# PIC – Asteroids

### 1NC

#### **Counterplan text: States ought to**

#### Eliminate all nuclear weapons except the minimum number necessary for asteroid deflection

#### Adopt the reforms suggested below

Koplow 19 2019 Exoatmospheric Plowshares: Using a Nuclear Explosive Device for Planetary Defense Against an Incoming Asteroid David A. Koplow Georgetown University Law Center, [koplow@law.georgetown.edu](mailto:koplow@law.georgetown.edu) \* Professor of Law, Georgetown University Law Center. The author gratefully acknowledges the valuable comments from the following experts, colleagues and friends who reviewed prior drafts of this manuscript: Hope M. Babcock, Michael R. Cannon, Pierce Corden, Thomas Graham, Jr., Henry R. Hertzfeld, Edward M. Ifft, Raymond Jeanloz, Daniel H. Joyner, Barry Kellman, Rob R. Landis, Paul B. Larsen, Daniel D. Mazanek, Steven A. Mirmina, Scott Pace, Gabriel Swiney, James B. (Bart) Wager, Jr., and Brian Weeden. The author also thanks Danielle B. Ellison for her extraordinarily effective research assistance throughout the project. The opinions expressed herein are those of the author and do not necessarily represent the views of the U.S. government or any other entity. <https://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?article=3215&context=facpub> TJHSSTAD

V. PROPOSED SECURITY COUNCIL RESOLUTION What follows is a candidate Security Council resolution, together with annotations that cite the precedents and origins of some of the passages and explain the drafter's options and choices. It is styled as a resolution that could be adopted today, but it attempts to deal with future contingencies that could pose either a stark emergency with worldwide consequences, or a somewhat less certain and less global catastrophe. It resolves some controversies immediately, and defers others for later development, depending upon the emerging facts and planetary defense capabilities. The Security Council,'82 note 37, at 317; Douglas Birch, The Plans to Use Nuclear Weapons to Blow Up Incoming Asteroids, ATLANTIC (Oct. 16, 2013) (reporting concerns that the concept of using a nuclear device against an asteroid might have been driven by a post-cold war need to find useful employment for U.S. nuclear weapons laboratories). 181 See Hickman, supra note 138 (arguing that the OST has disincentivized exploration of space, by restricting sovereign claims). See also U.S. Gov'T ACCOUNTABILITY OFF., GAO-14-449, NUCLEAR WEAPONS: ACTIONS NEEDED BY NNSA To CLARIFY DISMANTLEMENT PERFORMANCE GOAL 40-41 (Apr. 2014) (reporting that the U.S. government is delaying the dismantlement of excess nuclear weapons, in order to retain some for possible use in planetary defense). 182 The paragraphs of the preamble of a Security Council resolution are not traditionally 142 Exoatmospheric Plowshares: Using a Nuclear Explosive Device for Planetary Defense Against an Incoming Asteroid 143 1. Aware of the grave dangers to humanity posed by potentially hazardous near-Earth objects (NEOs), which carry the possibility of inflicting devastating damage upon localities, regions, and the entire planet, irrespective of national borders, 183 2. Commending the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) for their contributions in research, consciousness-raising, and organizing national and collective responses to the severe problems,18 4 3. Deeply concerned about the need to prepare for a potential catastrophe of unprecedented scope and scale and to take extraordinary measures now and in the future, possibly at sudden, unforeseeable times,8 4. Convinced that a coordinated, international effort will enable the most effective response to a NEO danger,' 86 5. Strongly endorsing the continued critical importance and vitality 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 of 1967 (Outer Space Treaty), the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water of 1963 (Limited Test Ban Treaty), the Treaty on the Non-Proliferation of Nuclear Weapons of 1968 (Non-Proliferation Treaty), and other relevant international instruments, 187 numbered, but here numbers have been inserted for ease of reference. 183 This resolution would be adopted today, when there is no potentially hazardous NEO on the horizon, but with the understanding that such a danger could be detected at any time, possibly with little advance warning before impact. The concept is that today's action by the Security Council would set the stage for later, more definitive action in a genuine crisis. 184 lAWN and SMPAG were acknowledged in G.A. Res. 68/75, ¶ 8 (Dec. 11, 2013), but were not there identified by name; this resolution would be the first explicit endorsement of those entities by the Security Council and would elevate their recognition. 15 This resolution is somewhat unusual in seeking to deal prospectively with a serious problem that has not yet ripened; the Security Council would be recognizing that considerable additional advance planning and preparation would be necessary to deal with the eventuality of a hazardous NEO. 1" A critical component of the resolution is the acknowledgement of the importance of the global nature of the necessary response. Although only a handful of states will be in a position to participate directly in a space mission to intercept and divert or destroy an incoming large NEO, all states will have a stake in the activity and different types of contributions may be required from each. 17 Here, the Security Council would underscore the importance of the OST, LTBT, and NPT, as well as other unnamed relevant international law instruments (such as those establishing regional nuclear-weapon-free zones) and the continuing commitment to their viability. The 23 UCLA J. INT'L L. & FOR. AFF. (2019) 6. Recognizing that traditional international legal and political instruments and arrangements may not be sufficient to enable an effective response to a large NEO," 7. Mindful of its primary responsibility under the Charter of the United Nations for the maintenance of international peace and security, especially in the face of novel and emerging global threats, 8 9 8. Acting under Chapter VII of the Charter of the United Nations, 90 1. Determines that a large NEO on a collision course with Earth would constitute a threat to international peace and security, demanding a response that is timely, effective, and global;' 9 2. Decides to take action, and to authorize member states to take action, now and in the future, to anticipate and respond to this threat;1 92 3. Anticipates that the Security Council will be prepared, as appropriate, to authorize and require member states to use all necessary measures to resolution could also call out the Liability Convention, supra note 64, and other components of space law. 188 In partial contrast to preambular paragraph 5, the point here is that existing international law instruments, for all their value, may not enable a sufficient, timely response to an incoming NEO, so the current legal rights and responsibilities may need to be augmented, modified or suspended. 189 This paragraph constitutes the Security Council's recognition of its special responsibilities for dealing with global threats to the peace, including previously-unacknowledged dangers such as NEOs. See U.N. Charter, supra note 2, art. 24. 190 This expression invokes the special powers of the Security Council pursuant to Chapter VII of the UN Charter, the source of its authority to establish binding rules for UN member states. See id. arts. 25, 39, 48. As noted, supra note 172, the Security Council might elect to proceed first via its Chapter VI powers, and exercise Chapter VII only when the threatening NEO is detected. 191 This paragraph is one of the most important and precedent-setting passages of the proposed resolution. It echoes the first preambular paragraph and translates it into operational text. A "determination" that something constitutes a "threat to the peace" is the formal predicate for the Security Council to exercise its Chapter VII powers. See id. art. 39. The Security Council has never previously determined that anything like an asteroid constitutes a threat to the peace, but it would be within the Security Council's power to expand its precedents in this way. See supra text accompanying notes 165-68 (describing prior Security Council practice in the exercise of Chapter VII). 192 Some of the relevant actions in response to the NEO threat will be undertaken by the Security Council itself; in addition, the Security Council will authorize states to undertake some actions and could in the future order states to undertake some actions, some of which might be inconsistent with other pre -existing legal obligations. 144 Exoatmospheric Plowshares: Using a Nuclear Explosive Device for Planetary Defense Against an Incoming Asteroid 145 respond to the NEO threat;' 93 4. Understands that a future notification about a NEO danger might provide only a short warning time, and could be accompanied by considerable uncertainty regarding whether and where the object might strike Earth, and regarding the scale of the damage the object might inflict, and concluding that this uncertainty should not delay or preclude effective action; 1 94 5. Seeks to promote the development of enhanced capabilities for detecting and responding to NEO dangers in a timely, effective fashion; 195 6. Calls upon IAWN and its participants to redouble their efforts, individually and in concert, to further develop the data base of NEOs by discovering, characterizing, tracking, and monitoring the population, to disseminate and coordinate relevant information in a timely fashion, to alert the world community to incipient dangers, and to coordinate campaigns for closer inspection of key celestial bodies;1 96 193 The phrase "all necessary measures" (or "means") has become the critical term for authorizing the use of military force. See, e.g., S.C. Res. 1973 (Mar. 17, 2011) (authorizing states to take "all necessary measures" to protect civilians in Libya; S.C. Res. 678 (Nov. 29, 1990) (dealing with Iraq's invasion of Kuwait). In this resolution, the Security Council is not yet taking that step, but is indicating its willingness to do so promptly in the future, should circumstances warrant. 194 This paragraph reflects the persistent uncertainties about the amount of advance warning that might be available prior to a NEO strike; about the possibly large and persistent "error ellipse" in mapping where the NEO might hit; and about the characteristics of the NEO (e.g., size, composition) that will affect whether it will inflict damage of a local, regional, or global character. Nonetheless, as an exercise of the precautionary principle, the Security Council will not allow the incompleteness of available information to block or delay protective action. See supra note 63 (discussing the precautionary principle). 195 This paragraph constitutes one of the core elements of the resolution: the effort to spur greater activity toward earlier, more accurate detection, tracking and characterization of NEO threats, and toward enhanced capabilities for remediating the dangers. The existing inventory of NEOs is reasonably complete (but not yet perfect) for the biggest NEOs (i.e., objects larger than about 1 km in diameter), but it is far less adequate for smaller objects that could still inflict great damage. See supra text accompanying notes 23-24 (describing the current catalog of NEOs). 196 IAWN is a loose confederation or a virtual network of national space agencies, nongovernmental entities, and other actors, rather than of states; it has little established infrastructure, but serves as a clearinghouse for information and as a coordinator of diverse actions. See supra text accompanying note 45 (describing IAWN). Note that this resolution does not separately address the activities of private commercial actors in space, including the incipient interest in mining asteroids to recover valuable minerals. See generally New NASA Mission to Help Us Learn How to Mine Asteroids, NAT' L AERONAUTICS & SPACE ADMIN. (Aug. 8, 2013), https://www.nasa.gov/content/goddard/new-nasa-mission-to-help-us-learn-how-to- 23 UCLA J. INT'L L. & FOR. AFF. (2019) 7. Calls upon SMPAG and its participants to likewise redouble their efforts, individually and in concert, to develop the technologies, tools, and techniques that would be necessary to mitigate the dangers of a NEO, including evaluating and recommending options for timely diverting or destroying it;197 8. Calls upon each member state to disseminate in a timely and comprehensive fashion any information it obtains regarding NEO dangers, taking care to ensure that the information can be understood accurately and without inducing panic;198 9. Calls upon all member states to assist, cooperate with, and support planetary defense activities to the best of their abilities, pursuant to their common but differentiated responsibilities;199 mine-asteroids [http://perma.cc/RY4B-CYNQ]; Providing Resources to Fuel Industry and Sustain Life in Space, PLANETARY RESOURCES, https://www.planetaryresources.com/ [http://perma.cc/B4HP-C2EN ] (last visited Sept. 20, 2018) (private corporation interested in mining celestial bodies); Andrew Wong, Space Mining Could Become a Real Thing - and It CouldBe Worth Trillions, CNBC (May 15, 2018), https://www.cnbc.com/2018/05/15/miningasteroids -could-be-worth-trillions -of-dollars.html [http://perma.cc/CB5B-W2ET]. See supra note 143 (discussing each state's responsibility under OST art. VI for the space activities of its nationals). 197 Like IAWN, SMPAG has few resources of its own; it functions to share information more effectively among its participating entities and to coordinate their individual activities. See supra text accompanying notes 46-48. (describing SMPAG). In this paragraph, the Security Council might decide to instruct that SMPAG should concentrate specifically on developing the array of non-nuclear planetary defense options; in the present version, that limitation is not included. 198 Existing international law does not include a direct, comprehensive obligation for states to share information they may obtain regarding NEO dangers; this paragraph of the resolution calls upon them to do so, but does not constitute a legal requirement. See OST, supra note 3, arts. I, XI. There is, of course, a grave danger that any public notification about an incoming NEO could be subject to exaggeration and distortion, generating panic, but this resolution proposes to disclose the information fully and to try to manage the resulting public reactions, rather than to try to maintain secrecy. 199 In a Security Council resolution, the phrase "calls upon" is generally understood not to create a binding legal obligation because either the term is non-legally-binding or it is ambiguous enough that it would not be the chosen language of drafters who were endeavoring to create a legal obligation; in contrast, use of verbs such as "demands" or "decides" connotes a legallybinding responsibility. James D. Fry, Dionysian Disarmament: Security Council WMD Coercive Disarmament Measures and Their Legal Implications, 29 Mich. J. Int'l L. 197, 229- 32 (2008); see also STEPHEN P. MULLIGAN, CONG. RESEARCH SERV., WITHDRAWAL FROM THE IRAN NUCLEAR DEAL: LEGAL AUTHORITIES AND IMPLICATIONS (May 17, 2018), https://fas.org/sgp/crs/nuke/LSB 101 34.pdf [https://perma.cc/A4W8-2BXJ]. Here, the paragraph establishes a general call for support for planetary defense efforts, rather than any 146 Exoatmospheric Plowshares: Using a Nuclear Explosive Device for Planetary Defense Against an Incoming Asteroid 147 10. Strongly urges member states urgently to expand their efforts and to devote additional resources to develop NEO mitigation technologies, tools, and techniques and to accelerate their flight testing to improve the ability to alter a NEO's trajectory under increasingly realistic and stressful conditions, consistent with their respective treaty obligations;2 00 11. Stands ready, upon the request from a member state, to authorize, if essential to a planetary defense test or mission, the testing of a non-nuclear weapon against a celestial body, notwithstanding article IV of the Outer Space Treaty, pursuant to article 103 of the Charter of the United Nations;20 specific commitment to a particular measure. But see Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) Notwithstanding Security Council Resolution 276 (1970), Advisory Opinion, 1971 IC.J. Rep. 16, ¶ 108-116 (June 21) (ICJ finds that a Security Council Chapter VII resolution that only "calls upon" states to act can impose a legally binding duty). The phrase "common but differentiated responsibilities" is drawn from international environmental law, where states' resources and other circumstances enable them to provide very different types of support to global undertakings, but all states should participate in some way. See United Nations Framework Convention on Climate Change art. 3.1, May 9, 1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S. 107; Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC), CLIMATENEXUS, https://climatenexus.org/climate-change-news/common-but-differentiated-responsibilitiesand-respective-capabilities-cbdr-rc/\_[http://perma.cc/LT6X-K223] (last visited Sept. 20, 2018); CTR. FOR INT'L SUSTAINABLE DEV. (CISDL), THE PRINCIPLE OF COMMON BUT DIFFERENTIATED RESPONSBILITIES: ORIGINS AND SCOPE (2002). 200 This paragraph of the resolution presses states to devote more urgency to the planetary defense mission, by increasing the tempo of their space activities to counteract NEOs and devoting additional resources to the task. In this version, the resolution concentrates on efforts to divert an asteroid; it could also stress the possibility of destrovin2 the asteroid if changing its trajectory proves impossible. See supra text accompanying note 38 (discussing the advantages and disadvantages of fracturing an incoming asteroid). In addition, the resolution might address terrestrial efforts to abate the effects of a NEO strike, such as via sheltering in place, emergency evacuation of the area to be affected, the training of first responders, the pre-positioning of relief supplies, etc., but those land-based routines are largely outside the scope of this Article. This paragraph contemplates that the global effort to improve asteroid-deflection capabilities might require a protracted campaign over many years, perhaps starting with relatively small space objects and working up toward an ability to manipulate larger, more difficult NEOs. It would be premature, at this point, for the Security Council to designate any particular state(s) to prepare for or undertake a planetary defense mission, since there is no known threat and little in situ capability. See supra text accompanying notes 53-61 (describing potential concepts for planetary defense technologies). 201 OST art. IV, para. 2 forbids "the testing of any type of weapons" on celestial bodies. OST, supra note 3, art. IV., para 2. It is possible that some planetary defense missions could necessitate the use of explosives or other devices that could be construed as weapons, so this provision might have to be abated. See supra note 101 (regarding testing of non-nuclear 23 UCLA J. INT'L L. & FOR. AFF. (2019) 12. Stands ready, in anticipation of a possible future NEO emergency, to convene immediately, to authorize and require particular member states to plan, prepare, and undertake a planetary defense space mission, and to authorize and require other member states to participate in, contribute to, and support the mission as appropriate;202 13. Declares its readiness, in the event of future meetings addressing a NEO threat, to invite affected member states, particularly those likely to be affected by the impact and those capable of contributing to mitigation efforts, to participate in the Security Council's deliberations;203 14. Contemplates that in some future extreme circumstances, it might be necessary to employ a nuclear explosive device as a last resort for a planetary defense mission, and in this connection declares:20 4 weapons on a celestial body). Under article 103 of the UN Charter, in the event of a conflict between a member state's obligations under the Charter and its obligations under any other international agreement, the Charter shall prevail. See U.N. Charter, supra note 2, art. 103. The Security Council, in the exercise of its Chapter VII powers, could therefore create an obligation under the Charter that would over-rule the OST. In this proposed resolution, the Security Council would not currently derogate from the OST provision, but would express its willingness to do so, if a state indicated that testing of a weapon on a celestial body was essential for the development of an effective planetary defense capability. In this paragraph, the scenario is confined to the testing of non-nuclear weapons. See supra text accompanying notes 60-61 and 91-101 (describing explosive interceptors for planetary defense and discussing the definition of a weapon respectively). 202 The Security Council is structured to be able to function continuously and it can convene at very short notice to deal with emergencies. U.N. Charter, supra note 2, art. 28. Another option here would be for the Security Council to create a committee to deal with NEO issues on a daily basis, rather than bringing every aspect to the attention of the full Security Council itself. See, e.g., S.C. Res. 1540 (Apr. 28, 2004) (creating a committee to monitor the proliferation of weapons of mass destruction and implement Security Council measures); S.C. Res. 1718, ¶ 12 (Oct. 14, 2006) (establishing a committee to implement sanctions on North Korea); S.C. Res. 1373 (Sept. 28, 2001) (the Counter-Terrorism Committee). In any event, there is always the potential problem of the veto power, as any of the five permanent member states can block action. Supra text accompanying notes 169-71 (discussing the problematic features of the Security Council). 203 Pursuant to article 31 of the UN Charter, the Security Council may invite any member state to participate in its discussions, without the right to vote, when the interests of that state are specially affected. U.N. Charter, supra note 2, art. 31. This could implicate many states, so each may have only limited participation, but the opportunity to hear from multiple stakeholders could be beneficial. It is also possible that the UN General Assembly, in which all member states are voting members, may also convene to discuss the NEO danger. 204 In this resolution, the Security Council is not yet authorizing the use of a nuclear explosive device against an asteroid; that would be premature. But it is signaling its awareness that such a scenario might emerge, potentially on short notice, and its willingness to engage on an 148 Exoatmospheric Plowshares: Using a Nuclear Explosive Device for Planetary Defense Against an Incoming Asteroid 149 a. that the Outer Space Treaty, the Limited Test Ban Treaty, the Nuclear Non-Proliferation Treaty and other relevant nuclear arms control agreements are of utmost importance, and all parties shall comply with their provisions;205 b. that the current moratoria against the conduct of any nuclear weapon test explosions or any other nuclear explosions should be continued;206 c. that the Security Council will be prepared, in the event of an anticipated global catastrophe caused by a NEO that cannot be diverted in any other way, to consider the possibility of superseding the relevant treaty provisions, in order to enable one or more member states to be designated to carry out the necessary planetary defense mission and to enable other member states to assist, participate in, and support that mission, notwithstanding any other treaty commitments, pursuant to article 103 of the Charter of the United Nations;207 and expedited basis at that time. It is possible that the Security Council would be called upon to adopt a series of increasingly-specific Chapter VII resolutions, as the emerging facts about an incoming asteroid become clearer. 205 This resolution does not derogate in any way from the existing treaty obligations regarding nuclear arms control, but signals the Security Council's willingness to consider that action, should a NEO emergency require it. 206 No state other than North Korea has tested a nuclear weapon since 1998. See Daryl Kimball, The Nuclear Testing Tally, ARMS CONTROL Ass'N, https://www.armscontrol.org/factsheets/nucleartesttally [http://perma.cc/TJ4Q-PHYZ] (last updated Sept. 3, 2017). The permanent members of the Security Council have declared that a nuclear explosion by any state would constitute a violation of the object and purpose of the CTBT, prior to that treaty's entry into force. See supra note 115 (regarding the CTBT). 207 In this resolution, the Security Council contemplates "superseding" the operation of the relevant treaties, by enacting a Chapter VII resolution that would displace selected elements of the treaty as the governing rule of law, pursuant to UN Charter art. 103. See U.N. Charter, supra note 2, art. 103. In so doing, the Security Council does not "amend" or "suspend" those treaties, but establishes a superior rule governing the behavior of states. This procedure would avoid the alternatives of utilizing those treaties' provisions regarding amendment or withdrawal. See supra text accompanying notes 133-35 and 137-41 (regarding amendment and withdrawal provisions respectively). For the states carrying out a nuclear planetary defense mission, the central elements of those agreements would be at stake; for the other states participating in or supporting the operation, the relevant treaty provisions would include those regarding assisting, encouraging, or inducing actions that would be in violation of the particular treaty. When the time for a planetary defense mission arises, the Security Council would likely designate the particular state(s) to conduct the mission and specify supporting roles for others (or delegate to the leading state(s) the task of lining up the other participant(s)). It is possible that a single state, such as the United States, would undertake the entire mission, but it is more likely that an international coalition would be assembled, as reflected in preambular para. 4. 23 UCLA J. INT'L L. & FOR. AFF. (2019) d. that if a nuclear explosive device is deployed for a planetary defense mission, it shall remain at all times under the jurisdiction and control of a member state that is legally permitted to possess such a device, and that other member states may participate in the mission in a way that respects their respective legal obligations;208 15. Declares its resolve to monitor closely the problem of NEOs and to receive regular reports on this topic from the Committee on the Peaceful Uses of Outer Space and other relevant bodies;2 09 and 16. Decides to remain actively seized of the issue.210

#### **Nukes are key to deflect big and close asteroids.**

Green 19 James A. Green, Planetary Defense: Near-Earth Objects, Nuclear Weapons, and International Law, 42 HastingsInt'l & Comp.L. Rev. 1 (2019). Available at: <https://repository.uchastings.edu/hastings_international_comparative_law_review/vol42/iss1/2> TJHSSTAD

* plan is competitive – Russia, U.S., and U.N. all investing in it now

Crucially, however, “in recent years, advocates of the use of nuclear weapons . . . have been gaining ground.”94 Many experts in relevant fields increasingly argue that nuclear explosive technology represents the most effective, and perhaps in certain situations the only, option humanity may have for responding to extreme NEO impact scenarios. In March 2007, for 89. See Jet Propulsion Laboratory, National Aeronautics and Space Administration, This is a Test: Asteroid Tracking Network Observes Close Approach, Oct. 10, 2017, https:// www.jpl.nasa.gov/news/news.php?feature=6969. 90. See Asteroid Impact and Deflection Assessment (AIDA) Mission, NATN’L AERONAUTICS & SPACE ADMIN., https://www.nasa.gov/planetarydefense/aida. 91. Id. 92. Id.; Cheng et al., supra note 87, at 262. 93. For discussion of proposed non-nuclear options, see Joseph Packer, Jeffrey A. Kurr & Adam Abelkop, The Policy Trajectory of United States Asteroid Deflection Planning, 1 TIMELY INTERVENTIONS: TRANSNAT’L J. PUB. POL’Y DEBATE 1, 4 (2013); H. J. Melosh, I. V. Nemchinov & Yu I. Zetzer, Non-Nuclear Strategies for Deflecting Comets and Asteroids, in HAZARDS DUE TO ASTEROIDS AND COMETS 1111 (Tom Gehrels ed. 1994). 94. Douglas Birch, The Plans to Use Nuclear Weapons to Blow up Incoming Asteroids, ATLANTIC, Oct. 16, 2013, https://www.theatlantic.com/technology/archive/2013/10/theplans-to-use-nuclear-weapons-to-blow-up-incoming-asteroids/280593. 2019] Planetary Defense: Near-Earth Objects, Nuclear Weapons, and International Law 19 example, NASA delivered a report to the U.S. Congress setting out the findings of an extensive survey of alternatives; a key conclusion in that report was that “[n]uclear standoff explosions [i.e., explosions near to an NEO as a means of diverting it] are assessed to be 10-100 times more effective than . . . non-nuclear alternatives.”95 Given the likelihood of any NEO interception mission being both time and resource96 constrained, nuclear devices also represent by far the most mass-efficient means of transporting large amounts of energy across long distances.97 Those who support the use of nuclear explosions for planetary defense do not argue that they will be suitable in all circumstances,98 stressing that this approach should be reserved as a last resort in extreme cases.99 For some potentially hazardous NEOs, non-nuclear options will be scientifically preferable (leaving aside, at this juncture, questions of politics and law).100 However, nuclear explosions particularly have been supported in relation to two circumstances: where the NEO is 1) especially large; or 2) especially close.101 Where the NEO is especially large, it has been claimed that diverting (or perhaps destroying) it by non-nuclear means is likely to be extremely difficult or impossible given the level of kinetic energy required. Writing in the hugely influential journal Nature in 1992, Ahrens and Harris concluded that “for larger objects [NEOs in the 1–10km diameter range] nuclear explosions seem to be the only practical means of deflection.”102 More than 20 years later, in 2013, Syal et al. made the same assertion: “At present, 95. Center for Near Earth Object Studies, Near-Earth Object Survey and Deflection Analysis of Alternatives: Report to Congress, NATN’L AERONAUTICS & SPACE ADMIN. 2 (March 2007) (emphasis added). See also Bong Wie, Hypervelocity Nuclear Interceptors for Asteroid Disruption, 90 ACTA ASTRONAUTICA 146, 151 (2013) (“… a nuclear explosion is much more effective than any other non-nuclear alternative …”). 96. Legal Aspects of NEO Threat Response, supra note 8, 33 (noting that cost is “a major aspect of … NEO mitigation campaigns …”). 97. Id.; National Research Council, supra note 74, 76; YEOMANS, supra note 3, at 146. 98. See generally Kaplinger, Wie & Dearborn, supra note 43, at 104. 99. See, e.g., National Research Council, supra note 74, particularly 4, 79; Packer, Kurr, & Abelkop, supra note 93, at 2; YEOMANS, supra note 3, at 148; Legal Aspects of NEO Threat Response, supra note 8, at 25. 100. See Megan Bruck Syal, J. Michael Owen & Paul L. Miller, Deflection by Kinetic Impact: Sensitivity to Asteroid Properties, 269 ICARUS 50 (2016) (specifically discussing kinetic non-nuclear approaches). 101. See, e.g., National Research Council, supra note 74, 78; Bucknam & Gold, supra note 80, at 149; Wie, supra note 95, at 151; Legal Aspects of NEO Threat Response, supra note 8, at 25. 102. Ahrens & Harris, supra note 75, at 429 (emphasis added). 20 Hastings Int’l & Comp. L. Rev. [Vol. 42:1 nuclear munitions are the only available technology capable of deflecting large bodies [NEOs exceeding 500m in diameter].”103 Similarly, a nuclear approach has been said to be necessary in cases where the NEO is especially close to Earth when it is detected.104 It has been argued that all of the proposed non-nuclear methods would require a substantial lead time (over 10 years, and in some cases much longer),105 or at least that non-nuclear methods involving “low energy” diversion/destruction of a “close” NEO would create significant amounts of potentially harmful debris.106 Whereas it has been argued that the “high energy” use of nuclear explosions “may substantially reduce the amount of mass remaining on impact trajectories”107 and could be employed in a much shorter timeframe.108 E. State-Level Support for Nuclear Approaches Reflecting what now seemingly is the majority view in the scientific research, states (at least the major players) have focused particularly on developing nuclear methods of NEO diversion over the last five to ten years. In the U.S., NASA has begun to receive heavy investment for research into nuclear approaches, and a series of big-money grants have been awarded to researchers at American universities and institutes to fund parallel work.109 Russia has also increased its focus on the nuclear option. From 2012-2015, for example, Russia’s federal space agency led the strand of the EU-funded NEOShield project110 that was aimed specifically at further developing viable nuclear explosive ways of diverting large NEOs.111 103. Syal, Dearborn & Schultz, supra note 79, at 103 (emphasis added). See also Gerrard & Barber, supra note 12, at 10; Su, Measures Proposed for Planetary Defence, supra note 12, at 2; Brooks, supra note 12, at 242, 246; National Research Council, supra note 74, 79. 104. See, e.g., National Research Council, supra note 74, at 76. 105. Wie, supra note 95, at 146. 106. Sanchez, Vasile & Radice, supra note 79. 107. Kaplinger, Wie & Dearborn, supra note 86, at 156. 108. Id. at 156 (“This method could be available with as little as 10 days of lead time between intercept and the predicted impact date.”). 109. Birch, supra note 94. 110. See supra note 62 and accompanying text. 111. Roland Oliphant, EU, Russia may Nuke Asteroids, THE TELEGRAPH, Jan. 17, 2016, https://www.telegraph.co.uk/news/worldnews/europe/russia/12103720/EU-Russia-may- 2019] Planetary Defense: Near-Earth Objects, Nuclear Weapons, and International Law 21 Of especial note is the fact that the U.S. and Russia have explored the possibility of collaborating on nuclear approaches to NEO response. In 2013, the two states concluded a wide-ranging, open-ended nuclear cooperation agreement,112 and, while that agreement did not explicitly reference nuclear planetary defense, the accompanying release statement from the U.S. Department of Energy confirmed that a key project envisaged as falling under the auspices of Article III of the agreement was for the U.S. and Russia to work together on “defense from asteroids” by nuclear means.113 The 2013 agreement was suspended by Russia in 2016 due to increased tensions between the states (primarily in relation to Crimea).114 Nonetheless, given the shared history of the U.S. and Russia when it comes to nuclear weapons, the very fact that they seriously have explored the possibility of collaborating on nuclear planetary defense initiatives, to the point of taking steps to formalize this as an aspect of a cooperative agreement, shows how prominent the nuclear approach to NEO response has become for both states. At the global institutional level too, it is notable that the new UN mandated body SMPAG listed, in its October 2016 work plan, the “study of the nuclear device option” as a key future activity for the group. Indeed, from a review of the full work plan, this is an activity that seems to have been given rather more prominence on SMPAG’s agenda than parallel work relating to non-nuclear alternatives.115 nuke-asteroids.html (citing a press release from Russia’s federal space agency); John Hall, Nuclear Weapons Could be Used to Blow Up Asteroids if They Threaten the Earth, Scientists Reveal, INTERNATIONAL BUSINESS TIMES, Jan. 17, 2016, https://www.ibtimes. co.uk/nuclear-weapons-could-be-used-blow-asteroids-if-they-threaten-earth-scientists-reve al-1538425. 112. Agreement between the Government of the United States of America and the Government of the Russian Federation on Cooperation in Nuclear- and Energy-Related Scientific Research and Development (United States-Russia Nuclear Research Agreement) (2013), http://fissilematerials.org/library/u-s-department-of-energy-agreement-with-rosatom. pdf. 113. United States, Russia Sign Agreement to Further Research and Development Collaboration in Nuclear Energy and Security, United States Department of Energy, Sept. 16, 2013, https://energy.gov/articles/united-states-russia-sign-agreement-further-researchand-development-collaboration-nuclear. 114. See Suspending the Russian-US Agreement on Cooperation in Nuclear- and Energy-Related Scientific Research and Development, The Russian Government, Government Decisions, Orders and Directives, Oct. 5, 2016, http://special.government. ru/en/docs/24766. 115. U.N. Office for Outer Space Affairs, Space Mission Planning Advisory Group, Work Plan, Document No. SMPAG—PL-001/1.2, 19–20 (Oct. 2016). 22 Hastings Int’l & Comp. L. Rev. [Vol. 42:1 Overall, nuclear options clearly have received significant increased support, in relation at least to the most extreme NEO threat scenarios, across the research community, some of the major state players, and at the inter-state level. Not only is NEO preparedness now truly on the global agenda for the first time, but the nuclear method of implementing it in particular is too.

#### Asteroids cause global suffering and turn nuke war – simulations prove.

Baum 19 Seth Baum, “Risk-Risk Tradeoff Analysis of Nuclear Explosives for Asteroid Deflection,” SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, May 31, 2019), <https://papers.ssrn.com/abstract=3397559>. TJHSSTAD

The most severe asteroid collisions and nuclear wars can cause global environmental effects. The core mechanism is the transport of particulate matter into the stratosphere, where it can spread worldwide and remain aloft for years or decades. Large asteroid collisions create large quantities of dust and large fireballs; the fire heats the dust so that some portion of it rises into the stratosphere. The largest collisions, such as the 10km Chicxulub impactor, can also eject debris from the collision site into space; upon reentry into the atmosphere, the debris heats up enough to spark global fires (Toon, Zahnle, Morrison, Turco, & Covey, 1997). The fires are a major impact in their own right and can send additional smoke into the stratosphere. For nuclear explosions, there is also a fireball and smoke, in this case from the burning of cities or other military targets. While in the stratosphere, the particulate matter blocks sunlight and destroys ozone (Toon et al., 2007). The ozone loss increases the amount of ultraviolet radiation reaching the surface, causing skin cancer and other harms (Mills, Toon, Turco, Kinnison, & Garcia, 2008). The blocked sunlight causes abrupt cooling of Earth’s surface and in turn reduced precipitation due to a weakened hydrological cycle. The cool, dry, and dark conditions reduce plant growth. Recent studies use modern climate and crop models to examine the effects for a hypothetical IndiaPakistan nuclear war scenario with 100 weapons (50 per side) each of 15KT yield. The studies find agriculture declines in the range of approximately 2% to 50% depending on the crop and location.11 Another study compares the crop data to existing poverty and malnourishment and estimates that the crop declines could threaten starvation for two billion people (Helfand, 2013). However, the aforementioned studies do not account for new nuclear explosion fire simulations that find approximately five times less particulate matter reaching the stratosphere, and correspondingly weaker global environmental effects (Reisner et al., 2018). Note also that the 100 weapon scenario used in these studies is not the largest potential scenario. Larger nuclear wars and large asteroid collisions could cause greater harm. The largest asteroid collisions could even reduce sunlight below the minimum needed for vision (Toon et al., 1997). Asteroid risk analyses have proposed that the global environmental disruption from large collisions could cause one billion deaths (NRC, 2010) or the death of 25% of all humans (Chapman, 2004; Chapman & Morrison, 1994; Morrison, 1992), though these figures have not been rigorously justified (Baum, 2018a). The harms from asteroid collisions and nuclear wars can also include important secondary effects. The food shortages from severe global environmental disruption could lead to infectious disease outbreaks as public health conditions deteriorate (Helfand, 2013). Law and order could be lost in at least some locations as people struggle for survival (Maher & Baum, 2013). Today’s complex global political-economic system already shows fragility to shocks such as the 2007- 2008 financial crisis (Centeno, Nag, Patterson, Shaver, & Windawi, 2015); an asteroid collision or nuclear war could be an extremely large shock. The systemic consequences of a nuclear war would be further worsened by the likely loss of major world cities that serve as important hubs in the global economy. Even a single detonation in nuclear terrorism would have ripple effects across the global political-economic system (similar to, but likely larger than, the response prompted by the terrorist attacks of 11 September 2001). It is possible for asteroid collisions to cause nuclear war. An asteroid explosion could be misinterpreted as a nuclear attack, prompting nuclear attack that is believed to be retaliation. For example, the 2013 Chelyabinsk event occurred near an important Russian military installation, prompting concerns about the event’s interpretation (Harris et al., 2015). The ultimate severity of an asteroid collision or violent nuclear conflict use would depend on how human society reacts. Would the reaction be disciplined and constructive: bury the dead, heal the sick, feed the hungry, and rebuild all that has fallen? Or would the reaction be disorderly and destructive: leave the rubble in place, fight for scarce resources, and descend into minimalist tribalism or worse? Prior studies have identified some key issues, including the viability of trade (Cantor, Henry, & Rayner, 1989) and the self-sufficiency of local communities (Maher & Baum, 2013). However, the issue has received little research attention and remains poorly understood. This leaves considerable uncertainty in the total human harm from an asteroid collision or nuclear weapons use. Previously published point estimates of the human consequences of asteroid collisions12 and nuclear wars (Helfand, 2013) do not account for this uncertainty and are likely to be inaccurate. Of particular importance are the consequences for future generations, which could vastly outnumber the present generation. If an asteroid collision or nuclear war would cause human extinction, then there would be no future generations. Alternatively, if survivors fail to recover a large population and advanced technological civilization, then future generations would be permanently diminished.

### 2NR O/V

### A2 No Threat

#### Literally tens of thousands of asteroids that pose a huge threat to humanity

Martin 1/13 Express. Asteroid warning: Millions of ‘nuclear bomb-like’ asteroids threaten Earth EARTH is under threat from tens of million of asteroids which have the power to explode on our planet with the power of a nuclear bomb, scientists have warned. By SEAN MARTIN PUBLISHED: 10:17, Mon, Jan 13, 2020 | UPDATED: 16:03, Mon, Jan 13, 2020 4

Asteroid impact: Global aftermath outlined by expert CLOSE Pause Unmute Current Time 0:09 / Duration 1:06 Facebook Twitter Share Fullscreen UP NEXT:George Galloway: Scotland re-joining EU would be ‘catastrophic’ Asteroids remain one of the major threats to humanity which could wipe out a civilisation in an instant – and experts have said there are tens of millions which are yet to be discovered. If these space rocks are not found, they could pose a risk to Earth as experts claimed anything larger than 10 metres could explode on our planet with the power of a nuclear bomb. The team behind Asteroid Day – an awareness day which falls on June 30 each year – has said that just 21,443 asteroids which pose a huge threat to humanity have been discovered. RELATED ARTICLES Asteroid alert: Do something NOW before ‘delay becomes fatal’ NASA astronaut reveals shock at close encounter in Apollo mission While this number seems large, there are tens of millions of near Earth objects (NEOs) in the solar system alone which have yet to be found and have the potential to cause large scale destruction on our planet. A statement from the Asteroid Day organisers, which includes Dr Holger Sierks, principal investigator Rosetta/OSIRIS and Dr Patrick Michel, AIDA/Hera principal investigator, read: “There are several tens of millions of NEOs larger than 10 meters in size that would have an energy larger than a small nuclear weapon if they entered the Earth’s atmosphere, and we have identified just 21,443, as of 5th November, 2019. “These bodies are leftover matter from the formation of planets and range in size from a few meters to tens of kilometres. PROMOTED STORY Field Maintenance - A Comparison Between On-site And Depot Repairs Many businesses in many different industry sectors have difficult... (Mercom Repair) “As with Earth, NEOs orbit the Sun and sometimes they come dangerously close or cross Earth’s trajectory – potentially causing impacts. asteroid bomb Asteroid warning: Millions of ‘nuclear bomb-like’ asteroids threaten Earth (Image: GETTY) asteroids Tens of millions of asteroids threaten Earth (Image: GETTY) “This has happened several times in the past and one day it will happen again.” The team is now calling on more protection for our planet, and said that the likes of the joint ESA and NASA project AIDA (Asteroid Impact and Deflection Assessment) are a good start. The statement added: “Unlike other natural disasters, an asteroid impact with Earth is not only one we know how to predict but one we can also prevent, by means that just need to be tested. “Today, we are the first generation of humans who have the necessary technology to try to change the trajectory of an asteroid. READ MORE: NASA almost fails to detect ANOTHER asteroid before it passes Earth asteroid “This has happened several times in the past and one day it will happen again.” (Image: GETTY) RELATED ARTICLES Scientists panic after NASA failed to pick up asteroid threat Asteroid alarm: Extreme close approach of colossal ball of rock “With early detection and increased knowledge of the properties of NEOs, we can enhance our tools and techniques under study to deflect NEOs away from Earth retiring the risk of an asteroid impact for good.” There are some other plans in the pipeline which are looking to protect Earth from asteroids. NASA is currently studying Asteroid Bennu, where its OSIRIS-Rex spacecraft arrived last year. Part of the reason NASA is sending the OSIRIS-Rex spacecraft there is to gather more information about the space rock which is 500 metres in length. NASA fears that the asteroid, which has the potential to wipe out a country on Earth, could hit our planet within the next 120 years, with the next close flyby in 2135.

#### **Thousands of NEOs – threat is inevitable**

Freeman 19 David Freeman, 4-29-2019, "What if a killer asteroid were headed toward Earth? NASA plans to find out this week," NBC News, https://www.nbcnews.com/mach/science/what-if-killer-asteroid-were-headed-toward-earth-nasa-plans-ncna999031

As of the start of 2019, [more than 19,000 near-Earth objects (NEOs) had been discovered](https://www.nasa.gov/planetarydefense/faq) — and 30 more are discovered each week as astronomers continue to search for them. "We've only found about one-third of NEOs large enough to cause severe regional damage, so we have a lot of work left to do," Amy Mainzer, an astronomer and asteroid expert at NASA's Jet Propulsion Laboratory in Pasadena, California, said in an email. "We need to build and operate more capable space- and ground-based telescopes, in my opinion," she added.

### A2 Illegal

### A2 Circumvention

### A2 “links to the advantage”

#### **The PIC does solve the aff – separating 10 to 20 nukes necessary for NEO protection and constructing proper international precedent will not interfere with disarmament**

Baum 15 Seth Baum, 6-16-2015, "Should nuclear devices be used to stop asteroids?," Bulletin of the Atomic Scientists, https://thebulletin.org/2015/06/should-nuclear-devices-be-used-to-stop-asteroids/ TJHSSTAD

Over the years, nuclear explosions have been proposed for a variety of pe aceful, nonmilitary purposes. More than 150 [peaceful nuclear explosions](http://www.ctbto.org/nuclear-testing/history-of-nuclear-testing/peaceful-nuclear-explosions) have been conducted, mainly by the Soviet Union. They were used for creating reservoirs, blasting away earth to make canals, and facilitating gas and oil extraction, among other purposes. The last of these occurred in 1988. Nuclear devices aren’t required to build infrastructure or extract resources. These activities can readily be done with non-nuclear technologies, hence we do not hear the construction and extraction sectors pushing for access to nuclear devices. But there is one sector in which nuclear explosions appear to be the best option available: protection from asteroids and comets, collectively known as near-Earth objects, or NEOs. The impact of an NEO hitting Earth could be catastrophic to humanity. A [2007 NASA study](http://neo.jpl.nasa.gov/neo/report2007.html) evaluated a range of options for deflecting NEOs, including conventional and nuclear explosives; kinetic impact (hitting an NEO with a non-explosive object); solar focusing (which would reflect sunlight to heat and “boil off” parts of the NEO); lasers; mass drivers (involving landing on the NEO and shooting pieces off into space); gravity tractors (objects with sufficient gravitational pull to move the NEO); tugs (which could attach to a NEO and pull it); and the “enhanced Yarkovsky” (essentially painting the NEO so that sunlight pushes it). Of all these options, the study found that “[n]uclear standoff explosions are assessed to be 10-100 times more effective than the non-nuclear alternatives analyzed in this study.” In 2014, a [US Government Accountability Office report](http://www.gao.gov/assets/670/662840.pdf) indicated that the National Nuclear Security Administration is retaining some nuclear device components “for potential use in planetary defense against earthbound asteroids.” A new article in the Bulletin’s subscription journal, “[The dilemma of nuclear energy in space](https://thebulletin.org/2015/may/dilemma-nuclear-energy-space8294),” explores this theme further. The article is written by John L. Remo, a research associate at the Harvard-Smithsonian Center for Astrophysics and the departments of Astronomy and Earth and Planetary Sciences at Harvard University. Remo notes that retaining nuclear devices for NEO protection is at odds with the goal of nuclear disarmament. He also points out that nuclear explosions in space would be prohibited by the [Comprehensive Nuclear Test Ban Treaty](http://www.ctbto.org/the-treaty/), if it comes into force, and the [Outer Space Treaty](http://www.unoosa.org/oosa/SpaceLaw/outerspt.html). The former is unambiguous in prohibiting all nuclear explosions. The latter prohibits nuclear “weapons;” one could debate whether this includes nuclear devices used for non-weapon, non-military purposes. Remo calls for rethinking these treaties in light of the NEO threat. He argues for dedicating a small stockpile of nuclear devices (no more than 10 or 20) to NEO protection. Ten or 20 nuclear devices would be insignificant compared to the thousands now held in military arsenals. While there are [campaigns to gradually reduce the number of nuclear weapons](http://www.globalzero.org/get-the-facts/timeline) in the world, it will be many years before the issue of whether to maintain an anti-NEO nuclear stockpile becomes critical. However, it is worth thinking through the dilemma now in order to be prepared when the time comes. Today the [International Campaign to Abolish Nuclear Weapons](http://www.icanw.org/why-a-ban) is calling for a new treaty to ban them, and some people argue that [the weapons are categorically immoral](http://unidir.ilpi.org/?p=247). The idea of an anti-NEO nuclear stockpile is fundamentally incompatible with both the ban effort and the moral stance—unless a distinction is made between nuclear weapons and peaceful nuclear devices. I don’t believe that nuclear devices, which include nuclear weapons, are categorically immoral. The problem is not the devices themselves but their potential consequences, which include massive humanitarian and environmental damage, though possibly also fewer wars (as in deterrence). Politically, it might be easier to simply ban all nuclear devices instead of attempting to retain some for peaceful purposes, such as NEO protection, or even beneficial military purposes, such as deterrence. In the decision over whether a small stockpile should be maintained for protection against asteroids and comets, the question is whether the reduced risk that one might crash into Earth is worth whatever harm the stockpile might cause to the political process of nuclear disarmament. The risk posed by NEOs is not zero, but it is small relative to the risk posed by nuclear weapons. A large NEO impact and a nuclear war would have similar consequences: massive initial explosions followed by severe global cooling. But NEO collisions large enough to threaten all of human civilization occur approximately once every 100,000 years. (Smaller NEO impacts are more common and less damaging.) The probability of nuclear war is harder to estimate but clearly much larger; based on current arsenals, it is reasonable to assume a rate of between once per 100 years and once per 1,000 years. So if retaining an anti-NEO nuclear stockpile would halt progress on nuclear disarmament, then we shouldn’t try to keep one. Nuclear war is too much larger of a threat. However, it may be possible to maintain a small stockpile of nuclear devices—as distinct from weapons—while continuing with disarmament. The key is to assure all stakeholders that the anti-NEO stockpile will not be used for military purposes. If any government believes otherwise, it might decide to maintain its own nuclear deterrent. If it is clear that the retained stockpile is strictly for protection from asteroids and comets, disarmament could proceed all the way down to zero. The international community could build confidence that the anti-NEO stockpile wouldn’t be used for the wrong reasons by splitting control across several major non-allied countries. For example, the devices, their delivery systems, and their launch codes could be divided among the United Nations Security Council members, including both the permanent and rotating members, such that using one would require unanimous agreement. Achieving consensus likely would be easy if a NEO threat were detected. If there is one thing that every state agrees on, it is that collision with an asteroid or comet would be bad. (The apocalyptic Islamic State is a possible exception; they should be given no role in NEO protection.) An NEO flying towards earth would present a clear global threat with no bad guys to muck up the politics. That said, achieving unanimous agreement can take time. It will thus be important to create as much time as possible to respond to the threats, for example by upgrading detection systems. Existing ones work well mainly for certain large NEOs, but there is a lot of room for improvement. At least at first glance, it does not seem that a stockpile of nuclear devices dedicated exclusively to NEO protection should interfere with the tasks of nuclear weapons control and disarmament. Given that asteroids and comets pose a significant risk of a low-probability extreme catastrophe, and given that the alternative means of deflecting them do not work as well, an anti-NEO nuclear stockpile merits serious consideration.