# 1NC

## 1NC—Asteroid Deflection Bad DA

### Asteroid deflection technology risks extinction via *intentional misuse*—*highly probable*.

Sagan 97 — Carl Sagan, Professor and Director of the Laboratory for Planetary Studies at Cornell University, winner of the Oersted Medal, two NASA Distinguished Public Service Medals, the Pulitzer Prize for General Non-Fiction, and the National Academy of Sciences Public Welfare Medal, holds a Ph.D. in Astronomy and Astrophysics from the University of Chicago, 1997 (“The Marsh of Camarina,” *Pale Blue Dot: A Vision of the Human Future in Space*, Published by Ballantine Books, ISBN 0345376595, p. kindle)

The foregoing are examples of inadvertence. But there’s another kind of peril: We are sometimes told that this or that invention would of course not be misused. No sane person would be so reckless. This is the “only a madman” argument. Whenever I hear it (and it’s often trotted out in such debates), I remind myself that **madmen really exist**. Sometimes they achieve the highest levels of political power in modern industrial nations. This is the century of Hitler and Stalin, tyrants who posed the gravest dangers not just to the rest of the human family, but to their own people as well. In the winter and spring of 1945, Hitler ordered Germany to be destroyed—even “what the people need for elementary survival”—because the surviving Germans had “betrayed” him, and at any rate were “inferior” to those who had already died. If Hitler had had nuclear weapons, the threat of a counterstrike by Allied nuclear weapons, had there been any, is unlikely to have dissuaded him. It might have encouraged him.

Can we humans be trusted with **civilization-threatening technologies?** If the chance is almost one in a thousand that much of the human population will be killed by an impact in the next century, isn’t it **more likely that asteroid deflection technology will get into the wrong hands** in another century—some misanthropic sociopath like a Hitler or a Stalin eager to kill everybody, a megalomaniac lusting after “greatness” and “glory,” a victim of ethnic violence bent on revenge, someone in the grip of unusually severe testosterone poisoning, some religious fanatic hastening the Day of Judgment, or just technicians incompetent or insufficiently vigilant in handling the controls and safeguards? **Such people exist. The risks seem far worse than the benefits, the cure worse than the disease**. The cloud of near-Earth asteroids through which the Earth plows may constitute a modern Camarine marsh.

### This outweighs the case—*probability* and *timeframe*.

Sagan and Ostro 94 — Carl Sagan, Professor and Director of the Laboratory for Planetary Studies at Cornell University, winner of the Oersted Medal, two NASA Distinguished Public Service Medals, the Pulitzer Prize for General Non-Fiction, and the National Academy of Sciences Public Welfare Medal, holds a Ph.D. in Astronomy and Astrophysics from the University of Chicago, and Steven J. Ostro, Director of the Asteroid Radar Group at NASA's Jet Propulsion Laboratory, holds a Ph.D. in Planetary Science from the Massachusetts Institute of Technology, 1994 (“Dangers of Asteroid Deflection,” *Nature*, Volume 368, Number 6471, April 7th, Available Online to Subscribing Institutions via Nature Online, p. 501)

This proposal is a double-edged sword. If we can perturb an asteroid out of impact trajectory, it follows that we can also transform one on a benign trajectory into an Earth-impactor. For example, the asteroid 1991 OA could in 2070 be deflected into Earth-impact trajectory 5 with an aggregate yield of only about 60 MT. Although a single asteroid can more readily be deflected away from, than into, an impact trajectory, there is not an orders-of-magnitude difference in technical effort; but there are orders-of-magnitude more Earth-crossing asteroids that can be induced to impact the Earth than will do so on their own. With a Spaceguard-like inventory of such asteroids and a launch-ready deflection system of nuclear-armed missiles, it might take only a few years to identify a suitable large asteroid, alter its orbit through a series of nuclear explosions with individual yields of about 10 MT (available in existing arsenals), and send it crashing into Earth.5 **There is no other way known in which a few nuclear weapons could by themselves threaten the global civilization**.

In our view, development of this asteroid-deflection technology would be **premature**. Given twentieth-century history and present global politics, it is hard to imagine guarantees against eventual misuse of an asteroid deflection system commensurate with the dangers such a system poses. Those who argue that it would be prudent to prevent catastrophic impacts with annual probabilities of 10-5 will surely recognize the prudence of preventing **more probable catastrophes of comparable magnitude** from misuse of a potentially apocalyptic technology.

It is of course sensible to seek cost-effective reduction of risks from all hazards to our civilization—even low-probability hazards, of which many may remain unidentified. At a total cost of some $300 million, Spaceguard arguably constitutes a reasonable measure of defence against the impact hazard. But premature deployment of any asteroid orbit-modification capability, in the real world and in light of well-established human frailty and fallibility, **may introduce a new category of danger that dwarfs that posed by the objects themselves**.

# Link Materials

## Link—Asteroid Deflection

### Deflection technology is inherently dual-use—if they solve, they link.

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The problem, Steven Ostro of JPL and I have suggested, is that if you can reliably deflect a threatening worldlet so it does not collide with the Earth, **you can also reliably deflect a harmless worldlet so it does collide with the Earth**. Suppose you had a full inventory, with orbits, of the estimated 300,000 near-Earth asteroids larger than 100 meters—each of them large enough, on impacting the Earth, to have serious consequences. Then, it turns out, you also have a list of huge numbers of inoffensive asteroids whose orbits could be altered with nuclear warheads **so they quickly collide with the Earth**.

## Link—Asteroid Detection

### Asteroid detection is a *booby trap*—the risk of underestimating the threat is *justified* in order to prevent intentional misuse of deflection technology.

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**Even if we restrict ourselves merely to surveillance, there’s a risk**. Imagine that in a generation we characterize the orbits of 30,000 objects of 100-meter diameter or more, and that this information is publicized, as of course it should be. Maps will be published showing near-Earth space black with the orbits of asteroids and comets, **30,000 swords of Damocles hanging over our heads**—ten times more than the number of stars visible to the naked eye under conditions of optimum atmospheric clarity. Public anxiety might be **much greater** in such a time of knowledge than in our current age of ignorance. There might be **irresistible public pressure** to develop means to mitigate even nonexistent threats, which would then **feed the danger that deflection technology would be misused**. For this reason, asteroid discovery and surveillance may not be a mere neutral tool of future policy, but rather **a kind of booby trap**. To me, the only foreseeable solution is a combination of accurate orbit estimation, realistic threat assessment, and effective public education—so that in democracies at least, the citizens can make their own, informed decisions. This is a job for NASA. Near-Earth asteroids, and means of altering their orbits, are being looked at seriously. There is some sign that officials in the Department of Defense and the weapons laboratories are beginning to understand that there may be real dangers in planning to push asteroids around. Civilian and military scientists have met to discuss the subject. On first hearing about the asteroid hazard, many people think of it as a kind of Chicken Little fable; Goosey-Lucy, newly arrived and in great excitement, is communicating the urgent news that the sky is falling. The tendency to dismiss the prospect of any catastrophe that we have not personally witnessed is in the long run very foolish. But in this case it may be **an ally of prudence**.

## Link—Asteroid Mining

### Attempting to move an asteroid into Earth’s orbit risks disaster—the margin of error is too small.

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The notion of moving asteroids into Earth orbit has proved attractive to some space scientists and long-range planners. They foresee mining the minerals and precious metals of these worlds or providing resources for the construction of space infrastructure without having to fight the Earth’s gravity to get them up there. Articles have been published on how to accomplish this end and what the benefits will be. In modern discussions, the asteroid is inserted into orbit around the Earth by first making it pass through and be braked by the Earth’s atmosphere, a maneuver with **very little margin for error**. For the near future we can, I think, recognize this whole endeavor as **unusually dangerous and foolhardy**, especially for metal worldlets larger than tens of meters across. This is the one activity where errors in navigation or propulsion or mission design can have **the most sweeping and catastrophic consequences**.

## They Say: “Link Not Unique”

### The link is unique—it would take 100 years to find a deflectable asteroid in the status quo but the plan makes it possible *within a year*.

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Suppose we restrict our attention to the 2,000 or so near-Earth asteroids that are a kilometer across or bigger—that is, the ones most likely to cause a global catastrophe. Today, with only about 100 of these objects catalogued, it would take about a century to catch one when it’s easily deflectable to Earth and alter its orbit. We think we’ve found one, an as-yet-unnamed\* asteroid so far denoted only as 1991OA. In 2070, this world, about 1 kilometer in diameter, will come within 4.5 million kilometers of the Earth’s orbit—only fifteen times the distance to the Moon. To deflect 1991OA so it hits the Earth, only about 60 megatons of TNT equivalent needs to be exploded in the right way—the equivalent of a small number of currently available nuclear warheads.

Now imagine a time, a few decades hence, when all such near-Earth asteroids are inventoried and their orbits compiled. Then, as Alan Harris of JPL, Greg Canavan of the Los Alamos National Laboratory, Ostro, and I have shown, **it might take only a year to select a suitable object, alter its orbit, and send it crashing into the Earth with cataclysmic effect**.

# Impact Materials

## DA Outweighs Case

### The risk of the DA is high and their takeouts are naïve—*comparative evidence*.

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It’s easy to think that all of this must be very unlikely, mere anxious fantasy. Surely sober heads would prevail. Think of how many people would be involved in preparing and launching warheads, in space navigation, in detonating warheads, in checking what orbital perturbation each nuclear explosion has made, in herding the asteroid so it is on an impact trajectory with Earth, and so on. Isn’t it noteworthy that although Hitler gave orders for the retreating Nazi troops to burn Paris and to lay waste to Germany itself, his orders were not carried out? Surely someone essential to the success of the deflection mission will recognize the danger. Even assurances that the project is designed to destroy some vile enemy nation would probably be disbelieved, because the effects of collision are planetwide (and anyway it’s very hard to make sure your asteroid excavates its monster crater in a particularly deserving nation).

But now imagine a totalitarian state not overrun by enemy troops, but one thriving and self-confident. Imagine a tradition in which orders are obeyed without question. Imagine that those involved in the operation are supplied a cover story: The asteroid is about to impact the Earth, and it is their job to deflect it—but in order not to worry people needlessly, the operation must be performed in secret. In a military setting with a command hierarchy firmly in place, compartmentalization of knowledge, general secrecy, and a cover story, can we be confident that even apocalyptic orders would be disobeyed? Are we really sure that in the next decades and centuries and millennia, nothing like this might happen? How sure are we?

**It’s no use saying that all technologies can be used for good or for ill**. That is certainly true, but **when the “ill” achieves a sufficiently apocalyptic scale, we may have to set limits on which technologies may be developed**. (In a way we do this all the time, because we can’t afford to develop all technologies. Some are favored and some are not.) Or **constraints may have to be levied by the community of nations on madmen and autarchs and fanaticism**.

### If it is close, *timeframe* is the trump card—vote neg.

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Meanwhile we must still face the deflection dilemma. If we develop and deploy this technology, it may do us in. If we don’t, some asteroid or comet may do us in. **The resolution of the dilemma hinges**, I think, **on the fact that the likely timescales of the two dangers are very different—short for the former, long for the latter**.

### Strongly err negative—misuse of technology is empirically likely.

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**We have a tendency to minimize the dangers of new technologies**. A year before the Chernobyl disaster, a Soviet nuclear power industry deputy minister was asked about the safety of Soviet reactors, and chose Chernobyl as a particularly safe site. The average waiting time to disaster, he confidently estimated, was a hundred thousand years. Less than a year later … devastation. Similar reassurances were provided by NASA contractors the year before the Challenger disaster: You would have to wait ten thousand years, they estimated, for a catastrophic failure of the shuttle. One year later … heartbreak.

Chlorofluorocarbons (CFCs) were developed specifically as a completely safe refrigerant—to replace ammonia and other refrigerants that, on leaking out, had caused illness and some deaths. Chemically inert, nontoxic (in ordinary concentrations), odorless, tasteless, nonallergenic, nonflammable, CFCs represent a brilliant technical solution to a well-defined practical problem. They found uses in many other industries besides refrigeration and air conditioning. But, as I described above, the chemists who developed CFCs overlooked one essential fact—that the molecules’ very inertness guarantees that they are circulated to stratospheric altitudes and there cracked open by sunlight, releasing chlorine atoms which then attack the protective ozone layer. Due to the work of a few scientists, the dangers may have been recognized and averted in time. We humans have now almost stopped producing CFCs. We won’t actually know if we’ve avoided real harm for about a century; that’s how long it takes for all the CFC damage to be completed. Like the ancient Camarinans, **we make mistakes**.\* **Not only do we often ignore the warnings of the oracles; characteristically we do not even consult them**.

## They Say: “International Norms Check”

### International norms won’t deter intentional misuse.

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Tracking asteroids and comets is prudent, it’s good science, and it doesn’t cost much. But, knowing our weaknesses, why would we even consider now developing the technology to deflect small worlds? For safety, shall we imagine this technology in the hands of many nations, each providing checks and balances against misuse by another? This is nothing like the old nuclear balance of terror. It hardly inhibits some madman intent on global catastrophe to know that if he does not hurry, a rival may beat him to it. How confident can we be that the community of nations will be able to detect a cleverly designed, clandestine asteroid deflection in time to do something about it? If such a technology were developed, can any international safeguards be envisioned that have a reliability commensurate with the risk?

## They Say: “Technology Will Never Exist”

### The basic technology required to deflect an asteroid into Earth *already exists*, and the plan makes it feasible.

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The technology required—large optical telescopes, sensitive detectors, rocket propulsion systems able to lift a few tons of payload and make precise rendezvous in nearby space, and thermonuclear weapons—all exist today. Improvements in all but perhaps the last can be **confidently expected**. **If we’re not careful, many nations may have these capabilities in the next few decades**. What kind of world will we then have made?

## They Say: “Asteroids Make Extinction Inevitable”

### If we win our disad, it turns their existential risk impact—short-term increases in risk *outweigh delay*.

Bostrom 3 — Nick Bostrom, Professor in the Faculty of Philosophy & Oxford Martin School, Director of the Future of Humanity Institute, and Director of the Programme on the Impacts of Future Technology at the University of Oxford, recipient of the 2009 Eugene R. Gannon Award for the Continued Pursuit of Human Advancement, holds a Ph.D. in Philosophy from the London School of Economics, 2003 (“Astronomical Waste: The Opportunity Cost of Delayed Technological Development,” *Utilitas*, Volume 15, Number 3, Available Online at http://www.nickbostrom.com/astronomical/waste.html, Accessed 07-30-2011)

In light of the above discussion, it may seem as if a utilitarian ought to focus her efforts on accelerating technological development. The payoff from even a very slight success in this endeavor is so enormous that it dwarfs that of almost any other activity. We appear to have a utilitarian argument for the greatest possible urgency of technological development.

However, the true lesson is a different one. If what we are concerned with is (something like) maximizing the expected number of worthwhile lives that we will create, then in addition to the opportunity cost of delayed colonization, **we have to take into account the risk of failure to colonize at all.** We might fall victim to an existential risk, one where an adverse outcome would either annihilate Earth-originating intelligent life or permanently and drastically curtail its potential.[8] Because the lifespan of galaxies is measured in billions of years, whereas the time-scale of any delays that we could realistically affect would rather be measured in years or decades, **the consideration of risk trumps the consideration of opportunity cost**. For example, **a single percentage point of reduction of existential risks would be worth** (from a utilitarian expected utility point-of-view) **a delay of over 10 million years**.

Therefore, if our actions have even the slightest effect on the probability of eventual colonization, this will outweigh their effect on when colonization takes place. For standard utilitarians, priority number one, two, three and four should consequently be to reduce existential risk. The utilitarian imperative “Maximize expected aggregate utility!” can be simplified to the maxim **“Minimize existential risk!”.**

## Status Quo = Delay CP

### Delay is good—we have *decades* and probably *centuries* to solve the case.

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Since the danger of misusing deflection technology seems so much greater than the danger of an imminent impact, we can afford to wait, take precautions, rebuild political institutions—for decades certainly, probably centuries. If we play our cards right and are not unlucky, we can pace what we do up there by what progress we’re making down here. The two are in any case deeply connected.

### That means the status quo functions as a delay counterplan—*unilateral* development of deflection technologies *now* poses unique dangers.

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I like to think that our future involvement with near-Earth asteroids will go something like this: From ground-based observatories, we discover all the big ones, plot and monitor their orbits, determine rotation rates and compositions. Scientists are diligent in explaining the dangers—neither exaggerating nor muting the prospects. We send robotic spacecraft to fly by a few selected bodies, orbit them, land on them, and return surface samples to laboratories on Earth. Eventually we send humans. (Because of the low gravities, they will be able to make standing broad jumps of ten kilometers or more into the sky, and lob a baseball into orbit around the asteroid.) Fully aware of the dangers, we make no attempts to alter trajectories until the potential for misuse of world-altering technologies is much less. That might take a while.

If we’re too quick in developing the technology to move worlds around, we may destroy ourselves; if we’re too slow, we will surely destroy ourselves. The reliability of world political organizations and the confidence they inspire will have to make significant strides before they can be trusted to deal with a problem of this seriousness. At the same time, there seems to be no acceptable national solution. Who would feel comfortable with the means of world destruction in the hands of some dedicated (or even potential) enemy nation, whether or not our nation had comparable powers? The existence of interplanetary collision hazards, when widely understood, works to bring our species together. When facing a common danger, we humans have sometimes reached heights widely thought impossible; we have set aside our differences—at least until the danger passed.

But this danger never passes. The asteroids, gravitationally churning, are slowly altering their orbits; without warning, new comets come careening toward us from the transplutonian darkness. There will always be a need to deal with them in a way that does not endanger us. By posing two different classes of peril—one natural, the other human-made—the small near-Earth worlds provide a new and potent motivation to create effective transnational institutions and to unify the human species. It’s hard to see any satisfactory alternative.

In our usual jittery, two-steps-forward-one-step-back mode, we are moving toward unification anyway. There are powerful influences deriving from transportation and communications technologies, the interdependent world economy, and the global environmental crisis. The impact hazard merely hastens the pace.

Eventually, cautiously, scrupulously careful to attempt nothing with asteroids that could inadvertently cause a catastrophe on Earth, I imagine we will begin to learn how to change the orbits of little nonmetallic worlds, smaller than 100 meters across. We begin with smaller explosions and slowly work our way up. We gain experience in changing the orbits of various asteroids and comets of different compositions and strengths. We try to determine which ones can be pushed around and which cannot. By the twenty-second century, perhaps, we move small worlds around the Solar System, using (see next chapter) not nuclear explosions but nuclear fusion engines or their equivalents. We insert small asteroids made of precious and industrial metals into Earth orbit. Gradually we develop a defensive technology to deflect a large asteroid or comet that might in the foreseeable future hit the Earth, while, with meticulous care, we build layers of safeguards against misuse.