Earth Objects (NEOs) hurtling around the Solar System. Throughout the Earth's 4.5billion-year history, asteroids and comets have collided with the planet on numerous occa-sions and there have been many near -misses. A giant object which slammed into the Earth 65 million years ago is widely believed to have wiped out the dinosaurs. The asteroid mission has been named SIMONE (Smallsat Intercept Missions to Objects Near Earth). Dr Roger Walker, the SIMONE senior mission and systems engineer at QinetiQ, said: "There is a critical science need to learn more about NEOs. He added: "The objective of the Simone mission will be to determine the characteristics of different NEO targets so that we can plan how best to respond to the threat."

## Other countries will detect

### US not key—other nations are developing non-nuclear deflection strategies

**Barrett ‘6** (Scott, Professor and Director of International Policy, School of Advanced International Studies, Johns Hopkins University and Distinguished Visiting Fellow, Center for the Study of Globalization, Yale University, 6 Chi. J. Int'l L. 527, lexis)

The United States's strong unilateral incentive to protect the Earth from asteroids makes provision of this global public good relatively easy. However, the rest of the world should not complacently rely on the US to act in its best  [\*539]  interest. Since the consequences of the actions that are taken or not taken will be shared, the responsibility for deciding which actions to take or not take should also be shared. There are two possible futures. In one, the United States would take the lead, but other countries would contribute materially to a joint effort, and share in the decision-making (an arrangement akin to the International Space Station). In the other, countries with strong incentives to supply this global public good unilaterally would develop initiatives of their own. The latter outcome is already developing. The European Space Agency, for example, is planning to deploy a spacecraft intended to alter an asteroid's orbit. **[47](http://www.lexis.com/research/retrieve?_m=65fe7099e860d61cf196eafeee25c4fe&csvc=bl&cform=searchForm&_fmtstr=FULL&docnum=1&_startdoc=1&wchp=dGLbVlb-zSkAb&_md5=18b5fc1f51d299cd38a3a153fcb9e62f" \l "n47" \t "_self)** The Task Force recommends establishing an Intergovernmental Panel on Threats from Space, modeled after the Intergovernmental Panel on Climate Change, to assess the science, the impacts, and the mitigation possibilities. **[48](http://www.lexis.com/research/retrieve?_m=65fe7099e860d61cf196eafeee25c4fe&csvc=bl&cform=searchForm&_fmtstr=FULL&docnum=1&_startdoc=1&wchp=dGLbVlb-zSkAb&_md5=18b5fc1f51d299cd38a3a153fcb9e62f" \l "n48" \t "_self)** This is a sensible proposal, as it would provide a common basis from which to develop an institution for coordinating a global response. A treaty on near-Earth objects would need to establish the objectives of international cooperation in this area, as well as provide the bases for decision-making and burden-sharing. Because of the incentive structure underlying asteroid defense, this would probably be a relatively easy treaty to negotiate, enforce, and sustain over time.

### Canadian space satellite solves

Hildebr et al.‘4(A.R., prof of Geology and Geophysics at U of Calgary, “Advantages of Searching for Asteroids from Low Earth Orbit: The NEOSSat Mission,” Earth, Moon, and Planets, http://www.springerlink.com.proxy.lib.uiowa.edu/content/x08097l2p7174105/fulltext.pdf)

A visible light telescope in a suitable low Earth orbit (LEO) may continuously search regions near the Sun both ahead of and behind the Earth (e.g., Hildebrand et al., 2004). Such a space-based search mission is currently in design with launch planned for 2008. Defence Research and Development Canada (DRDC) and the Canadian Space Agency (CSA), will use innovative microsatellite technology to build the Near Earth Object Surveillance Satellite (NEOSSat) to track artificial satellites in high Earth orbit (e.g., Wallace et al., 2004), and to discover, track, and study NEOs (This component is termed the Near Earth Space Surveillance (NESS) project.) The spacecraft design has been strongly influenced by the successful operation of the Microvariability and Oscillations of Stars (MOST) microsatellite space astronomy mission (Walker et al., 2003). This paper briefly discusses the advantages of asteroid searching from LEO with a visible light sensor as is envisaged for the NEOSSat spacecraft.

### There’s international cooperation on NEO detection

**Foster ‘7** (Harold, Geography Prof at U of Victoria, Chapter 27: Disaster Planning for Cosmic Impacts: Progress and Weaknesses, in *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, SpringLink)

Currently, Spaceguard consists of a network of professional laboratories, dominated by two 1-meter aperture telescopes near Socorro, New Mexico (operated by MIT Lincoln Laboratory) and numerous amateur and professional observers who follow up discoveries and attempt to refine knowledge of their orbits. Members of the Spaceguard search programs include the Lowell Observatory’s LONEOS in Flagstaff, Arizona, Jet Propulsion Laboratory’s near-Earth Asteroid Tracking [NEAT] facility, located in Maui and on Mt. Palomar, California and Spacewatch on Arizona’s Kitt Peak (Chapman 2004). In addition, the International Spaceguard Foundation is centerd in Italy. This consists of a team of astronomers who collaborate by e-mail whenever one discovers a particularly threatening Near-Earth-asteroid. This global network of professional and amateur observers continues to discover a new Near-Earth-asteroid every few days. As of February 2004, almost 2 670 have been found, some 600 of which are potentially hazardous. As Chapman (2004) points out, this compares with only 18 that were known in 1981. It is believed that the census is complete for near-Earth-asteroids greater than 3 kilometers in diameter. The estimated number of near-Earth-asteroids greater than one kilometer in diameter is some (1 100 ± 200) (Bottke 2006). About 55 percent of this total had been identified by early 2004. NASA also supports a Near-Earth Object Program that was established in 1998 to help coordinate and provide a focal point for research into asteroids and comets that approach the Earth’s orbit. It operates from the Jet Propulsion Laboratory and provides data on the recent approaches to the Earth, including the name of the object, its closest approach date, miss distance, estimated diameter and relative velocity. On June 27, 2004, when the author visited this website (NASA 2004) 40 such objects were listed, varying in size from an estimated 900 m–2.0 km to 15 m–34 m in diameter, with miss distances reaching a minimum of 1.5LD (1 LD [lunar distance] = ~384 000 kilometers).

## SQ Solves - Deflection

### NASA plans to ram asteroids despite small need for worry.

Fischetti, ’11 (Mark Fischetti, Scientific American Staff Writer, 3/1/11, “Death by Asteroid: A Graphic Look at Rocky Threats from Space,” 6/21/11, <http://www.scientificamerican.com/article.cfm?id=death-by-asteroid#>, MLK)

Researchers have identified more than 2,300 asteroids and comets that are big enough to cause considerable damage on Earth and could possibly hit us. These “potentially hazardous objects” look ominous on the flat plot here, but because they travel in three-dimensional orbits, the perfect timing needed to intersect Earth makes the likelihood of collision remote. The symbol sizes shown also deceive; each object is many thousands of times as small as Earth. NASA is concerned nonetheless. Scientists estimate that they have found fewer than 1 percent of the projectiles. “We are discovering them at a rapid clip, but the population is very large,” says Donald K. Yeomans, manager of the Near Earth Object Program Office at NASA’s Jet Propulsion Laboratory. A NASA advisory group says that for $250 million to $300 million annually over 10 years, the space agency could inventory the objects and develop and test technologies that could alter a worrisome asteroid’s trajectory. One option: ram it with a massive space¬craft to knock it off course.

### Status quo proves NASA and congress have plans already underway for protection of planet.

Herald Sun, ’06(Herald Sun, 5/16/06, “April 13, 2036 - our date with destiny,” 6/21/11, LexisNexis, MLK)

In 1998, lawmakers formally directed NASA to identify by 2008 at least 90 per cent of the asteroids more than 1km wide that orbit the sun and periodically cross Earth's path. That search is more than three-quarters complete. Last year, Congress directed the space agency to come up with options for deflecting potential threats. Ideas seriously discussed include lasers on the moon, futuristic ''gravity tractors'' -- spacecraft that ram incoming objects -- and Hollywood's old standby, nuclear weapons.

## Russia Solves

### Russia is ready to take charge, but believes it should be a cooperative mission

Tribe 06, (Tribe, 10/24/06, http://cosmologytalk.tribe.net/thread/b648147b-c135-4c28-978f-11367a79f896, SH)

MOSCOW (AFP) - **Russia is prepared to repel asteroids to save Earth "if necessary,"** deputy head of the Russian space agency Viktor Remishevsky reportedly said. **"If necessary, Russia's rocket-manufacturing complex can create the means in space to repulse asteroids threatening Earth," Remishevsky told** the ITAR-TASS **news agency**, without giving further details. **The official stressed that saving Earth from the threat of asteroids demanded international cooperation**. "Above all, space research institutions, telescopes, and the infrastructure of the Russian Academy of Sciences should warn about the threat of asteroids falling to Earth," Remishevsky said. According to Russia's Institute of Applied Astronomy, about 400 asteroids and over 30 comets currently present a potential threat to the planet. The institute's specialists are particularly concerned about an asteroid known as Number 2907, a kilometer-wide chunk of space rock that they believe "with a large degree of certainty" will strike the Earth on December 16, 2880.

### Russia will do whatever necessary to save the Earth

AFP ’06 (Agent France Presse, 10/24/06, “Russia can repel asteroids to save Earth: official,” 6/22/11, LexisNexis, MLK)

Russia is prepared to repel asteroids to save Earth "if necessary," deputy head of the Russian space agency Viktor Remishevsky said Tuesday, ITAR-TASS news agency reported. "If necessary, Russia's rocket-manufacturing complex can create the means in space to repulse asteroids threatening Earth," Remishevsky said, without giving further details. The official stressed that saving Earth from the threat of asteroids demanded international cooperation. "Above all, space research institutions, telescopes, and the infrastructure of the Russian Academy of Sciences should warn about the threat of asteroids falling to Earth," Remishevsky said. According to Russia's Institute of Applied Astronomy, about 400 asteroids and over 30 comets currently present a potential threat to the planet. The institute's specialists are particularly concerned about an asteroid known as Number 2907, a kilometer-wide chunk of space rock that they believe "with a large degree of certainty" will strike the Earth on December 16, 2880

### Russia solves any immanent NEO threat.

 Yury Zaitsev 09, (Yury Zaitsev is an expert with the Space Research Institute of the Russian Academy of Sciences, 4/23/09, “Deflecting Asteroids Difficult But Possible”, http://www.spacedaily.com/reports/Deflecting\_Asteroids\_Difficult\_But\_Possible.html, SH)
Col. Gen. Vladimir **Popovkin, commander of the Russian Military Space Forces, told a news conference Friday that the national satellite network lacked a spacecraft capable of preventing an asteroid strike.** He also said chances of such a collision were infinitely small, and it was inexpedient to spend huge sums on neutralizing this unlikely threat. Still, the general might be underestimating the scale of the asteroid threat. **Over the last few decades there has been a great deal of debate about the level of danger posed by impacts from asteroids and comets. It appears the world needs to take the threat of asteroid strikes a lot more seriously.** Astronomers have already spotted about 800 asteroids, solid rocky celestial bodies, with a diameter of over 1,000 meters (3,250 feet) moving along circumsolar elliptical orbits. However, there may be as many as 2,000 large asteroids, and some 135,000 rocks with a diameter of 100 meters (325 feet) and more. It should be noted that asteroid orbits are unstable and tend to change under the influence of gravitational fields of the terrestrial planets - Mercury, Venus, Earth and Mars. An asteroid, which flashed past our planet at a distance of 5 million kilometers (3.1 million miles) in November 1996, returned in September 2004 and flew by just 1.5 million kilometers (930,000 miles) from Earth's surface. In March 1989, a 300 meter (975 foot) asteroid crossed the terrestrial orbit and missed the Earth by just six hours. Astronomers spotted the rock only when it was receding into space. An asteroid measuring over 1,000 meters in diameter is potentially capable of destroying human civilization. Chances of a major asteroid impact in the 21st century are a mere 0.0002 percent, although there is a 2 percent probability of Earth colliding with a 100 meter asteroid before the year 2100. The blast would equal to 100 Megatons in trinitrotoluol equivalent, and it would kill millions of people if it hit a populous industrial region harboring many hazardous enterprises. Scientists are quite alarmed, because they register additional asteroids buzzing the Earth. Spaceguard Survey, an international service responsible for detecting and tracking potentially dangerous space objects, has now been established. Russia established the Space Shield Foundation east of the Urals. The organization involved scientists from the Snezhinsk (Chelyabinsk-70) nuclear center and the Makeev State Rocket Center in Miass. The foundation eventually set up subsidiaries in Novosibirsk and Korolev, outside Moscow. **The Planetary Defense Center, which was established in Russia three years ago, comprises the best defense-industry facilities, aerospace enterprises, in the first place, as well as academic and sectoral research**. Scientists say the best way to cope with the asteroid problem is to register and observe all potentially dangerous space objects. However, it is not enough to spot an asteroid, because most of them have unstable orbits; consequently such asteroids may disappear later on. Every terrestrial hemisphere must therefore have three or four telescopes with primary mirrors 4 meters to 5 meters in diameter for observing asteroids round the clock. Such observations would make it possible to catalog asteroids with a diameter of less than 1,000 meters. Many observatories - Russian observatories included - are now working on the asteroid catalog. **Scientists claim that it would become possible to warn about impending asteroid strikes 80 to 100 years in advance if 90 percent of asteroids are registered, and in case of regular observations**. But long-term asteroid protection remains in the realm of science fiction. **Two scenarios exist for shielding this planet from a dangerous space object. First, any hostile object can be shattered in deep space, before it reaches Earth. Second, its orbit can be changed, so the asteroid steers clear of our planet**. Some scientists think a nuclear device could be detonated on the asteroid's surface or in direct proximity to it, making it possible either to shatter that asteroid, whose fragments may still threaten Earth, or heat up one of its sides and vaporize large segments, thereby changing the asteroid's flight path. Technically speaking, a powerful nuclear explosion can change the orbit of the asteroid several months before it impacts the planet. Russian scientists suggest using the kinetic energy of asteroids in order to destroy them. **This can be accomplished by creating an artificial dust cloud in the asteroid's path. That cloud's particles would interact with the asteroid surface and gouge craters. The dangerous object would finally disintegrate because the mass of crater particles would be directly proportional to the kinetic energy of colliding bodies.** The United States demonstrated this effective method on July 4, 2005, when part of the Deep Impact spacecraft, a copper ball, 65 centimeters (about 3 feet) in diameter and weighing 140 kilograms (300 pounds) hit the comet Tempel 1, an object with a radius of 3 kilometers (1.9 miles) and carved a 200 meter crater. It would be much harder to build a catapult with the help of robots on the asteroid's surface for launching rocks into space and altering the asteroid's trajectory. A rocket engine on the asteroid's surface likewise could change its flight path. Both options present problems, because of the precision needed to deflect an asteroid correctly. **Another method suggests using laser or solar beams to heat up a small asteroid-surface section and to propel it in the required direction**. But it would be difficult to deliver a laser unit or a mirror-lens to the asteroid and to ensure the required attitude control for a long time. An asteroid patrol would prove quite expensive; consequently, it would be expedient to streamline its elements during current space programs, which is being done. The Deep Impact project shows scientists are working in the right direction. Russia's Lavochkin NPO has suggested the demonstration project Space Patrol for perfecting various asteroid-protection methods and systems. A small spacecraft with a mass of just 200 kilograms, now being developed within this project's framework, would act as navigator or pilot and could liftoff atop converted ballistic missiles such as the Strela and the Rokot. The European Space Agency also is working on its Don Quijote mission, intended to investigate the possibility of deflecting a dangerous asteroid. A Russian Soyuz-Fregat rocket would launch the Sancho and Hidalgo spacecraft, which would reach the asteroid within six or seven months. Sancho would be the first to arrive at its destination, taking position in orbit around the asteroid. Hidalgo eventually would slam into it at 10 kilometers per second (22,300 miles per hour). Sancho would then inspect the damaged asteroid and assess its changed trajectory. ESA will select the target asteroid in 2007, and Sancho and Hidalgo are scheduled to lift off in between 2010 and 2015.

### Russia is putting all of their resources into it.

Atkinson 09, (Universe Today, Nancy Atkinson is a science journalist who writes mainly about space exploration and astronomy, 12/30/09, “Russa may head mission to deflect asteroid apophis”, http://www.universetoday.com/48912/russia-may-head-mission-to-deflect-asteroid-apophis/, SH)
**Russia is considering sending a spacecraft to deflect a large asteroid and prevent a possible collision with Earth**, according to a radio interview by the head of the country’s space agency. Anatoly Perminov said the space agency will hold a meeting soon to assess a mission to asteroid Apophis, and said NASA, ESA, the Chinese space agency and others would be invited to join the project. **Apophis is** a 270-meter (885-foot) asteroid that was spotted in 2004. It is **projected to come within** 29,450 **kilometer**s (18,300 miles) **of Earth in 2029**, and currently has an estimated 1-in-250,000 chance of hitting Earth in 2036. A panel at the recent **American Geophysical Union conference stressed that asteroid deflection is a international issue**. “There is a geopolitical misconception that NASA is taking care of it,” said former Apollo astronaut Rusty Schweickart, who is part of the B612 Foundation, which hopes to prove the technology to significantly alter the orbit of an asteroid by 2015. “They aren’t and this is an international issue. The decisions have to be world decisions.” Perminov seemed unaware that NASA’s Near Earth Object program recently downgraded the possibility of a 2036 asteroid impact and also for a subsequent pass in 2068. **Perminov said that he heard from a scientist that Apophis asteroid is getting closer and may hit the planet. “I don’t remember exactly, but it seems to me it could hit the Earth by 2032,” Perminov said. “People’s lives are at stake. We should pay several hundred million dollars and build a system that would allow to prevent a collision, rather than sit and wait for it to happen and kill hundreds of thousands of people.**” Perminov wouldn’t disclose any details of the project, saying they still need to be worked out. But he said the mission wouldn’t require any nuclear explosions. “Calculations show that it’s possible to create a special purpose spacecraft within the time we have, which would help avoid the collision without destroying it (the asteroid) and without detonating any nuclear charges,” Perminov said. “The threat of collision can be averted.” Boris Shustov, the director of the Institute of Astronomy under the Russian Academy of Sciences, hailed Perminov’s statement as a signal that officials had come to recognize the danger posed by asteroids like 2036 Apophis. “Apophis is just a symbolic example, there are many other dangerous objects we know little about,” he said, according to RIA Novosti news agency.

## Russia Solves Apophis

### Russia is working on space technology to save us from asteroid collision.

Sudakov ’09 (Dmitry Sudakov, translator and writer for Pravda.ru, 12/30/09, “Russia To Send Asteroid Apophis Back into Deep Black Space,” 6/24/11, <http://english.pravda.ru//science/tech/30-12-2009/111499-asteroid_apophis-0/?mode=print>, MLK)

Russia’s Federal Space Agency Roscosmos will start working on a project to save planet Earth from the collision with Asteroid Apophis, which, as scientists predict, mayo happen in 2036. Anatoly Perminov, the head of Roscomos, said in an interview with the Voice of Russia Radio Station that the flight trajectory of the massive asteroid was gradually approaching the Earth. A scientist, who shared the information with Mr. Perminov, also told the official that Apophis was three times as large as the legendary Tunguska Meteorite.

## A2: Russia uses Nuclear Weapons

### Russia is developing deflection strategy for the asteroid Apophis that will not use nuclear weapons

**Barry 12-31-9** (Ellen, NYT staff reporter, NYT, 12-31-09, lexis)
Russia's top space researchers will hold a closed-door meeting to plan a mission to deflect 99942 Apophis, an asteroid that will fly close to Earth two decades from now, said Anatoly N. Perminov, the head of Russia's space agency, during an interview on Russian radio on Wednesday. Mr. Perminov said Apophis, named for the Egyptian god of destruction, is about three times the size of the Tunguska meteorite, apparently the cause of a 1908 explosion in Siberia that knocked over an estimated 80 million trees. He said that according to his experts' calculation, there was still time to design a spacecraft that could alter Apophis's path before it made a dangerous swing toward Earth. ''I don't remember exactly, but it seems to me it could hit the Earth by 2032,'' he said, adding, ''We're talking about people's lives here. It's better to spend several million dollars and create this system, which would not allow a collision to happen, than wait for it to happen and kill hundreds of thousands of people.'' In fact, Apophis's chances of hitting Earth have been downgraded since it was discovered in 2004, NASA said this year. Scientists originally thought the orbit of the 1,000-foot-long asteroid gave it a 2.7 percent chance of hitting Earth on its first approach in 2029, but after studying its path they said it would remain 18,300 miles above the planet's surface. On a second approach, in 2036, it was originally given a 1-in-45,000 chance of hitting Earth, but the odds were reduced to 1 in 250,000. The odds of impact on its third approach, in 2068, are 1 in 333,000, NASA scientists say. Scientists have proposed various methods of averting an asteroid impact, among them a spacecraft that would land on the asteroid and, using electric motors, very gradually turn its trajectory. Another method would involve striking it with missiles or employing a satellite that used gravitational pull to change the orbit. Mr. Perminov said the plan he envisioned would involve ''no nuclear explosions; everything will be based on the laws of physics.'' Once a mission has been developed, Russia will invite NASA, the China Space Agency and the European Space Agency to participate, he said.

## A2- No War - Yes War

### Mandelbaum says that war can still happen

Mandelbaum 1999

Michael Mandelbaum 99, American Foreign Policy Professor in the School of Advanced International Studies at Johns Hopkins, February 25, Council on Foreign Relations Great Debate Series, “Is Major War Obsolete?” [http://www.ciaonet.org/conf/cfr10](http://www.ciaonet.org/conf/cfr10/)

In conclusion, let me say what I’m not arguing. I’m not saying that we’ve reached the end of all conflict, violence or war; indeed, the peace I’ve identified at the core of the international system has made conflict on the periphery more likely. Nor am I suggesting that we have reached the end of modern, as distinct from major, war; modern war involving mechanized weapons, formal battles, and professional troops. Nor am I offering a single-factor explanation. It’s not simply nuclear weapons or just democracy or only a growing aversion to war. It’s not a single thing; it’s everything: values, ideas, institutions, and historical experience. Nor, I should say, do I believe that peace is automatic. Peace does not keep itself. But what I think we may be able to secure is more than the peace of the Cold War based on deterrence. The political scientist Carl Deutcsh once defined a security community as something where warlessness becomes a self-fulfilling prophecy. Well, he was referring to the North Atlantic community, which was bound tightly together because of the Cold War. But to the extent that my argument is right, all of Eurasia and the Asia-Pacific region will become, slowly, haltingly but increasingly, like that.

### War will escalate -- high alert guarantees

Phillips 2000

DR Alan Phillips Oct. 2000 http://www.peace.caInuclearwinterrevisitedhtm

With thousands of rocket-launched weapons at launch-on-warning”, any day there could be an all-out nuclear war by accident. The fact that there are only half as many nuclear bombs as there were in the 80’s makes no significant difference. Deaths from world-wide starvation after the war would be several times the number from direct effects of the bombs, and the surviving fraction of the human race might then diminish and vanish after a few generations of hunger and disease, in a radioactive environment.

### War is always possible – statements of lasting peace have never been correct – Mandelbaum’s exception of Russia and China undermine their entire argument

Kagan 1999

Donald Kagan is Hilihouse Professor of History and Classics at Yale University “Is Major War Obsolete? An Exchange” Survival, vol. 41, no. 2, Summer 1999, pp. 139—52

I agree that the present moment in history provides a better chance than ever for achieving a long period of peace, that the deterrent offered by nuclear weapons works towards that end, and that the growth of trade, democracy and economic interdependence assists that prospect. I do not, however, believe that war is obsolete — not yet, anyway. Nor do I believe that the present situation is unique in history any more than any moment is. As always, the chances for peace in the future depend on the decisions and the actions taken by people and these, as always, provide no guarantee against war — even ‘major’ war as Michael Mandelbaum has defined it. This is not the first time in history that people have thought that they had arrived at such a moment, such an extraordinary turning point. In 29BC, when Augustus closed the doors of the Temple of Janus in Rome for only the third time in the 500 years of Rome’s history, as a demonstration, a propaganda move, but also as a statement of a real expectation that new conditions had arrived that made peace appear to be a lasting peace. He turned out to be wrong. A more interesting year, perhaps, is 1792: a wonderful year for people to be stunningly optimistic about the prospects for the future. William Pitt the Younger, then Prime Minister of England, predicted that there were going to be at least 15 years of peace; never had the horizon looked clearer. And in the same year, two intellectuals of different sorts, Joseph Priestley and Tom Paine, had expectations of the same kind. In fact, they were less limited and more like the optimistic views that Michael Mandelbaum puts forward in his article. They based their future on a major change of conditions in the world. Priestley said:’ The present commercial treaties between England and France and between other nations, formerly hostile to each other, seem to show that mankind begin to be sensible to the folly of war and promise a new and important era in the state of the world in general, at least in Europe. Paine said: ‘If commerce were permitted to act to the universal extent it is capable, it would extirpate the system of war’. And of course, to this view were added the views of Kant and Montesquieu, who thought that the establishment of the political institution of the republic was going to have the same pacifying effect. Monarchies were really what war was about. Now that they were gone, there would be no more war. As Paine put it:2 The instant the form of government was changed in France, the republican principles of peace and domestic prosperity and economy arose with the new government, and the same consequences would follow in the case of other nations. Of course, within a year, France and England were at war, and 20 years or so of terrible, dreadful conflict followed. In 1848, John Stuart Mill also sang the praises of commerce:3 Commerce, which is rapidly rendering war obsolete, by strengthening and multiplying the personal interests which act in natural opposition to it . The great extent and rapid increase of international trade ... [is] the principal guarantee of the peace of the world. And then, of course, at the end of the nineteenth century and early in the twentieth century, two people of note wrote important statements of this thesis. One had a great impact; the other was not much noticed but was perhaps the more perceptive. The former was Norman Angell’s famous work, The Great Illusion. Basically, his message was that war had become so devastating from an economic point of view that nobody would ever fight. The only problem in Angell’s view was to teach people enough to know war was a disaster. Ivan Bloch was the other one, who said that war was so horrible in his day because the incredible means that had become available for fighting meant that no society could survive very long if they ever started such a war. The horror and danger of future war, he felt, would deter these conflicts. Well, of course, within a few years came the First World War. Now having said all this, even if all these men were wrong, this does not mean that Michael Mandelbaum cannot be right. But it should inspire some degree of modesty and caution. In fact Mandelbaum is very cautious in the language that he uses. Major war is not necessarily finished, he concedes. It’s not dead, it’s obsolete. This is a charming term that seems to say more than it does, because that allows Mandelbaum to draw back from the more total claims later on. A major war is unlikely but not unthinkable, which is to say he thinks it can happen. It is obsolete, he writes, in the sense that it is no longer fashionable. To pick up the metaphor is to see some of its limitations as well as its charm. Is war really a matter of fashion? And even if it is, don’t we have to face the fact that there are some people who choose to be unfashionable, and then there are other people who have never heard of fashion in the first place? China and Russia are two cases to which the writer points. He identifies the Taiwan Straits and the Russo-Ukrainian border as places where wars may well break out, should they erupt anywhere. They are the ‘potential Sarajevos of the twenty-first century’. He is right. And, of course, it is this concession, however genuinely and generously and modestly expressed, that gives away the game. Since there are at least two places where major wars between great powers might well break out even today — and two are quite enough — it seems to me that his entire thesis is undermined.

### Mandelbaum is wrong—resources, nationalism, security, history, strategy and experts agree

Mearsheimer 1999

John Mearsheimer, February 25 1999, Whitney H. Shepardson Fellow, Council on Foreign Relations; R. Wendell Harrison Distinguished Service Professor of Political Science, University of Chicago Council on Foreign Relations Great Debate Series, “Is Major War Obsolete?” [http://www.ciaonet.org/conf/cfr10](http://www.ciaonet.org/conf/cfr10/)

Now I think the central claim that’s on the table is wrong-headed, and let me tell you why. First of all, there are a number of good reasons why great powers in the system will think seriously about going to war in the future, and I’ll give you three of them and try and illustrate some cases. First, states oftentimes compete for economic resources. Is it hard to imagine a situation where a reconstituted Russia gets into a war with the United States and the Persian Gulf over Gulf oil? I don’t think that’s implausible. Is it hard to imagine Japan and China getting into a war in the South China Sea over economic resources? I don’t find that hard to imagine. A second reason that states go to war which, of course, is dear to the heart of realists like me, and that’s to enhance their security. Take the United States out of Europe, put the Germans on their own; you got the Germans on one side and te Russians on the other, and in between a huge buffer zone called eastern or central Europe. Call it what you want. Is it impossible to imagine the Russians and the Germans getting into a fight over control of that vacuum? Highly likely, no, but feasible, for sure. Is it hard to imagine Japan and China getting into a war over the South China Sea, not for resource reasons but because Japanese sea-lines of communication run through there and a huge Chinese navy may threaten it? I don’t think it’s impossible to imagine that. What about nationalism, a third reason? China, fighting in the United States over Taiwan? You think that’s impossible? I don’t think that’s impossible. That’s a scenario that makes me very nervous. I can figure out all sorts of ways, none of which are highly likely, that the Chinese and the Americans end up shooting at each other. It doesn’t necessarily have to be World War III, but it is great-power war. Chinese and Russians fighting each other over Siberia? As many of you know, there are huge numbers of Chinese going into Siberia. You start mixing ethnic populations in most areas of the world outside the United States and it’s usually a prescription for big trouble. Again, not highly likely, but possible. I could go on and on, positing a lot of scenarios where great powers have good reasons to go to war against other great powers. Second reason: There is no question that in the twentieth century, certainly with nuclear weapons but even before nuclear weapons, the costs of going to war are very high. But that doesn’t mean that war is ruled out. The presence of nuclear weapons alone does not make war obsolescent. I will remind you that from 1945 to 1990, we lived in a world where there were thousands of nuclear weapons on both sides, and there was nobody running around saying, “ War is obsolescent.” So you can’t make the argument that the mere presence of nuclear weapons creates peace. India and Pakistan are both going down the nuclear road. You don’t hear many people running around saying, “ That’s going to produce peace.” And, furthermore, if you believe nuclear weapons were a great cause of peace, you ought to be in favor of nuclear proliferation. What we need is everybody to have a nuclear weapon in their back pocket. You don’t hear many people saying that’s going to produce peace, do you? Conventional war? Michael’s right; conventional war was very deadly before nuclear weapons came along, but we still had wars. And the reason we did is because states come up with clever strategies. States are always looking for clever strategies to avoid fighting lengthy and bloody and costly wars of attrition. And they sometimes find them, and they sometimes go to war for those reasons. So there’s no question in my mind that the costs of war are very high, and deterrence is not that difficult to achieve in lots of great-power security situations. But on the other hand, to argue that war is obsolescent-I wouldn’t make that argument. My third and final point here is, the fact of the matter is, that there’s hardly anybody in the national security establishment-and I bet this is true of Michael-who believes that war is obsolescent. I’m going to tell you why I think this is the case. Consider the fact that the United States stations roughly 100,000 troops in Europe and 100,000 troops in Asia. We spend an enormous amount of money on defense. We’re spending almost as much money as we were spending during the Cold War on defense. We spend more money than the next six countries in the world spend on defense. The questions is, why are we spending all this money? Why are we stationing troops in Europe? Why are we stationing troops in Asia? Why are we concentrating on keeping NATO intact and spreading it eastward? I’ll tell you why, because we believe that if we don’t stay there and we pull out, trouble is going to break out, and not trouble between minor powers, but trouble between major powers. That’s why we’re there. We know very well that if we leave Europe, the Germans are going to seriously countenance, if not automatically go, and get nuclear weapons. Certainly the case with the Japanese. Do you think the Germans and the Japanese are going to stand for long not to have nuclear weapons? I don’t think that’s the case. Again, that security zone between the Germans and the Russians-there’ll be a real competition to fill that. The reason we’re there in Europe, and the reason that we’re there in Asia is because we believe that great-power war is a potential possibility, which contradicts the argument on the table. So I would conclude by asking Michael if, number one, he believes we should pull out of Europe and pull out of Asia, and number two, if he does not, why not?

## Yes War – China

### War with China is possible – the conflict would have global and long-lasting implications

Kaplan 2005

Robert Kaplan (Atlantic correspondent and the author of several books about the armed forces) June 2005 ‘How We Would Fight China”, http://www.theatlantic.com/doc/200506/kaplan

The relative shift in focus from the Middle East to the Pacific in coming years—idealistic rhetoric notwithstanding—will force the next American president, no matter what his or her party, to adopt a foreign policy similar to those of moderate Republican presidents such as George H. W. Bush, Gerald Ford, and Richard Nixon. The management of risk will become a governing ideology. Even if Iraq turns out to be a democratic success story, it will surely be a from-the-jaws-of-failure success that no one in the military or the diplomatic establishment will ever want to repeat—especially in Asia, where the economic repercussions of a messy military adventure would be enormous. "Getting into a war with China is easy," says Michael Vickers, a former Green Beret who developed the weapons strategy for the Afghan resistance in the 1980s as a CIA officer and is now at the Center for Strategic and Budgetary Assessments, in Washington. "You can see many scenarios, not just Taiwan—especially as the Chinese develop a submarine and missile capability throughout the Pacific. But the dilemma is, How do you end a war with China?" Like the nations involved in World War I, and unlike the rogue states everyone has been concentrating on, the United States and China in the twenty-first century would have the capacity to keep fighting even if one or the other lost a big battle or a missile exchange. This has far-reaching implications. "Ending a war with China," Vickers says, "may mean effecting some form of regime change, because we don't want to leave some wounded, angry regime in place." Another analyst, this one inside the Pentagon, told me, "Ending a war with China will force us to substantially reduce their military capacity, thus threatening their energy sources and the Communist Party's grip on power. The world will not be the same afterward. It's a very dangerous road to travel on." The better road is for PACOM to deter China in Bismarckian fashion, from a geographic hub of comparative isolation—the Hawaiian Islands—with spokes reaching out to major allies such as Japan, South Korea, Thailand, Singapore, Australia, New Zealand, and India. These countries, in turn, would form secondary hubs to help us manage the Melanesian, Micronesian, and Polynesian archipelagoes, among other places, and also the Indian Ocean. The point of this arrangement would be to dissuade China so subtly that over time the rising behemoth would be drawn into the PACOM alliance system without any large-scale conflagration—the way NATO was ultimately able to neutralize the Soviet Union. Whatever we say or do, China will spend more and more money on its military in the coming decades. Our only realistic goal may be to encourage it to make investments that are defensive, not offensive, in nature. Our efforts will require particular care, because China, unlike the Soviet Union of old (or Russia today, for that matter), boasts soft as well as hard power. Businesspeople love the idea of China; you don't have to beg them to invest there, as you do in Africa and so many other places. China's mixture of traditional authoritarianism and market economics has broad cultural appeal throughout Asia and other parts of the world. And because China is improving the material well-being of hundreds of millions of its citizens, the plight of its dissidents does not have quite the same market allure as did the plight of the Soviet Union's Sakharovs and Sharanskys. Democracy is attractive in places where tyranny has been obvious, odious, and unsuccessful, of course, as in Ukraine and Zimbabwe. But the world is full of gray areas—Jordan and Malaysia, for example—where elements of tyranny have ensured stability and growth.

### War with China is possible – the US must successfully manage the relationship

Zakaria 2008

Fareed Zakaria January 7 2008 “The Rise of a Fierce yet Fragile Superpower,’ Newsweek

China's sense of its own weakness casts a shadow over its foreign policy. It is unique as a world power, the first in modern history to be at once rich (in aggregate terms) and poor (in per capita terms). It still sees itself as a developing country, with hundreds of millions of peasants to worry about. It views many of the issues on which it is pressed--global warming, human rights--as rich-country problems. (When it comes to pushing regimes to open up, Beijing also worries about the implications for its own undemocratic structure.) But this is changing. From North Korea to Darfur to Iran, China has been slowly showing that it wants to be a responsible "stakeholder" in the international system. Some scholars and policy intellectuals (and a few generals in the Pentagon) look at the rise of China and see the seeds of inevitable great-power conflict and perhaps even war. Look at history, they say. When a new power rises it inevitably disturbs the balance of power, unsettles the international order and seeks a place in the sun. This makes it bump up against the established great power of the day (that would be us). So, Sino-U.S. conflict is inevitable. But some great powers have been like Nazi Germany and others like modern-day Germany and Japan. The United States moved up the global totem pole and replaced Britain as the No. 1 country without a war between the two nations. Conflict and competition--particularly in the economic realm--between China and the United States is inevitable. But whether this turns ugly depends largely on policy choices that will be made in Washington and Beijing over the next decade. In another Foreign Affairs essay, Princeton's John Ikenberry makes the crucially important point that the current world order is extremely conducive to China's peaceful rise. That order, he argues, is integrated, rule-based, with wide and deep foundations--and there are massive economic benefits for China to work within this system. Meanwhile, nuclear weapons make it suicidal to risk a great-power war. "Today's Western order, in short, is hard to overturn and easy to join," writes Ikenberry. The Chinese show many signs of understanding these conditions. Their chief strategist, Zheng Bijian, coined the term "peaceful rise" to describe just such an effort on Beijing's part to enter into the existing order rather than overturn it. The Chinese government has tried to educate its public on these issues, releasing a 12-part documentary last year, "The Rise of Great Nations," whose central lesson is that markets and not empire determine the long-run success of a great global power. But while the conditions exist for peace and cooperation, there are also many factors pointing in the other direction. As China grows in strength, it grows in pride and nationalist feeling--which will be on full display at the Summer Olympic Games. Beijing's mandarin class is convinced that the United States wishes it ill. Washington, meanwhile--sitting atop a unipolar order--is unused to the idea of sharing power or accommodating another great power's interests. Flashpoints like human rights, Taiwan or some unforeseen incident could spiral badly in an atmosphere of mistrust and with domestic constituencies--on both sides--eager to sound tough. Two thousand eight is the year of China. It should also be the year we craft a serious long-term China policy.

## Nuke War Causes Extinction

### Nuclear war would destroy the environment and the food chain, ensuring extinction of all life

Thompson 2008

Andrea Thompson 2008 LiveScience “Regional Nuclear War would affect entire globe”, http://www.livescience.com/environment/080407-nuclear-ozonehole.html

Previous studies ,including a 1985 National Research Council Report, had examined the effects of nuclear war on ozone loss by considering the chemicals the bombs would spew into the atmosphere. But they failed to consider the massive smoke plumes that would rise into the air as the bombed-out cities burned.  The new study considers both, painting a picture of citywide firestorms and ozone destruction.  "It has as much to do with the bombs as it does with the fuels in modern megacities," Mills said. "Pretty much everything will burn in a city."  A previous study conducted by Toon showed that as buildings, cars and other infrastructure burned, the air above would fill with soot. Some of this soot would fall out of the atmosphere in so-called black rains, but the rest would make its way up into the atmosphere within a matter of days, Mills said.  The heat from these firestorms (like those that destroyed Dresden, Germany, in World War II) would push the soot-filled air into the upper troposphere, the bottom-most layer of the Earth's atmosphere. The blackened air would then be warmed by incoming sunlight and would rise further, into the stratosphere, which sits atop the troposphere and is the layer of the atmosphere where the ozone that protects us from the sun's harmful ultraviolet rays is found. The soot could eventually rise 50 miles (80 kilometers) up in the atmosphere, the study found.  The new study found that up in the stratosphere, the soot would continue to absorb incoming sunlight and heat the surrounding air. This heat would jump-start the chemical reactions that destroy ozone.  "So the temperatures go way up and this changes the rates of a number of catalytic cycles that destroy ozone," Mills told LiveScience. As these cycles speed up, they wipe out the ozone molecules much faster than they would at normal temperatures.  The heating of the stratosphere would also alter its circulation, prolonging the time that it normally takes for the air in that layer to turn over, prolonging the soot's effect on ozone destruction.  Global ozone hole  Above the mid-latitudes, where the United States and most of Europe lie, ozone levels would drop by 25 to 40 percent. At higher northern latitudes, ozone losses would reach 50 to 70 percent, the model results show.   "The models show this magnitude of ozone loss would persist for five years, and we would see substantial losses continuing for at least another five years," Mills said.  The 1985 NRC report found only a 17 percent depletion of stratospheric ozone over the Northern Hemisphere, which would recover by half in just three years.  "The big surprise is that this study demonstrates that a small-scale, regional nuclear conflict is capable of triggering ozone losses even larger than losses that were predicted following a full-scale nuclear war," Toon said.  These losses would drop ozone levels below the amount that typically marks the seasonal ozone hole over Antarctica — only this ozone hole would extend from about 20 degrees north and south of the equator, creating a near-global ozone hole.  The loss of this protective "sunscreen" layer could have a terrible impact on the plants and animals living below that would then be susceptible to UV radiation.  Damage to plants and animals at mid-latitudes would likely rise sharply, according to the study, which was funded by the University of Colorado at Boulder. UV rays could also damage the bacteria at the roots of some crops, which the plants depend on for some food.   Previous studies have shown residents of aquatic ecosystems, especially amphibians, are particularly susceptible to UV rays because they can do little to avoid it. Many plankton in the ocean could also be wiped out, endangering the many marine organisms that depend on them for food.Nuclear war causes extinction

Woodwell 1986

George M Woodwell, PhD From Duke, Director of the Ecosystems center at the Marine Biological Laboratory at Woods Hole Mass. , Nuclear Winter, Deterrence, and the Prevention of Nuclear War, Edited by Sederberg, 1986 p. 20

The primary concern, I suppose, is the direct effects on people. Many of the same uncertainties that apply to the induction of climatic changes apply as well to inferences about human mortality. The size and characters of the war are important: Are cities the targets? The analyses from previous studies range widely up to the recent WHO analysis that suggests a total mortality of 1.1 billion for a 10,000 MT war. No estimates in this study dealt with the effects of a climatic crisis. Systematic efforts at estimating the additional mortality due to dark and prolonged cold in the weeks following such a war are beyond the limits of this discussion and, when developed, any estimates will prove as tenuous as virtually all other assumptions concerning the effects of a hypothetical war. Survivors of the immediate effects of the weapons will emerge into a radioactive environment that is likely to be perpetually dark and frozen with 10-20C or more of frost. On first analysis it would seem difficult to exaggerate the difficulties of accumulating the resources required for survival under those conditions. All supplies of fresh water would be frozen. Plants and animals, left unprotected, would be frozen and dead. Agriculture would be paralyzed transportation, normal communications of all types, sources of fuel, power supplies, and the normal machinery of govemment, including normal conventions established in law or in manners will have been destroyed or suspended: under those circumstances mere survival will be a major challenge and it is well within the realm of probability that few or none would survive in areas as large as continents, possibly in the northern hemisphere itself.

# DA & K - Links

## PTX - Plan Popular

### Plan is popular

**Boyle ‘7** (Alan, winner of the [AAAS Science Journalism Award](http://www.aaas.org/aboutaaas/awards/sja/2002/boyle.shtml), the [NASW Science-in-Society Award](http://nasw.org/mem-maint/awards/02Boylebio.html), member of the board of the [Council for the Advancement of Science Writing](http://www.casw.org/), and staff writer for MSNBC.com, “Dueling Over Asteroids,” <http://cosmiclog.msnbc.msn.com/archive/2007/03/21/97410.aspx>)

The kinetic impactor, perhaps combined with a gravity tractor or monitoring device, would be the most straightforward way to head off a NEO threat - and would probably be preferred for the smaller-scale threats. "You really don't have one technique that fits all - except for this standoff blast, perhaps - but I don't think anyone is comfortable with this nuclear option," Yeomans said. "I think nuclear is there and available, but it's sort of a last resort. That's my own opinion. ... It's politically a tough sell, and it gives most people the willies." \*[Donald Yeomans](http://www.msnbc.msn.com/id/9890268) is the head of NASA's Near Earth Object Program Office

### The plan will be spun as part of NASA’s new mission

Kelly ‘9(John, Florida Today space columnist, “Asteroid mission getting attention,” Florida Today, 8-31, lexis)

However, the underlying premise of the movie is very real, and more and more people are starting to say it would be a good idea for NASA to look at sending astronauts to an asteroid. Among them: the panel of space experts who are delivering their final report on the future of NASA to President Barack Obama this week. In that report, the president will find at least a passing reference to a human mission to an asteroid -- or more precisely, a Near-Earth Object. Asteroids will be listed among the alternate targets of the deep-space or flexible path option that the committee describes as more sustainable than NASA's current plan. It's not a new concept. People inside and outside NASA have long talked about the potential benefits of a human mission to a near-Earth object. Former astronaut Eileen Collins, who commanded the space shuttle Discovery on NASA's first mission after the 2003 Columbia disaster, recently presented the idea to the NASA Advisory Council. A mission to an asteroid, she and others argue, would push human exploration beyond our Earth and moon. The mission would prove NASA's ability to field a long-duration, long-distance expedition that would demonstrate progress toward the ultimate goal of landing people on Mars or moving deeper into space. Among the biggest hurdles to trips to Mars is our lack of knowledge, experience and technology to shield human explorers from deadly overexposure to deep space radiation. But why an asteroid? Well, supporters say, we need to better understand the internal structure of asteroids. We need to know more about potential physics of a gigantic space rock slamming into the Earth and maybe even the best ways to try to prevent it when -- not if -- the threat arises. That last item is among the reasons many cite for fielding such a mission -- it can capture people's imaginations and it seems important. It's dramatic because it sends people where they've never gone before. It's exciting because it addresses a real threat, albeit one that needs to be better communicated to the public. What's more, it could be pulled off with variations of the rockets and spacecraft **already being developed by NASA**. It could be done sooner, cheaper and with more chance of success than the current Mars reference mission. The presidential committee has said sending humans to Mars -- even in the next 20 years -- might not be possible because of limited funding and technological challenges. Among them: our inability to protect our astronauts from the killer dose of radiation they would be exposed to over a three-year round trip to Mars. A trip to a near-Earth asteroid could take a few months to a year. It could help us improve our ability to send people further from Earth. And it could get people excited again about space travel. There's a reason two Hollywood studios made very similar movies about the topic and millions of Americans piled into theaters to watch. It was interesting.

## A2 – Political Capital

### Obama won’t push—he doesn’t care about space

Berger ‘9(Eric, science blogger at the Houston Chronicle, “Nick Lampson for NASA Administrator?” Newstex Web Blogs, Nation-Building, 4-8, lexis)

It's clear Obama is unhappy with NASA's plan to rely on Russian support for five (or maybe even six) years while awaiting results from its work-in-progress Constellation program. He also just doesn't seem all that interested in space. These are hard times for folks at Johnson Space Center. They support manned spaceflight. But the shuttle program is coming to an end in a couple of years and the new boss may not support a robust manned spaceflight program in the future. That's bad for Houston. Perhaps even worse right now, NASA doesn't even have a new boss and the uncertainty over the future is palpable and damaging. The message to NASA from the President, whether intentional or not, is pretty much: "You're not a high priority."

## A2 – Politics

### Lack of policy and media interest means no perception

Dinerman ‘9(Taylor, journalist for the Space Review “The new politics of planetary defense,” The Space Review, 7-20, <http://www.thespacereview.com/article/1418/1>)

As a planning tool this matrix had its uses, but it lacked the ability to give political weight to the various threats. From the point of view of the US president and his administration, a low-level hostage seizure may or may not be a major event, depending on who the hostage is and how media-savvy the terrorists involved are. In contrast, the threat of a catastrophic celestial hit against planet Earth carries far less 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.

### Politicians don’t care about the plan—no perception

Villard ‘9(Ray, astronomy writer for magazines, radio shows and planetariums and is the news director for the Hubble Space Telescope, “Ignoring a Clear and Present Danger,” Discovery Channel Online, 8-13, <http://blogs.discovery.com/cosmic_ray/2009/08/ignoring-a-clear-and-present-danger.html>)

Despite the fact that end-of-world books and movies are a hot topic among the public, lawmakers go about more immediate affairs without taking the asteroid threat as a serious danger.  When astronomers dutifully quote estimates of a globe devastating asteroid impact as 1 in 100,000 or 1,000,0000 or greater, congressmen apparently nod off. Now, the odds of being killed in a chimpanzee attack instead of an asteroid collision must be vastly smaller. But that didn’t stop Congress from immediately insisting on better animal control legislation in the aftermath of a [tragic chimp attack](http://www.nytimes.com/2009/02/17/world/americas/17iht-chimp.1.20241928.html) on a Connecticut woman last February.

## Plan Costs Capital

### Plan causes taxpayer uproar

**Villard ‘9** (Ray, astronomy writer for magazines, radio shows and planetariums and is the news director for the Hubble Space Telescope, “Ignoring a Clear and Present Danger,” Discovery Channel Online, 8-13, <http://blogs.discovery.com/cosmic_ray/2009/08/ignoring-a-clear-and-present-danger.html>)

One of the last men to walk on the moon, New Mexico senator [Harrison Schmidt,](http://history.nasa.gov/alsj/a17/a17.crew.html) wrote in the Wall Street Journal this week that the United States once had the capability, with the Apollo Saturn V rocket, to place a propulsion source on an asteroid and altered its path so as to miss the Earth. (Simply blowing it up with nuclear bombs won’t work for numerous reasons, sorry [Bruce Willis](http://www.imdb.com/title/tt0120591/).) In the shadow of President Obama’s [Augustine Committee](http://www.spacetoday.net/Summary/4622) that is reviewing NASA’s current manned space program, Schmidt was putting in a plug for the planned Ares V rocket – a monster Saturn V class heavyweight. “The Ares V, combined with a helium-3 fusion propulsion system, would be a giant step toward protecting the Earth in the future,” Schmidt wrote.But **I cynically can’t imagine lawmakers getting serious about funding an Earth-defense payload, until it is too late. You can just imagine the uproar from** some **taxpayers.  The government would be accused, as it was in the early 1990s, of being “Chicken Little’s,” or simply looking for an excuse to build bigger rockets, bigger telescopes, and bigger super-bombs**.

## PTX - Unpopular

### Links to politics – NEO deflection is unpopular

Reich 2010 [Eugenie Samuel, Scientific American, “NASA panel weighs asteroid danger”, <http://www.scientificamerican.com/article.cfm?id=nasa-panel-weighs-asteroid-danger>]

Some time in the next decade, a U.S. president will probably be presented with this dilemma: Is it worth spending $1 billion to deflect a space rock that may never hit Earth? A NASA panel is wrestling with this question, which is growing more pertinent as scientists' ability to find asteroids that pose a potential risk, termed near-Earth objects (NEOs), outstrips their capacity to track them accurately. The Ad-Hoc Task Force on Planetary Defense, set up to suggest ways for the agency to protect Earth against a deadly impact, is expected to release its report next month. But public deliberations and interviews with its members have revealed their thinking. The dilemma stems from a 2005 congressional mandate directing NASA to log 90 percent of the estimated 20,000 NEOs larger than 140 meters in diameter by 2020. NASA seems unlikely to meet the goal, but the agency is stepping up its detection and tracking of smaller objects. That will create a new problem: If the pace of NEO detections grows but precision tracking of orbits lags behind, observers will start to find more rocks--perhaps a few per year--that seem, at first, to have a significant chance of hitting Earth, say panel members. "I don't think that issue has been understood outside the NEO community," says Lindley Johnson, NEO program officer at NASA and a member of the panel. Launching missions to track or deflect all potential asteroid threats will be prohibitively expensive, but even a small probability of regional or global devastation may not be politically palatable.

## 1NC Space Mil Da/Security K Link

### Asteroid threats are used as a smokescreen to justify deploying space weapons.

Felicity **Mellor 7**, Lecturer in Science Communication at Imperial College London, Colliding Worlds: Asteroid Research and the Legitimization of War in Space, Social Studies of Science 37: 499, http://sss.sagepub.com/content/37/4/499.full.pdf

Since the late 1980s, a small group of astronomers and planetary scientists has repeatedly warned of the threat of an asteroid impacting with Earth and causing global destruction. They foretell a large impact causing global fires, the failure of the world’s agriculture and the end of human civilization. But, these scientists assure us, we live at a unique moment in history when we have the technological means to avert disaster. They call for support for dedicated astronomical surveys of near-Earth objects to provide early warning of an impactor and they have regularly met with defence scientists to discuss new technologies to deflect any incoming asteroids. The scientists who have promoted the asteroid impact threat have done so by invoking narratives of technological salvation – stories which, like the Strategic Defense Initiative (SDI), promise security through a superweapon in space. The asteroid impact threat can therefore be located within the broader cultural history of fantasies about security and power, which, Bruce Franklin (1988) has argued, is inextricably linked to the century-old idea that a new superweapon could deliver world peace. Howard McCurdy (1997: 78–82), in his study of the ways in which the US space programme was shaped by popular culture, has suggested that the promotion of the impact threat can be seen as the completion of Cold War fantasies, which had used a politics of fear to justify space exploration. McCurdy highlights the alignment between the promotion of the impact threat and works of fiction. In this paper, I consider the reconceptualization of asteroid science that this alignment entailed. It is beyond the scope of this paper to give a complete history of the science of planetary impacts. My focus is on how a group of scientists moved from seeing impacts as significant events in Earth history to seeing them as threatening events in the human future – a move from historical to futurological narratives. Nor is there space to give a full account of the empirical developments that were used to support the construal of asteroids as a threat. Rather, I wish to make the case that these empirical developments were given meaning within a specific narrative context which drew civilian astronomers into contact with defence scientists, especially those working on SDI. A number of studies (for example, McDougall, 1985; Forman, 1987; Kevles, 1990; DeVorkin, 1992; Leslie, 1993; Dennis, 1994) have revealed the ways in which US research programmes and nominally-civilian scientific institutions originated in military programmes.1 One aim of this paper is to demonstrate how the boundary between civilian and military science is blurred not just institutionally, but also at a fundamental conceptual level. The civilian scientists discussed here followed different working practices and traded in different forms of expertise than did the defence scientists. They were typically astronomers or planetary scientists who worked for NASA or on NASA-funded research programmes at universities and private institutes. They saw themselves as distinct from the defence scientists who were typically physicists and engineers working on new weapons systems or other technologies of national security at the Los Alamos and Lawrence Livermore National Laboratories or at armed services institutions. 2 Yet the two groups came to share an interest in asteroids and with that a set of assumptions about the nature of human society, the role of technology and our place in outer space. As they came into contact, their differing backgrounds meant they disagreed over a number of issues, yet both sides pursued the collaboration despite the tensions. Many studies of the interaction between military and civilian science have focused on sources of funding and shared technologies.3 Important as these are, they fail to capture fully the dynamic between the two communities. In particular, a cynical picture of scientists simply pursuing sources of funding on any terms cannot reveal the far-reaching ways in which civilian research can become entrenched in particular patterns of thinking which are supportive of militaristic programmes. For military/civilian collaborations to be sustained, civilian scientists need to share with their counterparts in the defence sector an understanding of the overall trajectory of their research. For shared technologies to be developed, they need first to be imagined. Military/civilian interactions are therefore predicated on, and mediated through, a shared technoscientific imaginary. Despite expressing concerns about the motives and methods of the weapons scientists, the civilian scientists who promoted the asteroid impact threat drew on narratives that configured a human role in space in a similar way to SDI. These narratives helped make asteroids conceivable as a threat, yet they also served to make acceptable, and even necessary, the idea of space-based weaponry. Despite their disagreements, at the level of their shared narratives the discourses of the civilian and defence scientists were mutually supportive.

### The aff’s discourse serves the interests of the military industrial complex. Exaggerating the threat from space will be coopted to build support for defense expenditures.

Veverka ‘3(Joe, professor of astronomy at [Cornell University](http://www.cornell.edu/), Great Impact Debates Much Ado About Nothing? 2/17 <http://www.astrobio.net/index.php?option=com_debate&task=detail&id=378>)

Joe Veverka: Regarding the advocacy groups I mentioned, there are at least three different, well-established advocacy groups whose future and welfare depends on focusing the public's attention on the "threat from space." (The term "advocacy group" is a polite one. A much more accurate but cruder term can be found in Jean Giraudoux's play '[The Mad Women of Chaillot](http://www.reviewplays.com/mad_woman_of_chailot.htm).') The first advocacy group is the media. If all else fails, stories about comets and asteroids destroying New York or Tokyo sell newspapers and magazines and make for popular TV fodder.  Second, there is a strong advocacy group among astronomers. They want more resources devoted to studying comets and asteroids. Publicizing the "threat from space" has certainly proven an effective means for generating government support for the study of NEOs. Finally, there is an evolving engineering/industrial/military advocacy group that promulgates the "threat from space" because members of this group want public support to build and provide the defenses that will shield us from this "peril."

## Space Mil Link – Surveillance

### Surveillance via Asteroid detection transforms space into a geostrategic arena to be weaponized

Felicity Mellor 7, Lecturer in Science Communication at Imperial College London, Colliding Worlds: Asteroid Research and the Legitimization of War in Space, Social Studies of Science 37: 499, http://sss.sagepub.com/content/37/4/499.full.pdf

In contrast to traditional astronomical systems, which passively watched the skies, asteroid detection systems were to be surveillance systems that actively hunted the skies for objects of human import. The Spaceguard Survey was predicated on a will to action in a way in which the earlier Spacewatch Survey was not. Similarly, when it fired its impactor at Comet Tempel 1, NASA’s Deep Impact mission took a far more active intervention in space than did earlier generations of probes. This was not far from Edward Teller’s call for ‘experimentation’ with near-Earth objects to test defence technologies (Tedeschi & Teller, 1994; Teller, 1995), an idea dismissed at the time as extreme by some civilian scientists (Chapman, 1998). Likewise, one of the recommendations of the 2004 Planetary Defense Conference was that deflection techniques should be demonstrated on an actual asteroid (Ailor, 2004: 5).28 The technologization of space promoted in both the fictional works and the scientists’ technical proposals, also formed an integral part of the imagery and rhetoric that surrounded SDI, as its detractors highlighted when they re-named the project Star Wars. SDI was always premised on a vision of space as a technologized theatre of war. In the hands of a technoenthusiast such as Edward Teller, SDI was configured as a space-based technological extravaganza with few limits.29 In SDI, as in asteroid research and science fiction, space became a dynamic arena through which our technologies would move, in which our weapons would be placed, and across which our wars were to be waged.30 As discussed in the introduction to this paper, narrative is an inherently teleological form. In conventional narratives, the action is moved towards closure by the heroes of the story. In the impact narratives, the heroes are technological heroes set the task of saving the world. By drawing on these narratives and following the call for human agency inherent in the narrative structure, the scientists implicitly accepted this role as a necessary one. Having shifted apocalypse from the realm of nuclear politics to that of natural science, the impact-threat scientists were able to position themselves as heroes whose combined far-sightedness and technological know-how would save us all. Emphasizing the role of the unacknowledged hero in a foreword to a volume of conference proceedings, astronomer Tom Gehrels (2002: xiii) claimed: ‘There is a beauty also in hazards, because we are taking care of them. We are working to safeguard our planet, even if the world does not seem to want to be saved.’ In a paper in another volume of conference proceedings, astrophysicist Eugene Levy was even more explicit about the scientists’ expanded role: In the arms race, the motivating dynamic was a political one. A dynamic in which scientists and engineers provided the technical tools, but, as a group, brought no special and unique wisdom to the table in making judgements about what to do. In the present case, the dynamic is different. The adversary is not another nation; the calculus is not one of political fears, anxieties, and motivations, for which we scientists have no special expertise. Rather the ‘adversary’ is the physical world. In assessing this adversary, we scientists have special and unique expertise. (Levy, 1994: 7; italics in original) Eclipsing the political dimension of the impact threat with their appeals to the natural, the scientists appropriated for themselves a heroic role. This technological hero was a moral hero – he would warn us of the danger and save us despite ourselves. Thus the scientists frequently quoted Representative George Brown’s opening statement to a Congressional hearing when he warned that if we were to do nothing about the impact threat, it would be ‘the greatest abdication in all of human history not to use our gift of rational intellect and conscience to shepherd our own survival and that of all life on Earth’.31 Through such claims, the issue of planetary defence became a moral frame through which other threats of more human origin could also be addressed. Increased knowledge and surveillance of asteroids, the scientists insisted, would help stop mistakes by the military decision-makers by preventing the misidentification of asteroid airbursts as enemy nuclear warheads (Chapman & Morrison, 1994: 39). At the same time, destroying asteroids would provide us with a way of using up those unwanted bombs. As John Lewis (1997: 215) put it: ‘The net result of the asteroid deflection is really a twofold benefit to Earth: a devastating impact would be avoided and there would be one less nuclear warhead on Earth.’ Similarly, Duncan Steel saw the use of SDI technologies in asteroid missions such as Clementine II as ‘a prime example of beating swords into ploughshares’ (quoted in Matthews, 1997). Furthermore, the international tensions that led to the proliferation of nuclear weapons in the first place, would also be resolved by uniting against the common enemy of the asteroid. Thus Carl Sagan and Steve Ostro, although largely critical of the promotion of the impact threat, suggested that: In an indirect way the threat of interplanetary collision may have a political silver lining. They represent a common enemy to all nations and ethnic groups. By posing two different classes of danger to the human species, one natural and the other of our own making, Earth-approaching objects may provide a new and potent motivation for maturing international relations, ultimately helping to unify the human species. (Sagan & Ostro, 1994b: 72; see also Gehrels, 1988: 303) Even for Sagan and Ostro, then, as for the other civilian scientists, the impact threat offered hope of salvation.

## 1NC Moon Base Tradeoff-Link

### A. Moonbase plans will kick-off in 2010—new asteroid deflection initiative directly trades off

Easterbrook ‘8(Gregg, Editor of The Atlantic and The New Republic and Sr. Fellow at Brookings, “The Sky is Falling,” June, http://www.theatlantic.com/doc/200806/asteroids)

We will soon have a new president, and thus an opportunity to reassess NASA’s priorities. Whoever takes office will decide whether the nation commits to spending hundreds of billions of dollars on a motel on the moon, or invests in space projects of tangible benefit—space science, environmental studies of Earth, and readying the world for protection against a space-object strike. Although the moon-base initiative has been NASA’s focus for four years, almost nothing has yet been built for the project, and comparatively little money has been spent; current plans don’t call for substantial funding until the space-shuttle program ends, in 2010. This suggests that NASA could back off from the moon base without having wasted many resources. Further, the new Ares rocket NASA is designing for moon missions might be just the ticket for an asteroid-deflection initiative. Congress, too, ought to look more sensibly at space priorities. Because it controls federal funding, Congress holds the trump cards. In 2005, it passively approved the moon-base idea, seemingly just as budgetary log-rolling to maintain spending in the congressional districts favored under NASA’s current budget hierarchy. The House and Senate ought to demand that the space program have as its first priority returning benefits to taxpayers. It’s hard to imagine how taxpayers could benefit from a moon base. It’s easy to imagine them benefiting from an effort to protect our world from the ultimate calamity.

### See Moon Aff for Impacts.

## China DA Link

### The plan’s unilateral declaration causes international conflict with China

Easterbrook ‘8(Gregg, Editor of The Atlantic and The New Republic and Sr. Fellow at Brookings, “The Sky is Falling,” June, http://www.theatlantic.com/doc/200806/asteroids)

None of this will be easy, of course. Unlike in the movies, where impossibly good-looking, wisecracking men and women grab space suits and race to the launchpad immediately after receiving a warning that something is approaching from space, in real life preparations to defend against a space object would take many years. First the necessary hardware must be built—quite possibly a range of space probes and rockets. An asteroid that appeared to pose a serious risk would require extensive study, and a transponder mission could take years to reach it. International debate and consensus would be needed: the possibility of one nation acting alone against a space threat or of, say, competing U.S. and Chinese missions to the same object, is more than a little worrisome. And suppose Asteroid X appeared to threaten Earth. A mission by, say, the United States to deflect or destroy it might fail, or even backfire, by nudging the rock toward a gravitational keyhole rather than away from it. Asteroid X then hits Costa Rica; is the U.S. to blame? In all likelihood, researchers will be unable to estimate where on Earth a space rock will hit. Effectively, then, everyone would be threatened, another reason nations would need to act cooperatively—and achieving international cooperation could be a greater impediment than designing the technology.

## China DA Turns the case

### Turns the case – international dispute stalls deflection

Cowen ‘9(Robert, columnist for CSM, Christian Science Monitor, 5-15, lexis)

But if one of them - or even a smaller, city-destroying rock - were detected on a collision course, would the world community be prepared to handle it? A conference of legal experts that discussed this question at the University of Nebraska in Lincoln last month answered it with a resounding "No." Scientists and engineers who have studied the problem of deflecting a dangerous asteroid believe the technical issues are difficult but solvable. The challenge now is figuring out the legal issues of who takes action on behalf of humankind and of what their responsibilities and liabilities will be. Asteroid hunters believe they can give us plenty of warning. There is "a fair chance that the next Earth impactor will actually be identified with many decades and perhaps centuries of warning time," explains Mr. Chesley of the NASA Jet Propulsion Laboratory in Pasadena, Calif., in the March/April issue of the Planetary Report. That's plenty of time to develop a spacecraft whose gravitational attraction might nudge an asteroid aside - or a rocket or some application of nuclear explosives to do the job. However, **if a single country** - or small group of nations - **tries to take the initiative on its own, the international reaction could stall any action at all.** "The international political reactions to the US shooting down one of its own satellites a year ago to prevent presumably dangerous and toxic rocket fuel from reaching Earth only foreshadows what would happen if the US would detonate nukes claiming to destroy an incoming asteroid," said Frans von der Dunk, a University of Nebraska space law expert, at the Nebraska conference, according to Space News. Overlooking the hype about nuclear weapons, which engineers consider an unlikely, extreme measure, Professor von der Dunk has pointed out the main issue. Averting a regional or global asteroid threat may involve unforeseen collateral damage - such as splintered chunks making their way to Earth or worse. Therefore, the world community has to have a say in how that threat is handled.

# CPs

## Ground-based Telescopes CP

### CP Text: The United States federal government should develop and deploy a ground-based Near Earth Object detection system.

### CP solves the case, Panstarrs telescope solves detection.

Lunau ‘9(Kate, Maclean’s, “Look out Below!” June 29, lexis)

Thousands of asteroids, most of them untracked, swarm around our planet; some are over 10 km wide. "Right now, the most probable amount of warning we'll have for an asteroid impact is zero, because we don't know where most of them are," says Robert Jedicke, 46, a University of Hawaii astronomer originally from Niagara Falls, Ont. Jedicke is part of a team at UH's Institute for Astronomy that's working to change that. A new program, called Pan-STARRS, will combine the world's most powerful asteroid-tracking telescope with the largest digital camera ever built. The first of four planned telescopes is set to begin its full scientific mission any day now. "In the past 200 years, we've discovered half a million asteroids," he says. The first telescope alone "should find a comparable number in a single year." Asteroids, which are leftovers from the creation of our solar system, pepper our planet more often than most realize. "Basketball-sized objects come in every day, and Volkswagen-sized objects come in once or twice a year," says Don Yeomans, who manages the Near-earth Object Program Office at NASA's Jet Propulsion Laboratory. Those under 25 m in diameter cause little damage. (Sand-sized particles burning up in the atmosphere can be seen from the ground as "shooting stars.") Events like Tunguska happen two or three times every 1,000 years. Asteroids one kilometre across or wider strike our planet only about once or twice every million years, but their impact is devastating on a global scale: 65 million years ago, a 12-km asteroid crashed into earth, killing off 70 per cent of all species, including the dinosaurs. In 1998, NASA set about discovering and tracking asteroids one kilometre in diameter or greater. Scientists now say they've found about 83 per cent of them, and that none threaten us within the next century; but when it comes to those *under* one kilometre--including potential city killers, like the one at Tunguska--it's another story. A 140-m asteroid "packs about 250 megatons of equivalent energy," Yeomans says. "Even five megatons is a substantial nuclear weapon." The U.S. Congress is now pushing NASA to find asteroids that measure 140 m and up. It's these objects that Pan-STARRS will be hunting for. Tracking asteroids, which are only visible by the reflected light of the sun, requires a telescope with a wide mirror to concentrate light: the fainter the object, the larger the mirror that's needed. Instead of building one giant telescope, which can be prohibitively expensive, Pan-STARRS will combine images from four smaller ones watching the same patches of sky. (PS1, the first of the four, is ramping up to its full-time mission now. All four telescopes, called PS4, will be in use within the next few years.) At a cost of roughly $10 million apiece, they are as powerful as a single 3.5-m telescope, at half the price. Within each telescope will be a 1.8-m mirror and the biggest digital camera ever made, with 1.4 billion pixels over an area of 40 sq. cm. (Your average digital camera has about five million pixels on a chip just a few millimetres across.) "The sheer amount of information we'll be able to generate is amazing," says Jedicke, who notes that each telescope will gather about six gigabytes of image data per minute--enough to fill up a typical laptop in under an hour.

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### CP solves—we have telescopes that monitor the sky for asteroids

Economist ‘8 (“Watching and waiting,” 12-6, lexis)
The search for dangerous asteroids is about to begin in earnest. EVER since 1980, when Luis and Walter Alvarez came up with the idea that the dinosaurs had been wiped out when the Earth was hit by an asteroid, people have worried that something similar might happen again. Indeed, on a much smaller scale it did, 100 years ago. In 1908 an object about 50 metres (150 feet) across entered the atmosphere above Siberia. When it blew up it flattened some 2,000 square kilometres (800 square miles) of forest. Experts in the field put the chances of a 1908-style event happening some time this century at about one in ten. That would be devastating if it occurred over a densely populated area—of which there are many more than there were a century ago. This, plus the more remote chance of a big collision, has stimulated efforts to map the orbits of potential threats so that people will be prepared. They might, by attaching rocket motors to the incoming rock, or nudging its orbit with nuclear explosions, even be able to avert disaster. Until now, these efforts have been carried out with existing telescopes, and researchers think they have found about three-quarters of the 1,000 or so neighbouring asteroids that have a civilisation-wrecking diameter of 1km or more. But to locate the rest, and to look for smaller objects that could still wreak local devastation, they need more specialised tools. This month they will start to get them. On December 6th the University of Hawaii will activate a telescope designed specifically to look for dangerous asteroids. It is called PS1, a contraction of Panoramic Survey Telescope & Rapid Response System, and it is the first of four such instruments that will be used to catalogue as many as possible of the 100,000 or so near-Earth asteroids that measure between 140 metres and a kilometre across. A typical telescope is designed to peer at a tiny portion of the sky. That is fine for examining things in detail, but not so good for a general search. PS1 and its colleagues will therefore take in large chunks of the heavens at one go. Together, they will look at blocks about 35-times the size of the full moon. They are able to do so because they are fitted with special digital cameras whose electronics were developed at the Massachusetts Institute of Technology's Lincoln Laboratory. Each camera has about 1.4 billion pixels. A typical shop-bought digital camera, by comparison, has about 5m pixels. The complete array of telescopes will be able to survey the entire night sky visible from Hawaii about once a week. Comparisons of successive scans should reveal the movement of objects and thus the locations and orbits of the target asteroids. The other three telescopes should be completed by 2012, at a cost of about $100m for all four. They should take about ten years to catalogue 90% of the remaining dangerous asteroids thought to be out there. And even if no killer asteroids are found, the money will not have been wasted. The telescopes will also be good at spotting supernovae and gamma-ray bursts. With luck, none of these will be close enough to damage the Earth.

### Combination of Spaceguard, PANSTARRS, LSST and other radar, on the ground means we’ll know if an asteroid is coming

Bucknam & Gold ‘8 (Mark, Deputy Dir for Plans in the Policy Planning Office of the Office of the US Secretary of Defense, Colonel USAF, PhD in War Studies from U of London, BS in physics, MS in materials science and engineering from Virginia Tech & Robert, Chief Technologist for the Space Department at the Applied Physics Laboratory of Johns Hopkins “Asteroid Threat? The Problem of Planetary Defence,” Survival vol. 50 no. 5 | 2008 | pp. 141–156)

In 1998, NASA began the Spaceguard Survey, an effort to find, catalogue and track Near-Earth Objects (NEOs) larger than 1km in diameter, and to identify any that might be a hazard to Earth. An NEO is defined as an object that passes within 1.3 astronomical units, or 193m kilometres, of the Sun – that is, 1.3 times the average distance between the Earth and the Sun.6 The programme is funded at $4.1m per year through 2012. In 2005, Congress tasked NASA with analysing alternatives for detecting and deflecting NEOs. NASA responded in March 2007 with a report entitled Near-Earth Object Survey and Deflection Analysis of Alternatives.7 In that report, NASA stated that it had, by December 2006, discovered 701 NEOs larger than 1km, and that NASA’s models projected 1,100 such objects might exist. A kilometre-sized asteroid, if it struck the Earth, would deliver well over 25,000 megatonnes of energy, the equivalent of more than a million Hiroshima bombs.8 Congress also called on NASA to lead efforts to find, by the end of 2020, 90% of all NEOs larger than 140m – objects smaller than the 1km NEOs initially surveyed, but still large enough to cause catastrophic regional effects. NASA’s March 2007 report analysed various approaches to finding and deflecting these, but recommended the focus of the survey be shifted from NEOs – the vast majority of which pose no threat to Earth – to the subset of potentially hazardous objects (PHOs), objects passing within 0.05 astronomical units (7.4m kilometres) of Earth’s orbit, thereby posing a greater risk of collision. Scientific estimates predict the existence of 20,000 PHOs larger than 140m.9 NASA analysed options for better detecting PHOs, ranging from continuing the current terrestrial-based Spaceguard Survey to putting visual or infrared sensors on satellites in space. The existing Spaceguard techniques have little to contribute to the expanded goal of detecting objects on the scale of 140m, and NASA estimates Spaceguard could only detect approximately 14% of the 140m-or-larger PHOs by 2020,10 well short of Congress’ goal of 90%. The addition of a ground-based telescope, such as the University of Hawaii’s planned Panoramic Survey Telescope and Rapid Response System (PanSTARRS 4)11 or the proposed Large Synoptic Survey Telescope (LSST),12 would boost the results to 75–85%, depending on whether NASA shared the telescope with another agency or supported building an additional copy of its own. The most efficient means of finding PHOs would be to place an infrared sensor in a Venus-like orbit – that is, 0.7 astronomical units from the sun. By itself such a sensor system could find 90% of PHOs larger than 140m by 2020. Furthermore, a space-based infrared telescope would allow scientists to reduce the uncertainties in determining the size of PHOs to 20% from over 200% for optical telescopes.13 A factor-of-two uncertainty – the limit of accuracy with optical telescopes – equates to a factor-of-eight uncertainty in mass. Because the size and mass of a PHO are important characteristics for assessing the danger it could pose, the added performance of a space-based infrared telescope warrants serious consideration. Moreover, an infrared telescope in a Venus-like orbit could efficiently detect PHOs that primarily orbit between the Earth and the Sun; these are difficult to detect from Earth and, according to NASA, have a chance of being perturbed by gravity and becoming a threat. The cost of such a system is on the order of $1bn, and the harsh space environment would likely limit its useful life to around seven to ten years.14 Though radar telescopes, such as the giant 305m dish at Arecibo, Puerto Rico, enable rapid and accurate assessments of PHO size and orbit, they are only useful when the objects pass within a few million kilometres of Earth. NASA recommended against developing a radar specifically for finding and tracking PHOs, stating that ‘orbits determined from optical data alone will nearly match the accuracy of radar-improved orbits after one to two decades of observation’.15 Existing radar telescopes should be used as far as possible to refine predictions of Apophis’s trajectory – either confirming or ruling out the potential for an impact in 2036. In addition to fielding new Earth- and space-based sensors as suggested by NASA, former astronaut Rusty Schweickert called for placing a transponder on Apophis during a close approach in 2013 to help determine whether a 2036 collision is likely.16 This could save years of worrying, or give us extra years to prepare and act. Such a mission would cost on the order of a few hundred million dollars. In addition to new sensors, NASA will need new data-processing capabilities for the expanded effort to find, track, characterise, catalogue and then store and distribute the data for the estimated 18,000 PHOs larger than 140m that the space agency will be expected to monitor. Today, NASA’s Jet Propulsion Laboratory uses a system called Sentry to turn known PHO data into predictions of PHO orbits projected 100 years into the future. Though NASA’s March 2007 report briefly described four possible alternatives for managing data, it left out details on the costs of going from tracking nearly 800 PHOs today to a system that could handle 18,000 PHOs.

## Neg slayer agent CP card

### In the case of NEOs – policymakers DO have to consider other agents in weighing the benefits of policy.

Richard Crowther, 2009 Ph.D. Science and Technology Facilities Council (STFC), Harwell Science and Innovation Campus, Chilton, Oxfordshire OX11 0QX, UK Journal of Cosmology, 2009, Vol 2, pages 411-418. Cosmology, October 31, 2009 Near Earth Object (NEO) Impact Threat: An International Policy Response

In addition to the probability of, and time to impact, the other parameters that will influence the response strategy will be the anticipated intersect locus on the surface of the Earth and the vulnerability of that area to the impact. Further the different options for deflection and the implications (technical readiness, political acceptability, cost of development and operation, translation of intersect locus) of a particular deflection strategy will also have to be weighed up against the alternatives. It is quite possible that countries without the capability to mount a deflection mission may be threatened by an impact, whereas those with the capability are not. Further it may be considered more attractive for one capable actor to take the lead in mounting a particular deflection mission rather than a grouping of agencies with different roles, due to the complexity of the mission, and the political expedient of protecting sensitive technical information. Hence one can envisage a matrix of options, with agreed responses to a range of impact scenarios, with identified players performing specific roles.

## 1NC Consultation Key

### Must consult

**Dinerman ‘9** (Taylor, journalist for the Space Review “The new politics of planetary defense,” The Space Review, 7-20, <http://www.thespacereview.com/article/1418/1>)

While the US is obviously going to have to take the lead in any effort to detect and possibly deflect any celestial object that might do our planet harm, **it will have to consult with others**, both to keep other nations informed and to help make the choices needed to deal with the threat. 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.

## International Cooperation Key

### International cooperation is key to averting disaster.

Parker ’09 (Randall Parker, Professor of Economics at East Carolina author of Reflections on the Great Depression and The Economics of the Great Depression: A Twenty-First Century Look Back at the Economics of the Interwar Era both published by Edward Elgar, 12/16/09, “Diplomatic Problem With Asteroid Deflection,” 6/21/11, http://www.futurepundit.com/archives/006796.html, MLK)

Former astronaut Rusty Schweickart’s group for promoting the development of asteroid defenses points out a curious problem: While an asteroid would be in the process of getting deflected its aim would shift across the planet Earth. Countries would oppose an asteroid's collision path cross over their territory while it was in the process of being re-aimed to miss Earth entirely. Schweickart’s group, The B612 Foundation, has advocated a different approach to asteroid deflection, but one that will require an equally difficult international negotiation. They propose to bump or tow an asteroid “in a controlled manner” so that it misses Earth. The only problem is that such a process would take time and as the asteroid’s trajectory changed, it would be “pointed” at different places along a horizontal plane on Earth called the risk corridor.

### Asteroids are coming now, we need to work together now to stop them

NANCY ATKINSON on OCTOBER 29, 2010“Mitigating Asteroid Threats Will Take Global Action” http://www.universetoday.com/76994/mitigating-asteroid-threats-will-take-global-action/

During the past 24 hours, the Earth has been hit by about a million small meteoroids – most of which burned up in the atmosphere as shooting stars. This happens every day. And occasionally – once every 10,000 years or so — a really big asteroid (1 km in diameter or larger) comes along and smacks Earth with an extinction-level impact. That idea might cause some of us to lose some sleep. But in between are other asteroid hits that occur every 200-300 years where a medium-sized chunk of space rock intersects with Earth’s orbit, producing a Tunguska-like event, or worse. ―Those are the objects we are concerned with, said former Apollo astronaut Rusty Schweickart, speaking at a 3-day workshop in Darmstadt, Germany which focused on plans and recommendations for global coordination and response to an asteroid threat. ―We need to take action now to bring the world together and recognize this as a global threat so that we can make a cooperative international decision to act to extend the survival of life on Earth.

## UN CP

### UN committee on Space should coordinate NEO Response.

Richard Crowther, 2009 Ph.D. Science and Technology Facilities Council (STFC), Harwell Science and Innovation Campus, Chilton, Oxfordshire OX11 0QX, UK Journal of Cosmology, 2009, Vol 2, pages 411-418. Cosmology, October 31, 2009 Near Earth Object (NEO) Impact Threat: An International Policy Response

In considering how to address the policy requirements previously identified for NEOs, we can learn much from the approach adopted for analogous topics such as man-made debris. Within a relatively short time frame from identifying that man-made orbital debris posed a significant threat to future space operations, an inter-Agency forum1 was established with different nations performing complementary roles, to review and seek scientific consensus on related aspects of debris measurement, modelling, risk evaluation and identification of measures for mitigation. The resulting outputs were then used to inform the debate on the subject within the Scientific and Technical Sub-Committee of United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) which led to international agreement on a series of guiding principles2 to minimise the future proliferation of such debris. The resulting international policy subsequently became widely recognised and is in the process of being adopted in national regulatory activities with resources being made available accordingly. Such a model for policy development is appropriate for NEOs, not least because many of the assets and techniques, and the Executive Agencies involved, are the same.

### UN policy on NEOS critical to get international buy-in to support detection/deflection.

Richard Crowther, 2009 Ph.D. Science and Technology Facilities Council (STFC), Harwell Science and Innovation Campus, Chilton, Oxfordshire OX11 0QX, UK Journal of Cosmology, 2009, Vol 2, pages 411-418. Cosmology, October 31, 2009 Near Earth Object (NEO) Impact Threat: An International Policy Response

An IADC analogue for NEOs involving space-faring nations would be able to deal with a number of the technical/policy issues identified previously, such as establishing data management policies/protocols, developing a recognised risk assessment methodology, and performing a technical assessment of the mitigation options for a range of impactor scenarios. Such a body would not however be well placed to identify the criteria and thresholds for the communication of a specific impact threat, or identifying the channels for communication of this risk and those responsible for subsequent action. Further, the international community may be reluctant to trust the establishment of criteria and thresholds for actions such as when to act, how, and on what basis, to a body with limited international representation, especially when the outcomes of the (in)action would have direct consequences for those not involved in the governance of that body. Hence the role of UNCOPUOS is critical to ensuring any response is proportionate, consistent, targeted, transparent and accountable.

### UN empirically solves.

Richard Crowther, 2009 Ph.D. Science and Technology Facilities Council (STFC), Harwell Science and Innovation Campus, Chilton, Oxfordshire OX11 0QX, UK Journal of Cosmology, 2009, Vol 2, pages 411-418. Cosmology, October 31, 2009 Near Earth Object (NEO) Impact Threat: An International Policy Response

In 2007, the Working Group on NEOs was established (by the Scientific and Technical Subcommittee of UNCOPUOS) in the expectation that international procedures to address the NEO threat would be proposed by this Working Group for consideration by UNCOPUOS. In 2007 and 2008, the Association of Space Explorers (ASE) convened a Panel on Asteroid Threat Mitigation (PATM), consisting of renowned non-governmental, multi-disciplinary experts in science, diplomacy, law, and disaster management from around the world. In 2008, ASE submitted its recommendations in a report entitled ìAsteroids threats: a call for a global responseî to UNCOPUOS for consideration by the NEO Working Group. UNCOPUOS welcomed this important contribution to a possible NEO policy framework, and recognised its value in its review of potential policies related to the handling of the NEO hazard, and its consideration of drafting international procedures for handling such a threat. During the 46th session of the Scientific and Technical Subcommittee of COPUOS in February 2009 the ASE Report was reviewed and as a result an associated UN document A/AC.105/C.1/2009/CRP.13 was developed building on the recommendations of the ASE Report. These draft UN recommendations will be submitted to the Working Group on NEOs and Member States for their consideration and review during the 47th session of Scientific and Technical Subcommittee to be held in Vienna from 8-19 February 2010.