# Asteroid Mapping Negative

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# Significance Answers: Probability of a Strike is Low

## The probability of a major asteroid collision is extremely low.

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

Models of the orbit-dependent distribution of taxonomic types among the NEO population have been recently developed 36,(see ref. 35). Coupled to the NEO orbital distribution models discussed above, the statistical knowledge of albedos and densities of NEOs has allowed the calculation of the frequency of impacts on Earth as a function of collision energy (Fig. 1). Ultimately, this is the information that we need in order to assess the real hazard represented by asteroid impacts and to decide the appropriate actions to counteract this menace. Again, the fact that models-despite being constructed in very different ways and calibrated on disjoint observation datasets- agree with each other at a very fine level, shows that NEO science has now reached a high degree of accuracy. Figure 1 shows that collisions liberating an energy of 1,000 MT should happen on average only once every 65,000 years. They are due to NEOs of about 250-300 m in size.

## The odds of a civilization ending asteroid hitting earth are small, and the warning time would allow damage prevention efforts to be put into place:

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

6.1. 2–3 km diameter civilization destroyer A million-megaton impact, even though 100 times less energetic than the K–T impact, would probably destroy civilization as we know it. The dominant immediate global effect would be sudden cooling, lasting many months, due to massive injection of dust into the stratosphere following impact. Agriculture would be largely lost, worldwide, for an entire growing season. Combined with other effects (a firestorm the size of India, destruction of the ozone layer, etc.), it is plausible that billions might die from collapse of social and economic institutions and infrastructure. No nation could avoid direct, as well as indirect, consequences of unprecedented magnitude. Of course, because civilization has never witnessed such an apocalypse, predictions of con-sequences are fraught with uncertainty. As discussed earlier, **few bodies of these sizes remain undiscovered**, so the chances of such an event are **probably <1-in-100,000 during the next century**. The **warning time would almost certainly be long**, in the case of a NEA, but might be only months in the case of a comet. With years or decades of advance warning, a technological mis-sion might be mounted to deflect the NEA so that it would miss the Earth; however, moving such a massive object would be very challenging. In any case, given sufficient warning, many immediate fatalities could be avoided by **evacuating ground zero** and longer-term casualties could be minimized by **storing food supplies to survive the climate catastrophe**. Susceptible infrastructure (transporta-tion, communications, medical services) could be strengthened in the years before impact. However, no preparation for mitigation is warranted for such a rare possibility until a specific impact prediction is made and certified. The only advance preparations that might make sense would be at the margins of disaster planning developed for other purposes: considering such an apocalypse might foster ‘‘out- of-the-box’’ thinking about how to define the outer envelope of disaster contingencies, and thus prove serendipitously useful as humankind faces an uncertain future.

## No civilization threatening asteroid collision is likely.

Richard Binzel, 2010 (Prof., Planetary Science, MIT), REPORT OF THE NASA ADVISORY COUNCIL AD HOC TASK FORCE ON PLANETARY DEFENSE, Oct. 6, 2010, 6.

NASA’s search for near-Earth objects has discovered at least 87% of the large asteroids whose impacts could pose a global threat to our civilization. None pose a credible threat of a collision with Earth for the foreseeable future.

## The probability of a large asteroid hitting this century is one hundredth of one percent.

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

6) 1 km diameter NEOs are civilization killers, with billions of deaths expected from one impact. Their energy release is equivalent to 1,000,000 MT of TNT. They are believed to impact on the average every 1,000,000 years and the probability of one impacting in this century is 0.01 %.

## The Apophis asteroid is not a threat.

John Lake, 2011 (staff writer). April 13, 2011. "April is Apophis Month; The Asteroid Nested in Uncertainty ", http://blogcritics.org/scitech/article/april-is-apophis-month-the-asteroid/)

April is an important month for those concerned or perhaps obsessed with the asteroid Apophis, the “Serpent that dwells in darkness.” In 2002, following the discovery of the fate-laden space traveler, it was thought that an impact of the asteroid with Earth was probable; scientists were recalling the end days of the giant dinosaurs that once walked the Earth. In the years since then the potential for impact has been studied and is now considerably lower; basically the figure is about 2% to 3%; even lower probabilities have been seen in reliable media. Friday, April 13, 2029, will be the next occasion of the asteroid's by-pass of our earth. Scientists agree that the pass will be close, within the orbits of our satellites. Then, on Easter Sunday, April 13, 2036, the asteroid Apophis will pass our planet, even closer, with a diameter of 885 feet, a length of 460 feet, and moving at 13,129 mph. The basic premise is that impact is highly unlikely. Scientists allow that in the event of a collision in 2029 with a communication, or “geosynchronous” satellite, all pervious computations become obsolete; both for 2029, and more so for 2036. There are, we hasten to mention, factors contributing to general uncertainty. Basics, such as mass, and spin, have not been calculable. An indication of the asteroid's direction of spin will be available in the year 2013. A retrograde rotation would result in a much higher impact probability. We consider, though, that because Apophis will pass through our orbiting satellites in a plane inclined at 40 degrees to the Earth's equator, and passing outside the equatorial geosynchronous zone when crossing the equatorial plane, Apophis does not pose much threat to the satellites in the heavily populated equatorial region.

# Significance Answers: Probability of a Strike is Low

## (--) Odds are that no mid-size NEO’s will hit the earth in the next century:

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

The odds are that, once all 250m NEOs are discovered and catalogued, **none will turn out to be**

**on a collisional trajectory with our planet during the next century.** But, given the possibility that we can deflect an NEO in the unlikely event one \*is\* found to be on an impact trajectory, we are obliged to improve the current NEO survey capabilities in order to find all NEOs larger than 200m or so (see ref. 22). This will make us definitely sure (not only at a probabilistic level) that the Earth is “safe”. Whether it makes sense to extend, at considerable additional expense, the search down to 150 m or even smaller remains a matter of discussion.

## (--) Asteroids are likely to hit over the ocean—resulting in zero casualties:

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

6.2. Once-in-a-century mini-Tunguska atmospheric explosion Consider a 30–40-m office-building-sized object striking at 100 times the speed of a jetliner. It would explode f 15 km above ground, releasing the

energy of f 100 Hiroshima-scale bombs. Weak structures would be damaged or destroyed by the blast wave out to 20 km. The death toll might be hundreds; although casualties would be far higher in a densely populated place, **they would much more likely be zero** (i.e., if the impact were in the ocean or a desolate location). Such an event is likely to occur in our grandchildren’s lifetime, although **most likely over the ocean** rather than land. Even with the proposed augmented Spaceguard Survey, it is unlike-ly that such a small object would be discovered in advance; impact would occur without warning. Since it could occur literally anywhere, there are no loca-tion-specific kinds of advance measures that could or should be taken, other than educating people (per-haps especially military forces that might otherwise mistake the event as an intentional attack) about the possibilities for such atmospheric explosions. In the lucky circumstance that the object is discovered years in advance, a relatively modest space mission could deflect such a small body, preventing impact [26].

# Harms: No Extinction From an Asteroid Strike

## The Odds of the affirmative advantage are extremely low.

Dan Vergano, (Staff), USA TODAY, Aug. 13, 2009, 10D.

Astronomers rate the odds of a civilization-threatening space impact at once every 2 million years. The chances of a smaller impact, such as the 1909 Siberian event that leveled nearly 800 square miles of forest, are rated at once every two centuries, according to a 2008 estimate by space scientist David Morrison of NASA's Ames Research Center in Moffett Field, Calif.

# Long Time Frame For An Asteroid Collision

## The time-frame for a major asteroid collision is 300 years in the future.

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

Recent research by Mark Boslough of Sandia National Laboratories explains Tunguska as the impact of a small asteroid, perhaps 40 m in diameter. The object detonated in a 3-5-megaton airburst some 5 km up, scorching and flattening 2,000 km2 of Siberian forest. Compared with previous estimates of the impact energy, this smaller explosion implies a smaller impactor as well (the old estimate was a diameter between 60 and 100 m). Because smaller asteroids are more numerous, a Tunguska-like event should occur more often, perhaps every 300 years or so, rather than at the previously estimated rate of approximately once every millennium.

## An asteroid impact is unlikely anytime in the near future.

Graham Swinerd, 2008 (Prof., Engineering, U. of Southampton), HOW SPACECRAFT FLY, 2008, 245.

\*Impacts of the magnitude of the Yucatan event fortunately do not happen often -- about once every 100 million years. So it is probably something we do not need to worry about for a long time.

## The Long time-frame means there is no immediate need for action.

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

In looking for a formal response from government in relation to the NEO hazard, we also need to be realistic and pragmatic. The current surveys have demonstrated that a global-scale asteroid impact is not imminent, and so there are few immediate actions which need to be taken, the most urgent perhaps being the need to reduce the size threshold of detection of the survey programs to include objects which still pose a very significant threat to society should they impact the Earth. Instead we need to exploit existing policy platforms and infrastructures where appropriate, and bridge the gaps in capability (whether it be process or infrastructure) with specific actions related to NEOs.

# Disads Outweigh Risk of An Asteroid Strike

## Major wars outweigh the risk of an asteroid collision:

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

## This has occurred several times, the most recent being the impact 65 million years ago which extinguished the dinosaurs and 60% of other species, but fortunately their average impact frequency is only every 100,000,000 years. The impact of NEOs 1-6 km in diameter would result in catastrophic damage regionally or globally. There are an estimated over 1,100 such NEAs (Near Earth Asteroids) and their estimated average impact frequency is every 1,000,000 years. NEOs about 300 m diameter would result in great local or regional damage and millions of deaths, and their average impact frequency is every 10,000 years. Smaller NEOs in the 45 m diameter class may not penetrate the atmosphere but could still create extensive local damage and deaths due to blast, and their average impact frequency is every 100 years. The average NEO hazard is very important in the spectrum of hazards humanity faces, being greater than that from biological warfare and terrorism (to date), though smaller than that from major wars. A global nuclear war can rival an asteroid’s impact to the environment--

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

I have argued [59] that impacts must be excep-tionally more lethal globally than any other proposed terrestrial causes for mass extinctions because of two unique features: (a) their environmental effects hap-pen essentially instantaneously (on timescales of hours to months, during which species have little time to evolve or migrate to protective locations) and (b) there are compound environmental consequences (e.g., broiler-like skies as ejecta re-enter the atmo-sphere, global firestorm, ozone layer destroyed, earthquakes and tsunami, months of ensuing ‘‘impact winter’’, centuries of global warming, poisoning of the oceans). Not only the rapidity of changes, but also the cumulative and synergistic consequences of the compound effects, make asteroid impact over-whelmingly more difficult for species to survive than alternative crises. Volcanism, sea regressions, and even sudden effects of hypothesized collapses of continental shelves or polar ice caps are far less abrupt than the immediate (within a couple of hours) worldwide consequences of impact; lifeforms have much better opportunities in longer-duration scenar-ios to hide, migrate, or evolve. The alternatives also lack the diverse, compounding negative global effects. Only the artificial horror of global nuclear war or the consequences of a very remote possibility of a stellar explosion near the Sun could compete with impacts for immediate, species-threatening changes to Earth’s ecosystem.

## (--) The disads outweigh the case: Even astronomers think that asteroids rank below war, disease, and famine as risks to be dealt with:

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

7. Evaluation of the modern impact hazard Unlike other topics in astronomy (except solar flares and coronal mass ejections), only the impact hazard presents serious practical issues for society. Contrasting with most practical issues involving meteorology, geology and geophysics, the impact hazard is both more extreme in potential conse-quences and yet so rare that it has not even been experienced in more than minor ways in historical times. It has similarities to natural hazards in that its practical manifestations mainly involve familiar destructive processes, such as fire, high winds, earthquakes, falling debris and floods. The impact hazard also ranks with other natural disasters in the **mid-range of risks of death** [67]: **much less impor-tant than war, disease**, famine, automobile accidents or murder but much more important than shark attacks, botulism, fireworks accidents or terrorism. Yet, impacts differ from natural disasters because the hazard is mainly not location-dependent (impacts happen anywhere, not just along faults, although ocean impact effects are amplified along coastlines) and there are no precursor or after-shock events.

## (--) Wars, cancer, and even traffic accidents outweigh the risk of asteroids:

Joe **Veverka,** 3/3/20**03** (professor of astronomy at Cornell University

<http://www.astrobio.net/debate/389/collision-course-for-earth>)

It is only when we get down to impacts that occurred early in the 20th century that it makes sense to discuss mitigation - for example, the Tunguska explosion of 1908 that has been attributed to a meteoroid 60 meters in diameter. But even for these events, which might occur every few hundred to a thousand years, **the cost of a mitigation policy must be weighed against the likely benefit**. We have to keep in mind all of the other ways resources could be used to benefit society in preserving and improving life. Even in the case of Tunguska-type events, there are far more urgent and potentially more beneficial uses of our resources than developing a system to protect us from impacts by bodies a hundred or so meters across. Almost certainly more people will die from **wars, cancer, and even traffic accidents** during the next few hundred years **than are likely to die from the next Tunguska**.

## (--) NEO impact risk is lower than major wars & disease:

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

8) The NEO impact hazard (in terms of average fatalities per year over the time scale of the

occurrence) is greater than that due to shark attacks, botulism, or terrorism (to date), however is **lower than that due to major wars,** disease, famine, car accidents, or murder.

# Should Ignore Long Time-Frame Events

## Long time frame, low probability events don’t need to be countered—we should worry about more immediate, higher likelihood threats:

Joe **Veverka,** 3/3/20**03** (professor of astronomy at Cornell University

<http://www.astrobio.net/debate/389/collision-course-for-earth>)

I believe that we currently are not in a position to protect Earth from impacts by one kilometer-sized objects. The technology required to carry out such a task exists, or it can be developed, but the effort would be colossal by any standards. I would argue that the question, while of academic interest, is not very relevant from a practical point of view. In such a discussion, it is essential to define a "horizon of concern." In other words, **how far into the future does it make sense to worry about something and take precautions?** The answer might depend on where and when we live, but right now any planning that society does hardly extends more than a few decades into the future, and at most perhaps to a few centuries. Planning for events that occur on time scales of hundreds of thousands to a few million years just doesn't make practical sense. Nor is it necessary to expend resources to protect ourselves against events that occur on time scales of a million years. For instance, few of us lose sleep over the fact that the sun will turn into a red giant some 5 billion years from now.

# Deflection Will Fail

## The lack of a consensus on how to deflect asteroids will prevent successful deflection.

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

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.

## (--) The most likely asteroid scenario is one we can do nothing about:

Tom **Blackwell,** 8/29/20**02** (National Post, Lexis)

A worldwide project to identify potentially hazardous asteroids -- the thousands of objects that are 200 metres or more wide and could cross paths with Earth -- has probably identified 15% to 20% of them. The rest could be anywhere. The most likely scenario, therefore, is that an unidentified asteroid would show up on the radar screen with hours warning -- not years, **meaning little could be done to stop it,** said Mr. Balam. "This amounts to a sort of celestial sucker punch," he said.

## Deflection we fail: we lack sufficient knowledge of asteroids:

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

First we lack the specific knowledge of the characteristics of NEAs necessary to design anything approaching a reliable operational system. We could readily show that the technology would exist within a few years to get to and land on an asteroid. We also determined that after arriving at the asteroid we would have enough propulsive energy available to successfully deflect the asteroid from an Earth impact a decade or so later. What was missing however was knowledge about the structure and characteristics of asteroids detailed enough to enable successful and secure attachment to it.

## The plan would need decades of warning time for its alternative options to be effective:

Henry **Fountain**, 11/19/20**02** (staff writer, <http://www.nytimes.com/2002/11/19/science/space/19ASTE.html>)

No warning time means no options. A short amount, on the order of a decade or two, might leave a nuclear blast as the only choice. But with many decades of warning, there is room to investigate the asteroid first by sending a spacecraft to it, and then use a slow-acting method to divert it, one that wouldn't require launching a nuclear weapon. "We would want to seek out every alternative to a nuclear weapon before turning to that technology,'` Dr. Chapman said.

## Lack of an international consensus on how to respond to an asteroid will prevent detection from being successful:

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

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

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.

# Deflection Will Fail

## Turn: Nuclear Deflection

## A) The only option to stop a large NEO with little warning time is to use nuclear weapons:

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

There is only one option for changing the velocity of a large NEO or one with little warning and that is to use nuclear devices because the energy requirements can be enormous, and the energy release of nuclear devices can be millions of times greater than that produced by kinetic impacts. Standoff nuclear explosion engagement of a NEO is very similar to that of a non-nuclear kinetic impact deflection technique, with the device being detonated just before or at impact. The tremendous radiative flux from a nuclear explosion ablates the surface of the NEO and results in a hot expanding plasma, whose reaction forces accelerate the NEO and change its velocity essentially instantaneously. With sufficient stand-off distance the area over which the energy is deposited could be large, and hence the forces low enough to possibly avoid fragmentation in some NEOs, but others could still fragment. A variant is to bury a nuclear device in the NEO which gains greatly in deflection force but requires rendezvous and surface operations; and would probably fragment most NEOs.

## B) Using a nuclear weapon fragments the asteroid: increasing the overall threat:

Russell L. **Schweickart, 2004** (Chair, B612 Foundation, “Asteroid Deflection; Hopes and Fears,” www.b612foundation.org/papers/Asteroid\_Deflection.doc)

The hard options consist of various forms of nuclear explosion as well as that of direct (or kinetic) impact. In each case, however, to be effective the resultant force must be applied along the NEA’s velocity vector, with the exception of two cases. If one considers the option of **fragmenting the NEA a viable option** (i.e., **blowing it to pieces**) then the direction of impulse becomes meaningless. While there are many uncertainties regarding the effect of a nuclear explosion intended to fragment an asteroid (generally assumed to be a sub-surface burst) it seems clear that, given a large enough nuclear weapon, the **fragmentation could be achieved**. Arguments have been made from the first discussion of this option, however, that such a strategy would be unwise since the possibility exists that the **resultant fragmentation could actually increase the overall threat** and not eliminate it. No general answer to this debate will likely evolve since it is highly dependent on the structural character of the asteroid in question.

## Nuclear deflection will fail—the warheads will explode on earth:

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

There is a persistent notion in lay circles that the way to deal with a dangerous NEO is to

**simply hit it with an ICBM and vaporize it in space**. Unfortunately, **reality is far removed from this illusion**. While it is likely that we may be able to rapidly reconfigure an ICBM computer guidance system to intercept a point or object in near-Earth space, ICBM propulsion system performance is insufficient to enable intercept beyond a few hundred kilometers above the Earth’s surface. Stages must be added to an ICBM to enable it to achieve the necessary escape velocity and to place the weapon on an intercept trajectory with a NEO. While these upper stage technologies are space qualified, such a system **would have too low a reliability for the NEO intercept mission** given the potentially horrendous consequences of an Earth impact, and might thus require many sequential launches of several such vehicles to have any reasonable chance of successfully deflecting a NEO. Such attempts would be part of a dedicated “campaign” utilizing several different launch vehicle types, designed with different upper stages, using different end game techniques, and different nuclear warhead types, in order to obtain a high probability of success. Furthermore at least one failed launch attempt is likely if many are required, and with a nuclear payload **this could result in serious environmental effects in and of itself**. Thus, it is clear that for the nuclear concept several dedicated designs of a inherently highly reliable launch vehicles and multi-stage interceptors would be extremely desirable to loft the nuclear warheads, and thus the use of existing ICBMs, even if outfitted with current technology upper stages, is **highly undesirable if not essentially ruled out.**

## Asteroids explode on impact: nuking the asteroid risks fragmentation:

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

\* Pg. 83, 6.11.2, 3rd bullet. This vital assumption that a PHO will "not experience large-scale fracturing" by an impulsive deflection strike rules out, from the beginning, what could be the majority of cases requiring deflection of especially dangerous NEOs. Most NEOs 150 - 300 m in size are probably rubble piles and one of the major concerns is that they would be disrupted by a KI impact. Asteroids in general, and rubble piles in particular, are weak; **they can be thought of more like eggs than golf balls**: if you strike them, **they are likely to rupture before you can move them very much.**

# Deflection Will Fail

## Nuclear deflection will fail: most chunks will still head toward the Earth:

Zeeya **Merali,** 11/12/20**05** (New Scientist, “Don't nuke deadly asteroids, tow 'em,” Lexis)

WHEN it comes to deflecting an asteroid that is on a collision course with Earth, "most people think of the Hollywood treatment – throw a nuclear weapon at it", says NASA astronaut Edward Lu. "That's the blast-and-hope strategy." It is hard to predict where the shattered pieces would go, and **many smaller chunks might still head towards Earth.**

## Even attempting deflection with nukes risks fragmentation:

Zeeya **Merali,** 11/12/20**05** (New Scientist, “Don't nuke deadly asteroids, tow 'em,” Lexis)

Other ideas for dealing with such threats have included detonating nuclear bombs near the asteroid – rather than nuking it directly – to nudge it off track. But this carries the same risks as **shattering the asteroid.** Some have advocated painting the asteroid white to change the amount of solar energy it reflects, thus altering the forces acting upon it and hopefully changing its course. However, the sheer amount of paint this would require makes it impractical, says Lu.

## Fragmentation actually increases the destructive power of asteroids:

Ian **O'Neill,** 7/27/20**08** (staff writer,

<http://www.universetoday.com/2008/07/27/bad-idea-blowing-up-asteroids-with-nuclear-missiles/>)

Schweickart has expressed concern with the possibility of using nuclear weapons to destroy, or deflect Earth-bound asteroids, pointing out there are many other less harmful ways of dealing with the asteroid threat. At the moment he points out that we are completely unprepared to deal with asteroids, but by 2015, we should have developed a gentler means of deflection. Simply blowing asteroids up have many knock-on implications. First and foremost, Schweickart believes that NASA may be open to manipulation to put forward the proliferation of space-based nuclear weapons under the guise of international "safety." Another problem I can see is blowing up a large piece of rock only to create many smaller (but just as deadly) pieces of rock, doesn't really extinguish the destructive power of an asteroid on collision course, in fact, **it might increase it.**

# \*\*\*Disad Links\*\*\*

# General: Plan Will Be Perceived Internationally

## The plan will be perceived internationally—almost any discussion of nuclear weapons and asteroids causes other nations eyebrows to go up:

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

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."

# Politics Links

## Funding for asteroid mapping costs political capital:

Matthew T. Dearing, 2011 (April 12th 2011, “Protecting The Planet Requires Heroes, Money, And Citizen Scientists,”

The Citizen Science Journal, <http://research.dynamicpatterns.com/2011/04/12/protecting-the-planet-requires-heroes-money->and-citizen-scientists/)

Artist's concept of a catastrophic asteroid impact with the early Earth. An impact with a 500-km-diameter asteroid would effectively sterilize the planet. The Earth may have experienced such gigantic impacts in its youth, but fortunately today there are apparently no projectiles this large to threaten our planet. Courtesy Don Davis, NASA. This childhood behavioral bias infiltrated adulthood in the relationship between professional astronomers, policy-makers and national budget-number crunchers. When a scientist expresses probabilistic concerns about the impending doom of our planet from a cataclysmic change of a major impact event, say, in the next 100, 1,000, or 10,000 years, it requires just too much risk of political capital and tax-payer dollars to divert significant budget resources to something that might only be a concern for our uber-great grandchildren. “Earth Impact Effects Program: A Web-based computer program for calculating the regional environmental consequences of a meteoroid impact on Earth” [PDF] Gareth S. Collins, et al. Meteoritics&Planetary Science 40, Nr 6, 817–840 (2005) The simultaneous efforts of two Hollywood studios in the late nineties of the last century tried to get something stirring in our cultural awareness with their mega-disaster flicks, Armageddon and Deep Impact. These features did bring us through the box office (which was certainly their primary goal!), but they did not push us en masse to the round table to prepare for the ultimate defensive plan for our planet.

## (--) No risk of a politics link turn: there is no identifiable constituency that will speak out in favor of policies designed to solve asteroid collisions:

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

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

Perhaps the greatest intellectual challenge in dealing with this threat is the extraordinarily low annual likelihood of occurrence coupled with the incomparably dire consequences.12 The higher than expected likelihood of "death by asteroid" is attributed to the supposition that no event short of global nuclear war has the potential to kill tens or hundreds of millions of people—more than accounting for a large-scale impact’s low chance of occurrence. There is, however, no "relevant history" for an **asteroid strike** causing a global catastrophic event, so even if it is inevitable that such a strike will someday occur, **few are able to internalize the risk or view a need for action**. Political changes need constituencies and ‘**people who will be harmed by an impact’ simply do no make up an identifiable constituency today** 13--unlike the millions who fight for funding to further diminish those threats which are, statistically, far less likely to kill them (e.g., nuclear power accidents).

## (--) Asteroid deflection issues are controversial—raise the specter of weaponizing space:

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

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

It is, however, ranked at the bottom of Space Command’s Space Control needs and 62nd, 54th, and 53rd overall of the command’s overall 65 near-term, mid-term and far-term prioritized deficiencies, respectively.42 A recent article in the Air Force’s Aerospace Power Journal by Lieutenant Colonel Cynthia McKinley does suggest that the role for space surveillance and debris and asteroid mitigation be given to a "Space Guard," as she would name a separate service organized to patrol and protect assets in space much as the U.S. Coast Guard performs at sea.43 This view, though, is not a reflection of official Air Force policy and is unlikely to become so in the foreseeable future. The scientific community is not united behind Worden’s proposals either. Though many find merit in his thoughts, others (including some CCNet subscribers) question whether defining NEO detection as a military mission might inhibit scientific and international cooperation or might again be a convenient cover for developing technologies critical to a national missile defense system, again raising the specter of weaponizing space.

# Asteroid Bomb Turn

## Turn: Asteroid bombs—

## A) Deflection inherently contains with it the ability to deflect inward and use the asteroid as a weapon:

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

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

Chapter Three and Appendix B used the physics of meteoroids as a starting point for developing an understanding of kinetic-energy weapons delivered from space. The discussions examined idealized meteoroids at sizes having effects that would be of **tactical interest in conventional warfare**. The impressive effects on earth of past large meteoroids suggest the possibility that natural objects—earthcrossing asteroids—could be used as weapons on a scale more suitable for strategic deterrence, as are nuclear arsenals. Such notables as Carl Sagan, in discussing means of preventing catastrophic natural collisions, have expressed concern about the possibility of **deliberately deflecting an asteroid toward earth as a weapon** (Harris et al., 1994; Sagan, 1994; Sagan and Ostro, 1994).

## B) The asteroid bomb turns the case: there are several thousand times more “near misses” that could be deflected into Earth than actual hits we’ll take:

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

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

The lower bound on the availability of likely candidates can be determined from the history of actual natural collisions. The upper bound will depend on the amount of effort and lead time that can be

devoted to **deflecting what would otherwise be near misses into precise impacts**. The frequency with which earth-asteroid collisions occur without assistance has been estimated from satellite observations and from extrapolations by counting lunar craters (Morrison et al., 1994). Objects of the 10-m diameter class impact almost annually. Stone objects this small fragment too high up to be useful weapons. Iron meteorites are observed in 3.2 percent of all falls (Lewis, 1997, p. 323). It would therefore follow that a 10-m iron asteroid—a Sikhote-Alin class object—strikes land on average once per century or so and the ocean twice as often. Objects with diameters of 100 to a few hundred meters impact earth naturally with a frequency of about one in a few thousand years (Morrison et al., 1994). Iron objects produce craters like the Barringer crater in Arizona. Stony objects produce air bursts like the Tunguska event in Siberia. Increasing the opportunities to employ one of these natural weapons requires increasing the range of near-misses to some maximum miss distance. As the area the maximum miss distance covers expands, the incidence of objects available to divert should increase in proportion to the increased cross-sectional area. For example, diverting asteroids that would otherwise miss earth by a distance as far as the average distance to the moon should multiply the incidence of “near-enough” misses by about 3,600. If it is possible to divert objects at such distances, suitable opportunities would be available **as often as weeks or months apart, rather than years or centuries**.

# Asteroid Bomb Extensions

## (--)Radio astronomy allows us to obtain the precise position point to bomb someone, and the mass of the asteroid will keep it on target—turning the case:

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

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

Diverting the course of an asteroid requires only a small Δv, if the deflection is done far enough in advance of earth impact. The displacement is proportional to both the lead time and Δv.1 Done well in advance, diverting an asteroid that would otherwise come no closer than midway between earth and moon requires imparting a Δv of at least several tens of meters per second to the asteroid. Deflecting

an asteroid within days of its closest approach to earth would require a very large Δv, on the scale of kilometers per second. It is only possible to deflect an intermediate-size asteroid well in advance. The precision of the angle and timing of entry into the atmosphere determine the degree of control over the location of the impact. Because the lead time for deflecting an asteroid is long, it is precise control of the velocity vector applied to the asteroid, not the time deflection begins, that is important. An error of only about 1 percent could alter the impact point by about 1,000 km.2 In practice, ensuring damage to a particular large, soft earth target would mean controlling the asteroid’s Δv to at least 1 part in 10,000. Reducing the target error to the range of kilometers would mean controlling the Δv to 1 part in 100,000, an accuracy **comparable to that of simple ballistic missiles**. The instantaneous position and velocity of the asteroid must be known during the deflection process and must continue to be monitored afterward for perturbations to the asteroid’s trajectory. **Radio astronomy** provides the means of obtaining such precise position and velocity measurements: the differential, very-long-baseline interferometry used to navigate deep-space probes.3 And, because of their large mass, these objects inherently have βs high enough to preserve accuracy through atmospheric entry. The principal uncertainty would be in the altitude of **fragmentation for asteroids** chosen to achieve blast, rather than impact, effects.

## Asteroid deflection allows us to build a super-weapon where we deflect the asteroid inward at an enemy:

David **Morrison, 2006** (staff writer, “Carl Sagan and Edward Teller: an uneasy alliance over defending the earth,” http://findarticles.com/p/articles/mi\_kmske/is\_1\_13/ai\_n29332744/)

To illustrate this concern, Sagan turned to the ancient history of the Greek city-states in Sicily, writing about the "Marsh of Camarina" in Parade magazine--read by millions of Americans--and in a chapter in his 1994 book, Pale Blue Dot. To illustrate the danger of unintended consequences, he told the story of how the Camarinans drained their marsh to improve public health, only to be wiped out when their enemies realized that the marsh that had protected the Camarinans from their enemies no longer existed. These considerations led to what Sagan called the "asteroid deflection dilemma", asking whether the danger of developing the technology to alter asteroid orbits for protection of the Earth might not provide a super weapon that could someday be turned against us. Sagan saw no way out of this dilemma other than to defer asteroid defense to a future time when we might be better able to handle the responsibility.