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The Precautionary Principle as the Law of Planetary Defense: Achieving the Mandate to Defend the Earth Against Asteroid and Comet Impacts While There is Still Time

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ARTICLES

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CONTENTS

Current legal and policy efforts to enable adequate defense against potential asteroid or comet collisions with the earth are insufficient because they are indirectly premised upon theories that require verification of a clear and imminent threat before governmental agencies can act. This Article identifies the "precautionary principle" as the preeminent law of planetary defense against

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asteroid and comet impacts. The precautionary principle requires governments to take action to prevent harm even when it is uncertain if, when, or where the harm will occur. It requires governments to implement specific frameworks for making prompt decisions, directs intergovernmental bodies to plan for the "worst case scenario," and requires planners to develop self-reinforcing standards by scheduling continuing simulations and updates to their technical guidelines. If governments institute these measures and then fail in their efforts to protect earth populations, the principle shields agencies from liability with "Good Samaritan" immunity. Finally, the precautionary principle mandates that governments coordinate the roles of all the different agencies that could foreseeably become involved in planetary protection in advance of any actual threat. The development of the Initial National Response Plan by the Department of Homeland Security and the experience of governments responding to public health issues offer further guidance to planetary defenders.

I. INTRODUCTION

Although the topic of asteroids and comets striking the earth (natural impact) has caused innumerable skeptics to roll their eyes condescendingly,[1] the public came very close to knowing the horror of an impending asteroid disaster first-hand on January 13, 2004. On the very day before President George W. Bush was expected to deliver a speech on the new American space policy, asteroid threat detection experts contemplated issuing a warning that an asteroid named 2004 AS1 could collide with the Earth within 36 hours.[2] Unlike other recent "near misses," this one prompted agencies like the National Aeronautics and Space Administration (NASA) to consider their limitations in responding to a short-notice asteroid threat and their subsequent responsibility to notify more capable operational agencies.[3] For the first time, scientists were forced to answer the difficult questions that they had previously entertained only as brainteasers:

- which agencies are responsible for planetary defense;
- what options do they have in mounting an effective defense;
- how do they determine unacceptable consequences in their selection of methods to prevent utter chaos;

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1. CARL SAGAN, PALE BLUE DOT: A VISION OF THE HUMAN FUTURE IN SPACE 262 (1994) ("On first hearing about the Asteroid Hazard, many people think of it as a kind of Chicken Little fable. . . The tendency is to dismiss the prospect of any catastrophe we have not personally witnessed."); Martin E.B. France, *Planetary Defense: Eliminating the Giggle Factor*, AIR & SPACE POWER CHRON., 1 (Aug. 7, 2000), *available at* http://www.airpower.maxwell.af.mil/airchronicles/cc/france2.html (describing the skepticism professionals display when addressing their responsibilities in relation to this unique space threat).

2. David Whitehouse, *Earth Almost Put on Impact Alert*, BBC NEWS (Feb. 24, 2004), *available at* http://news.bbc.co.uk/1/hi/sci/tech/3517319.stm.

3. *Id.* at 3 ("Many astronomers recognize that a false alarm could have brought ridicule on their profession. They are calling for more planning and less panic if it should happen for real next time.").

- who has the final say; and
- what guarantees that nations will cooperate in defensive measures rather than taking a unilateral approach?[4]

For a brief time while decision-makers confirmed the nature of the threat posed by 2004 AS1, the total lack of answers to these questions indicated to the scientific community the importance of clarifying such "rules of the road" as quickly as possible. Fortunately, the threat posed by 2004 AS1 never materialized.

Even before the 2004 AS1 incident, space policymakers were beginning to recognize the need for mitigation measures.[5] While no living person has experienced the horror of a massive asteroid or comet strike, the inherent threats from space debris and deorbiting space stations have independently alerted governments of their need to plan for such dangers. While developing threat response programs to address the falls of Skylab in 1979 and the Mir Space Station in 2001, various agencies considered several different collision scenarios and concluded that no amount of planning fully contain all potential threats.[6]

Without question, asteroids and comets are distinct from falling space stations or space debris because they are far less predictable and pose much greater harm. First, the lack of a coordinated series of telescopes across the globe makes it impossible for astronomers to monitor all potential asteroid and comet threats.[7] As a result, some policymakers have wagered that novice sky watchers will be just as likely as professional astronomers to spot the next significant asteroid or

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4. *Cf.* Brigadier General Simon P. Worden, Deputy Director for Operations of U.S. Space Command, Military Perspectives on the Near-Earth Object (NEO) Threat (Jul. 10, 2002) *available at* http://www.spaceref.com/news/viewpr.html?pid=8834 (raising similar concerns).

5. They agreed some action was necessary to prevent harm even though they could not define precisely what was meant by the term "mitigation." *See* U.N. Comm. on the Peaceful Uses of Outer Space, International Cooperation in the Peaceful Uses of Outer Space, U.N. Doc. A/AC.105/819 (Dec. 3, 2003), at 3, item 4 (recognizing "the growing international recognition that public safety officials need to consider [natural impact] and to develop jointly appropriate measures for a variety of impact scenarios"); An Open Letter to the Australian Federal Government from International Scientists (Jan. 28, 2002), *available at* http://www1.tpgi.com.au/users/tps-seti/pr_oz_sg.htm (urging international collaboration due to the serious nature of the threat); REPORT OF THE TASK FORCE ON POTENTIALLY HAZARDOUS NEAR EARTH OBJECTS (U.K., Sept. 2000) [hereinafter U.K. TASKFORCE REPORT] (developing national policies due to the potential for harm from natural impacts); Ames Space Sci. Div., NASA, Spaceguard Survey Report *available at* http://impact.arc.nasa.gov/reports/spaceguard/index.html (discussing policies of the United States).

6. *Compare* NASA Skylab Reentry: Hearing Before a Subcomm. of the Comm. on Government Operations House of Representatives, 96th Cong. 178 (1979) [hereinafter SKYLAB HEARINGS], *with* R.J. McKinnon & M.T. Sullivan, *Mir Emergency Management: National Arrangements for Managing the Public Safety Aspects of the Re-Entry of the Russian Mir Space Station*, 16 AUSTL. J. EMERGENCY MGMT. 36, 36 (2001).

7. *E.g.*, Andrea Carusi, *Present and Future of the Spaceguard Survey*, *in* JAPAN SPACEGUARD ASSOCIATION, INTERNATIONAL WORKSHOP ON COLLABORATION AND COORDINATION AMONG NEO OBSERVERS AND ORBITAL COMPUTERS 59, 61, 64 (Syuzo Isobe & Yoshifusa Asakura eds., Oct. 23-26, 2001) (observing the "problem" that confirmation of asteroid or comet threats requires "a great number of observing stations [be] continuously operational" and the dearth of observation points in Europe and the Southern hemisphere).

comet threat.[8] In addition to inadequate monitoring capabilities, some threats, such as long period comets, may emerge so quickly that they will evade even the best telescopes altogether or until it is too late to respond.[9]

Second, unlike Skylab or the Mir Space Station, the collision of even a smaller range asteroid can cause damage similar to the detonation of a nuclear bomb.[10] While scaremongers or filmmakers may dwell entirely on horrific predictions of significant damage, it is evident to even the most objective scientist that victims of an asteroid or comet impact face severe consequences. Impacts in the oceans will endanger coastal regions with tsunamis; direct impacts with land could result in a host of problems, like earthquakes in proximate regions, individuals losing their hearing from the sound of the strike, and poisoning of the atmosphere.[11]

Based on predicted harm to earth populations, statistical analyses of the likelihood of another significant impact, and continuing discovery of large asteroid craters across the globe, international policymakers have concluded that a real threat will require international cooperation, and that decisions made in the near-term may have consequences for many generations to come.[12] Ultimately, governments can increase the chances of limiting or eliminating threats to an impact zone by detecting such threats long before the impact is due. With enough time to mount defensive measures from a space station or from earth, governments will be able to deflect or destroy the oncoming object. However, even if time is limited or affirmative defensive measures fail, agencies can secure life and property by effectively preparing local governments and their citizens to evacuate and survive under the difficult and undesirable conditions.

In light of recent unexpected crises including the international outbreak of Sudden Acute Respiratory Syndrome (SARS), widespread blackouts affecting Canada and the United States, and continued terrorist activities across the globe, planners are beginning to recognize the public's increasing vulnerability to

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8. *See* House Committee on Science, *available at* http://www.house.gov/science/press/107/107-286.htm (describing H.R. 5303, the Charles "Pete" Conrad Astronomy Awards Act, which "establishes awards to encourage amateur astronomers to discover and track asteroids crossing in a near-earth orbit").

9. Alan W. Harris, *Can We Defend Earth Against Impacts by Comets and Small Asteroids?*, MERCURY, Nov./Dec. 1996, at 12 (describing criticisms of existing programs that cannot track certain types of asteroid or comet threats).

10. *See* Michael B. Gerrard & Anna W. Barber, *Asteroids and Comets: U.S. and International Law and the Lowest-Probability, Highest Consequence Risk*, 6 N.Y.U. ENVTL. L.J. 4, 7 (1997).

11. *E.g.*, Duncan Steel, *Project Spaceguard: Will Humankind Go the Way of the Dinosaurs?*, 24 IRISH ASTR. J. 19, 21 (1997) (describing such events).

12. Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space. Vienna, July 19-30, 1999, U.N. Doc. A/CONF.184/6, Resolution I.1.c.ii (calling for countries "[t]o improve the international coordination of activities related to near-Earth objects" on many levels); Organization of Economic Cooperation and Development Global Science Forum, *Workshop on Near Earth Objects: Risks, Policies, and Actions* 3, at Conclusion 1 (Jan. 20-22, 2003), *available at* http://www.oecd.org/dataoecd/39/40/2503992.pdf; U.K. TASKFORCE REPORT, *supra* note 5, at 33, Recommendation 9 ("There is an obvious need for some international forum of discussion of the scientific aspects of the problem. There is an equally obvious need for a forum of intergovernmental action.").

unpredictable threats. Perhaps the greatest stride in planning has been the Department of Homeland Security's development of the National Response Plan, which is designed to consolidate various threat-specific policies into a single all-hazards plan to deal with sudden onset harm.[13] Natural impact falls within this scope of unpredictable harm because planners suffer from a lack of experience deflecting and destroying threatening space objects.[14]

In the context of planetary defense, proclamations that nations and local governments must cooperate accomplish nothing of substance. Such gestures are, in fact, not much different from the concerns historically voiced by experts in relation to all space threats. In the 1960s, legal scholars attacked the vague principles regarding cooperation and concern for future generations on the basis that these policies contributed to a "legal vacuum" in space, devoid of practical guidance.[15] The greatest problem then, and now, is that well-intentioned principles impair the ability of governments to address foreseeable danger because these vague principles create a false sense that important inroads have been forged.[16] Despite the provisions of the existing Outer Space Treaty, and several United Nations policies and proclamations, none of these documents provided clear direction to the international community regarding responsibilities to deal with the fall of Skylab.[17] The historical push for greater, more meaningful, regulation of space harm provides a working definition for true progress in planetary defense: "detailed administration," opposed to "the language of agreement,"[18] coupled with "methods for reaching specific decisions in particular cases."[19]

This Article addresses four legal and policy aspects of planning for sizeable asteroid and comet threats. Part II explains specific measures required by the precautionary principle. The purpose of this Part is to provide the general theoretical basis underlying governmental obligations to take certain actions to prepare for, respond to, and recover from natural impact threats.

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13. *See infra* Part III.

14. United Nations, *supra* note 5, at 2, item 2:

> In designing a rational response to this potential threat, policy and decision makers are hampered by the currently very incomplete state of knowledge of the number, sizes, orbits and physical properties of near-Earth objects, such as asteroids and comets. Equally counterproductive is the almost complete lack of defined governmental responsibilities for addressing the issue of near-Earth objects, even at the national level, and the complete lack of coordination of policies at the international level;

SAGAN, *supra* note 1, at 251-57 (discussing a multitude of specific unknown factors).

15. WILLIAM A. HYMAN, MAGNA CARTA OF SPACE 27, 43 (1966).

16. *Id.* at 43.

17. SKYLAB HEARINGS, *supra* note 6 (investigating several unanswered questions about countries' responsibilities the deal with the harm threatened).

18. Maxwell Cohen, *Introduction: Law and Politics in Space*, *in* LAW AND POLITICS IN OUTER SPACE 11, 16 (Maxwell Cohen ed., 1963) [hereinafter SPACE POLITICS].

19. Oscar Schachter, *The Prospects for a Regime in Outer Space and International Organization*, *in* SPACE POLITICS, *supra* note 18, at 95, 99.

Part III applies Homeland Security Presidential Directive/HSPD-5 to the threat of asteroid and comet impact. HSPD-5 is crucial to planetary defense because it reveals that the U.S. Government recognizes an obligation to act preventively against all potentially serious, national-level threats. While the document is still being revised, it must inevitably deal with the problem of natural impact and, as a result, represents a significant stride in space disaster mitigation.

Part IV considers the potential liability that governments face for inaction or accidents encountered during deployment of defensive measures. It emphasizes that the need to take preventive action is entirely separate from the issue of how governmental agencies should conduct themselves in an operational sense. While nations have an inherent right to self-defense under the United Nations Charter,[20] they cannot defend themselves with any and all possible means. Operational considerations such as necessity and the use of proportional force provide guidance.[21] Considerations of governmental liability will assist agencies responding to natural impact in a similar way by providing additional considerations while the agencies act on their obligation to mount defensive measures.

Finally, Part V shares helpful lessons in organization and collaboration gleaned from public health, especially in the area of infectious disease law and policy at domestic and international levels. These final considerations emphasize that some problems are so common to all crises that their successful resolution in one context will assist governments in another context, even when, as in this case, it is difficult to appreciate even the possibility of natural impact devastation. All the considerations addressed by this Article apply equally to any asteroid or comet threat regardless of the amount of time existing before an impact is due, including threats that manifest with no notice at all.

II. THE PRECAUTIONARY PRINCIPLE

The precautionary principle governs responses to unknown types of harm. In many international agreements and other bodies of rules, the principle obligates governments to institute measures to prevent potential harm from a source, even if it is not certain if, when, or where, the harm will occur.[22] The current policy of

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20. U.N. Charter art. 51.

21. Dawn R. Eflein, *A Case Study of Rules of Engagement in Joint Operations: The Air Force Shootdown of Army Helicopters in Operation Provide Comfort*, 44 A.F.L. REV. 33, 40 (1998) (reviewing military precedents) ("Necessity is the requirement that force be used in response to a hostile act or in situations in which the hostile intent is evident . . . 'Proportionality' means that the amount of force used in response to a threat must be of reasonable intensity, duration, and magnitude to counter the threat.").

22. The original document expressing the precautionary principle is from the German policy on pollution. It is called the *Vorsorgeprinzip*, and states, "Environmental policy is not fully accomplished by warding off imminent hazards and the elimination of damage which has occurred. Precautionary environmental policy requires furthermore that natural resources are protected and demands on them be made with care." Konrad von Moltke, *The Vorsorgeprinzip in West German Environmental Policy, reprinted in* ROYAL COMM. ON ENVTL. POLLUTION, TWELFTH REPORT: BEST PRACTICAL ENVIRONMENTAL OPTION 57, 58 (1988). Since the articulation of

the United States requiring agencies to prevent terrorist attacks before they occur rests squarely within this principle. Mitigation measures contained in this policy depend on preventive and anticipatory action: "[t]he greater the threat, the greater the risk of inaction—and the more compelling the case for taking anticipatory action to defend ourselves, *even if uncertainty remains as to time and place of the enemy's attack*."[23] In the context of planetary defense, the same principle applies because some natural impact threats can strike without notice (*e.g.*, long-period comets). Likewise, in hypothesized situations where asteroids are spotted with some advance notice, response times may require so much preparation that delaying action will preclude effective intervention.

In line with the precautionary principle, lawmakers and planners should be cautious of adopting different alternatives to deal with asteroid and comet threats that are projected to occur within different timeframes.[24] While some priorities must change over time, such as evacuating people in impact zones closer to the time of impact, governments must be capable of responding to threats of the greatest magnitude at all times. Planning for a "worst case scenario" is common in disaster relief circles. Whether the harm is an earthquake, flood, or other natural disaster, the government's goal must be to withstand maximum harm; not only harm that is considered "normal."[25] The logic underlying this practice recognizes that there may only be one chance to avert significant harm. Multiple

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this directive, countless international agreements have adopted the same language in contexts ranging from climate change to protection of waterways. A commonly cited example is the convention dealing with the Baltic Sea: "The Contracting Parties shall apply the precautionary principle, i.e., to take preventative measures when there is a reason to assume that substances or energy ... may create hazards ... even when there is no conclusive evidence of a causal relationship between inputs and their alleged effects." Convention for the Protection of the Marine Environment of the Baltic Sea Area, (Apr. 9, 1992), Art. 3 (2) *available at* http://fletcher.tufts.edu/multi/texts/22los.txt. For a more detailed discussion, *see* Evan R. Seamone, *The Duty to "Expect the Unexpected": Mitigating Extreme Natural Threats to the Global Commons Such as Asteroid and Comet Impacts with the Earth*, 41 COLUM. J. TRANSNAT'L L. 735, 761 n.144 (2003) (listing international agreements and their specific language).

23. THE NATIONAL SECURITY STRATEGY OF THE UNITED STATES OF AMERICA § 5 (Sept. 2002), *available at* http://usinfo.state.gov/topical/pol/terror/secstrat.htm (emphasis added).

24. In a recent conference sponsored by the American Institute of Astronautics and Aeronautics, the facilitators requested that experts consider three different hypothetical asteroid and comet threats. These threats would occur in six years, twelve years, and twenty-nine years, raising the issue of how agency responses should change in relation to the amount of notice available to disaster response personnel. David K. Lynch & Glenn E. Peterson, *Athos, Porthos and Aramis: Three Planning Scenarios for Planetary Protection* (unpublished paper: AIAA 2003), at 1.

25. In other words, if you are prepared for the worst, you must also be prepared for anything less severe. Evan R. Seamone, *When Wishing on a Star Just Won't Do: The Legal Basis for International Cooperation in the Mitigation of Asteroid Impacts and Similar Transboundary Disasters*, 87 IOWA L. REV. 1091, 1113 n.106 (2002) (describing the "spill-over" benefits of all-hazards planning). One applied example of this is the concept of the probable maximum flood, which guides planners in preparing for flash floods. JOHN B. MILLER, FLOODS: PEOPLE AT RISK, STRATEGIES FOR PREVENTION 17-19 (United Nations Department of Humanitarian Affairs, 1997). While statistical analyses of past trends would call for minimal efforts, planners anticipate the worst possible flood in the measures they institute as an added precaution in populated areas. *Id.* at 17 (noting circumstances when "some estimate of the greatest flood that could occur at a particular site is often sought").

plans for every imaginable scenario could lead to mass confusion.[26]

The consequence of the precautionary principle on policy is the adoption of "effectiveness as international law" in measures to mitigate a potential threat.[27] This means that governments have an obligation to respond to crisis with the most effective measures warranted by the circumstances, *i.e.*, measures that will preserve the greatest number of lives and protect the most property.[28] This simple proposition provides governments with necessary guidance where other well-intentioned policies and principles cannot. Most importantly, it requires prompt action and not merely proclamations of good will that have little force.

As an example of this phenomenon, the italicized terms in Article 1 of the hypothetical Planetary Defense Plan, presented below, reflect a number of concerns voiced by scientific and legal scholars who have addressed the need for a treaty on asteroid and comet mitigation.[29]

> ARTICLE 1
>
> All of the parties to this treaty shall *cooperate* to the *best of their ability* in measures to deflect or destroy *serious* asteroid or comet threats.
>
> a) Nations that possess advanced technological capabilities (helpers) shall provide *adequate notice* and *assistance* to other members, especially their less-developed neighbors, *in advance* of *likely harm*, to the degree that notification or assistance measures do not compromise the helper's *national security*, *public health*, or *governance interests*.
>
> b) All parties shall *participate* in the development of precautionary methods to *communicate for*, *evacuate from*, *defend against*, or *otherwise respond to* asteroid or comet threats of *a serious magnitude* before these threats occur.

Similar to the Outer Space Treaty, which is often criticized for its ambiguity, the first paragraph of this hypothetical Plan provides no definition for "cooperation."[30] Furthermore, it does not explain how to determine whether a nation has

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26. *See, e.g.*, Thomas V. Inglesby et al., *A Plague in Your City: Observations from TOPOFF*, 32 CLINICAL INFECTIOUS DISEASES 436, 439 (Donald A. Henderson et al. eds., 2001).

27. JOHN VOLGER, THE GLOBAL COMMONS: ENVIRONMENTAL AND TECHNOLOGICAL GOVERNANCE 155 (2d ed. 2000).

28. Seamone, *supra* note 22, at 747-48 (discussing exercise of the government's police powers to regulate in the best interests of a populace).

29. *E.g.*, Liara M. Covert, Before Celestial Bodies Collide—Enhanced Dialogue and Coordination: Precursors to a Treaty for Effective Near Earth Object (NEO) Response, PROC. OF THE INST. OF SPACE L. (Bremen, Germany) (forthcoming July 2004), at 7 (explaining that agencies should develop a treaty and must "exchange views on terms like harm, threat, mitigate, rights & protection, and environmental security" for it to be effective).

30. Critics of space policies and agreements have also recognized, "Definitions are lacking for such terms as 'international regime,' 'common heritage of mankind,' and 'international scientific preserves.' " Eilene Galloway, *The Present Status of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, *in* ENVIRONMENTAL ASPECTS OF ACTIVITIES IN OUTER SPACE 81, 98 (Karl-Heinz Böckstiegel ed., 1988).

cooperated to the "best of [its] ability." And, in mentioning "serious" threats from asteroids and comets, the paragraph calls for the parties to the treaty to set a threshold of harm that they all will agree requires mitigation measures.

Subparagraph a) fails to explain what "adequate notice" means or how long notice can be justifiably withheld. In other words, it is unclear whether "adequate notice" constitutes a day or a month. Finally, it is unclear to what extent a nation can relieve itself of the responsibility to assist another nation simply by claiming any of the three exemptions. Would the mere suggestion of a flood of refugees from a nearby State permit a nation to refuse providing aid due to its interest in "internal governance?"

In subparagraph b), it remains unclear how a disaster relief organization in Calcutta can "participate" in asteroid and comet mitigation programs enacted between the United States and Japan, for example. The provision also fails to explain what constitutes effective "communication" or "defensive measures," and again leaves the tall order of declaring a threshold for harm sufficient to act.

The hypothetical Planetary Defense Plan may appear to resolve the most pressing issues facing nations that must respond to the threat of natural impact. However, it falls short of effectiveness as law. The document is nothing more than vague legal language, and it is ineffective. By requiring definitions of terms and thresholds for action, the document embraces the idealistic concept of unanimous decisions. However, the proposal ignores the reality that no two scientists share precisely the same definition of any concept, let alone a complex one related to asteroids and comets. For thirty years, committee members could go on arguing over the meaning of each and every word in the Plan, without committing to a single measure that would produce results in the effort to mitigate asteroid and comet threats.[31]

In the programs used to mitigate the spread of infectious disease, trans-border forest fires, nuclear and radiological emergencies, and terrorist attacks, disaster response agencies have uniformly implemented specific measures that reject the traditional ineffective approaches to treaty development.[32] Recognizing that their policies must address a nearly infinite number of potential disaster scenarios, the agencies have not obsessed over treaty language.

They have, instead, adopted comprehensive technical guidelines that must be updated regularly based on input from practical simulation exercises and a schedule of mandatory reviews. For example, in the legislation authorizing the TOPOFF exercises,[33] the United States Congress required state and federal

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31. Jürgen Reifarth, *An Appropriate Legal Format for the Discussion of the Problem of Space Debris*, *in* ENVIRONMENTAL ASPECTS OF ACTIVITIES IN OUTER SPACE, *supra* note 30, at 301, 309 (explaining how prevention of harm from space cannot be accomplished through the U.N.'s traditional deliberative process and, instead, requires prompt action).

32. Seamone, *supra* note 22, at 764-71.

33. Officials named the exercise "TOPOFF" in recognition of the intended participants: "top officials" of

agency administrators to participate in annual mass disaster simulations with the goal of improving policies on interagency cooperation.[34] The Nuclear Energy Agency has adopted similar guidelines at the international level through its INEX program.[35] To oversee these operations, participating agencies have created centers that serve as clearinghouses in times of peace and command stations in responding to widespread disaster.[36] While these recent developments in disaster response provide new insight into the types of mechanisms required to deal with sudden-onset harm, including natural impact, natural impact requires additional thought because of its highly-scientific nature. Moreover, the fact that the origin of harm is nature makes many mitigation approaches designed to handle human error ineffective in the space context.

As it now stands, no agency has been explicitly designated to take the lead in planetary defense measures at the international level. In the United States, while NASA currently has responsibility for tracking Near-Earth Orbiting asteroids (NEOs), it is not authorized to deploy nuclear devices or evacuate populations. In other words, the mission of NASA is heavily dependent on research rather than operational activities. Similarly, no technical guidelines exist to coordinate the efforts of the multiple agencies that would be forced to respond to asteroid and comet impacts. At a minimum, the precautionary principle requires that governments institute very rudimentary interventions in protecting the planet. While effective planetary protection efforts will require the participation of different nations and their own respective agencies, the precautionary principle calls for a single center to coordinate activities of different organizations. One example of such an organization is the Northeastern Forest Fire Protection Commission, which coordinates activities of various firefighting organizations in parts of the United States and Canada by developing regulations and providing necessary guidance.[37]

Based on existing plans to more effectively prepare for a natural impact, governments should now agree to disagree on specific measures regarding thresholds for taking action or definitions of words relating to asteroid and comet impact defense. Rather than continue the debate, they should instead survey all of

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agencies who might otherwise be unprepared to interact with different agencies during a sudden-onset crisis. Department of Justice, Press Release, Justice Department, *State Department to Conduct Exercises Combating Weapons of Mass Destruction: State and Local Law Enforcement/Emergency Responders From Illinois, Washington, and Canada to Participate*, Oct. 8, 2002, available at, http://www.usdoj.gov/opa/pr/2002/October/02_ag_585.htm, at 1 (describing the involvement of "[t]op federal officials, state governors, mayors, [and] city managers").

34. S. Rep. No. 105-235, at 14 (1999).

35. Seamone, *supra* note 22, at 767. "INEX," which stands for "International Nuclear Emergency Exercise," describes an international program of simulations coordinated by the Nuclear Energy Agency to prepare nations for the transboundary effects of nuclear disasters. INEX Introduction, *available at* http://www.oecdwash.org/PUBS/ELECTRONIC/inexintro.pdf (last visited, July 27, 2004).

36. Seamone, *supra* note 22, at 786 fig.1 (depicting "Unified Command Components").

37. *Id.* at 768-9 (discussing various aspects of the Commission and its governing regulations).

the agencies that would have to address an asteroid or comet threat and ask these same agencies to develop estimates regarding their capabilities and the extent of their involvement. Each agency should identify points of contact for planetary defense, its current capabilities, and specific measures that would require interagency collaboration in responding to asteroid and comet threats.

Agency representatives should pool the responses and develop a single, comprehensive technical manual summarizing the current state of interagency preparedness. Based on this manual, the representatives should identify common themes (tentative rules) in planetary defense and any further information that would be necessary to establish a firm policy on each theme.

As is the case for many national plans,[38] the lead agency responsible for pooling responses should set a six-month suspense period for developing a draft manual with the additional requirement of a practical exercise to test key aspects of the plan by the end of the first year. Participating agencies should now commit, in advance, to make the guidelines binding after a set number of simulations and revisions.

A. SPECIFIC RECOMMENDATIONS

This Article recommends that agencies adopt the following actions to bring their planning into compliance with the mandates of the precautionary principle. First, because the planning process could go on indefinitely, and effective preparation to deal with a sudden-onset asteroid or comet crisis requires decisions in advance of the threat's identification, agencies should agree today that all tentative plans to deflect or destroy asteroids and comets will have a binding effect on participating agencies within three years, no matter where the developmental process leads in the interim.

Next, because agencies experience great difficulty identifying their own areas of responsibility in contributing to joint efforts, agencies should, within six months from today, complete a comprehensive survey of all organizations that could potentially respond to an asteroid or comet threat. When doing this, responding organizations should determine their current capabilities, needs, areas in which they can act independently, and areas in which interagency cooperation is necessary. They should certainly indicate points of contact and their alternates during this process.

To determine the accuracy of their projected capabilities and needs, agencies should, within one year from today, conduct simulations of asteroid and comet disasters with multiple organizations to test the most complex aspects of the plan and to determine where it needs revision.

After revising the plan in accordance with noted practical applications of its major concepts, to produce a meaningful and functional document, agencies

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38. *See, e.g.*, Office for Domestic Preparedness Support, White Paper, *The Clinton Administration's Policy on Critical Infrastructure Protection: Presidential Decision Directive Sixty-Three*, at 5-6 (May 22, 1998).

should agree to finalize an initial binding version of the plan by the end of one-year-and-six months. Then, to address future changes, they should agree to conduct a set number of revisions based on continued reviews and simulations until they reach the three-year mark, at which time the plan would concretize into a final version.

By developing policy in this manner, agencies will adopt a grounded approach that depends on their existing capabilities,[39] rather than on idealistic notions based solely on good will and appeals to humanity. In effect, this precautionary approach can be considered a phenomenology of asteroid and comet impact mitigation.[40] Most importantly, the process complies with the doctrine of effectiveness as law.

III. HOMELAND SECURITY PRESIDENTIAL DIRECTIVE/HSPD-5

Although there is not currently a national plan regulating the United States government's defense against asteroid and comet impacts, recent developments from within the Department of Homeland Security (DHS) provide a very basic operational framework that will overlap with responses to any natural impact threat until agencies develop a more detailed threat-specific plan. While these provisions do not directly address natural impact, they require a series of steps that agencies must use when responding to natural impact threats. In this sense, the regulations are more successful than any others to date in addressing many aspects of natural impact.

In light of serious indications that America is unprepared for no-notice harm, including the terrorist attacks of September 11, 2001 and the spread of Sudden Acute Respiratory Syndrome (SARS),[41] President Bush, in the Homeland Security Presidential Directive/HSPD-5 (HSPD-5), directed the DHS to develop a comprehensive plan on how the nation would react to a threat of serious magnitude.[42] He required the DHS to develop a National Response Plan with the sole purpose of coordinating the responses of federal, state, and local entities in the event of a widespread disaster: "[t]o prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies, the United States Government shall establish a single comprehensive approach to domestic incident management."[43]

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39. *See* BARNEY G. GLASSER & ANSELM L. STRAUSS, THE DISCOVERY OF GROUNDED THEORY: STRATEGIES FOR QUALITATIVE RESEARCH (1967) (describing an inductive and iterative method for researching issues that achieves much more than a traditional deductive process).

40. *See generally* DON IHDE, EXPERIMENTAL PHENOMENOLOGY: AN INTRODUCTION (1977) (explaining the nature of that discipline, which requires the suspension of pre-formulated hypotheses that are not based on intensive observation).

41. Also consider the widespread blackouts of 2003, which occurred during the initial phases of this effort.

42. Press Release, Homeland Security Presidential Directive/HSPD-5, (Feb. 28,. 2003) *available at* http://www.whitehouse.gov/ news/releases/2003/02/20030228-9.html.

43. *Id.* at para. 3.

The HSPD-5 and its required National Response Plan both have significance for all agencies that will eventually respond to a natural impact disaster. These doctrines make it DHS's responsibility to become involved in responses to widespread harm and they require agencies to follow certain guidelines when mounting defensive measures. Although the National Response Plan is still in development and there is currently no agency tasked with the responsibility of defending the earth against natural impact threats, the directives provide a coordinating structure, a framework for interagency decision-making, and a method to disseminate warnings quickly.

Paragraph four of HSPD-5 explains that DHS will be the lead agency for disasters in any one of four situations. Three of these scenarios could potentially extend to natural impact if a federal agency or state asks for help or the President orders the Secretary of Homeland Security to assume responsibility. However, Subparagraph (3) requires DHS's involvement when "more than one Federal department or agency has become substantially involved in responding to the incident."[44] Natural impact falls within this third provision mainly because of the lack of a coordinating structure to deal with the threat. Any real natural impact scenario would require a simultaneous response by at least NASA, the military, federal public health agencies, and federal disaster response organizations.[45]

HSPD-5 and the National Response Plan oblige agencies to cooperate with DHS in developing the National Response Plan with respect to their unique disaster response functions.[46] Agencies achieve this goal by updating their own planning documents to reflect new changes imposed by the Plan. Agencies also cooperate by reporting the development of any plan to "prevent, respond to, or recover from an incident for which a department or agency has responsibility under law or directive under the criteria established in HSPD-5."[47]

The consequence of this requirement to notify DHS of plans to mitigate serious threats makes it inevitable that DHS will be involved in any planetary defense plan. While it is still questionable when or to what extent the involvement will occur, agencies partnering with DHS in efforts to mitigate natural impact have much to gain. The applicable regulations provide a coordinating framework by making DHS responsible for the following interventions.

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44. *Id.* at para 4.

45. *See, e.g.*, Michael Gerrard & John L. Remo, *Response to Sub-Critical Cosmic Impacts*, 52 J. BRIT. INTERPLANETARY SOC'Y 115, 118-20 (1999) (recognizing that numerous organizations would be required to institute response measures to mitigate the threat of a real natural impact).

46. U.S. DEPARTMENT OF HOMELAND SECURITY, INITIAL NATIONAL RESPONSE PLAN (Sept. 30, 2003), *available at* http://www.dhs.gov/interweb/assetlibrary/Initial_NRP_100903.pdf [hereinafter INITIAL PLAN].

47. *Id.* at § V.A.4.a at 8.

A. APPLICABLE SOLUTIONS FOR PLANETARY DEFENSE

The new provisions in the National Response Plan enable planetary defense because they incorporate all serious threats into a single plan. A major benefit of the National Response Plan is its objective to "integrate the current family of federal domestic prevention, preparedness, response, and recovery plans into a single all-discipline, all-hazards plan."[48] By consolidating standards in multiple areas, the Plan permits agencies to distill themes that apply to them collectively. New considerations and lessons learned in other contexts can easily motivate disaster-specific mitigation measures. The final version of the Plan will inevitably answer many of the most pressing questions facing agencies involved in planetary defense.

The provisions also provide for an operations center, which will benefit planetary defense by providing the ability to launch programs around-the-clock as soon as a threat is identified. Recognizing the need for effective oversight during emergencies, as well as the dissemination of coordinating information at all times, DHS has instituted the National Homeland Security Operations Center (HSOC). The Center operates at all times, assessing incidents throughout the nation, issuing warnings and advisory bulletins, and supplementing preparedness efforts in concert with state and federal agencies.[49] At the HSOC, representatives from multiple agencies are on hand to "integrate a full spectrum of interagency subject matter expertise and reach-back capacity."[50] At present, without such a framework specifically addressing natural impact response, the HSOC provides a ready alternative. However, due to the unique nature of the natural impact threat, it would be far more effective to develop an analogous organization specifically tailored to natural impact, which would coordinate with the HSOC in the event of a confirmed threat.[51] For example, it is unclear whether the warning system developed by the HSOC comports with warning scales intended for natural impact. Harmonization of the different scales will be crucial for disseminating effective warnings to the public.

Provisions regarding interagency cooperation also strengthen the ability to develop far-reaching natural impact prevention strategies from an interdisciplinary standpoint. A staple of the National Response Plan is the Interagency Incident Management Group (IIMG). This is a panel of senior representatives from key agencies that can be convened at short notice to reach a consensus on measures to mitigate a potential or confirmed threat.[52] The IIMG will confirm the existence of the threat, prioritize responsive measures, and anticipate resources

48. *Id.* at § I.C, at 1.
49. *Id.* at § IV.A.1a-e at 3.
50. *Id.* at § IV.A.4 at 3.
51. Seamone, *supra* note 22, at 786, fig.1.
52. INITIAL PLAN, *supra* note 46, at § IV.B.2 at 4.

required to promptly recover from a serious incident.[53] Subsequent to a decision by the IIMG, ranking members of the Homeland Security Council and Presidential assistants will develop a course of action based on the Council's findings.[54] Such coordination will permit agencies to adapt to the nuances of a situation rather than forcing them to abide by an inflexible set of guidelines that is supposed to solve every problem. Decision-making fostered by the IIMG would address natural impact scenarios far better than a treaty-based approach alone.

For those concerned that no one has the responsibility to take the lead in responding to asteroid or comet threats, the new regulations provide guidance applicable to natural impact. In an effort to develop a clear chain of command, the National Response Plan provides for a Principal Federal Officer (PFO) to direct interagency efforts as a national spokesperson based on the nature of a specific threat. Among other duties, this individual will "serve as a primary, although not exclusive, point for Federal interface with State, local, and tribal government officials, the media, and the private sector for the incident management."[55] As a fallback plan, this mechanism will designate a lead agency and individual responsible for responding to natural impact if these entities are not selected by other means prior to a serious incident involving comets or asteroids.

Finally, the new provisions require methods to predict and respond to the unknown aspects of natural impact threats. In relation to the National Response Plan and HSPD-5, HSPD-8 directs that all agencies with responsibility for national disaster response will participate in disaster simulations to enhance their response capacities.[56] HSPD-8 provides for a "master exercise calendar" specifically to "establish a national program and a multi-year planning system to conduct homeland security preparedness-related exercises that reinforces identified training standards, provides for evaluation of readiness, and supports the national preparedness goal."[57] Each agency is required to evaluate its own needs in relation to these objectives, so the lessons learned can be shared and implemented across programs.[58] Any agency remotely involved in space activities should incorporate natural impact scenarios into its requests for time on the master exercise calendar.

B. QUESTIONS THAT REMAIN UNANSWERED IN THE NEW POLICIES

Measures at the Department of Homeland Security are still developing, which leaves ample room for inclusion of natural impact mitigation. How-

53. *Id.* at § IV.B.2a-g at 4-5.

54. *Id.* at § IV.C.1 at 5.

55. *Id.* at § IV.D.1d at 6.

56. HSPD-8 requires a "comprehensive training program." Homeland Security Presidential Directive-8, para. (17) (Dec. 17, 2003), *available at* http://www.whitehouse.gov/news/releases/2003/12/20031217-6.html.

57. *Id.* at para. 18.

58. *Id.* at paras. 19-20.

ever, it is questionable if or when the Plan will directly address planetary defense.

On the one hand, much of the National Response Plan depends on pre-existing policies and agency frameworks. Since there are none for planetary defense, there may be less impetus to define specific responsibilities. On the other hand, NASA has not even been designated among the many agencies involved in staffing the HSOC[59] and serving on the IIMG.[60] Given the lingering issues posed by Skylab, the Mir station, Cosmos 954, the Columbia shuttle explosion, and the problem of space debris, one would expect space disasters to take a greater level of priority at the Department of Homeland Security. As long as these issues are ignored, it is unlikely that natural impact will rocket to the forefront without significant political pressure.

The major benefit of the National Response Plan is overlap in the development of measures that apply directly to planetary defense. Working groups from different agencies are now identifying the most difficult problems plaguing international and interagency cooperation and answers are just a phone call or short visit away. In the advent of these developments, agencies involved in planetary defense now have the tools necessary to meet the requirements of the precautionary principle. Governments must begin to investigate existing alternatives for mounting prompt action to defend the planet against asteroid and comet collisions.

IV. GOVERNMENT LIABILITY

Consider the massive legal battle that will ensue if a huge asteroid strikes a country without any warning or the case where measures to deflect or destroy an asteroid fail and cause damage. Government liability associated with this type of harm depends on a number of factors. In most jurisdictions, private individuals are not liable for the harm they cause when rescuing people in distress unless rescuers act in a manner that is grossly negligent, reckless, or intentional.[61] The policy behind the protection afforded rescuers is to encourage heroic acts without the threat of a lawsuit. In states like Vermont, which has recognized a duty to rescue, this immunity is part of the law.[62] In all U.S. jurisdictions, first responders like doctors, nurses, and emergency technicians, are given similar protections for their acts of rescue when responding to disasters or emergencies.[63] These provisions are not very different from the immunities granted by disaster treaties

59. INITIAL PLAN, *supra* note 46, at 10 app. A.

60. *Id.* at 11 app. B.

61. WILLIAM PROSSER & W. PAGE KEETON, THE LAW OF TORTS § 33, at 196 (5th ed. 1984) ("The courts have been compelled to recognize that an actor who is confronted with an emergency is not to be held to the standard of conduct normally applied to one who is in no such situation.").

62. VT. STAT. ANN. tit. 12, § 519 (1973 & Supp. 1994).

63. Eric A. Brandt, Comment, *Good Samaritan Laws - The Legal Placebo: A Current Analysis*, 17 AKRON L. REV. 303 (1983).

addressing mutual aid. In the international convention addressing nuclear and radiological disasters, Article 10(2) makes it clear that countries that render aid to others who face harm will not be liable for death, harm to property, or environmental damage during rescue efforts unless the harm is willful.[64]

A. UNINTENDED DEFLECTION ONTO ANOTHER COUNTRY

Following the precedent set by the nuclear and radiological assistance convention, if a planetary protector attempts to deflect an asteroid and inadvertently harms another country by changing the course of the object or firing a projectile at it, the protector would not be held liable. International agreements should contain such language encouraging prompt action to defend against threats. However, an exception occurs if a defender intentionally alters the course of the object into the territory of another nation to protect its own interests. To avoid that scenario, the provision should be coupled with warning requirements similar to the nuclear and radiological assistance convention addressed above.

B. INADEQUATE PROTECTIVE MEASURES

There is a difference between mounting a calculated defense and launching hasty defensive measures in a panic. Prior plans, simulations, and other testing must characterize the nature of a protective measure. If the planetary defender institutes a measure negligently in a gamble that it will be effective without any prior testing and evaluation, this behavior can be considered reckless, removing the immunity that would otherwise attach. In the early case of *United States v. Lawter*,[65] a federal court grappled with a situation where an inexperienced crewmember of a United States Coast Guard rescue helicopter killed a shipwrecked woman by dropping her from a hoist that he had never used before.[66] While, normally, the government would not be held liable for such actions, in this case, the guardsman's gross negligence provided a basis for increased monetary relief. Similarly, in the case of *Indian Towing v. United States*,[67] the Supreme Court explained that government agencies must skillfully complete tasks they have undertaken.[68] At issue in that case was a lighthouse operated by the Coast Guard, which lost its signal in bad weather and failed to properly direct a tugboat at sea.

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64. Convention on Early Notification of a Nuclear Accident, Sept. 26, 1986, *reprinted in* 25 I.L.M 1369 (1986); Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Sept. 26, 1986, *reprinted in id.* at 1377.

65. 219 F.2d 559 (5th Cir. 1955).

66. *Id.* at 560 n.1 (Findings of Fact).

67. 350 U.S. 61 (1955).

68. *Id.* at 69 ("The Coast Guard need not undertake the lighthouse service. But once it exercised its discretion to operate a light on Chandeleur Island and engendered reliance on the guidance afforded by the light, it was obligated to use due care to make certain that the light was kept in good working order.").

Cases such as *Lawter* and *Indian Towing* illustrate circumstances when government agencies, in adopting protective measures for members of the public, develop "special relationships" that require them to exercise care. While governments may not be required to provide adequate safety services in all cases,[69] they must do so in situations where they act: "(1) by way of a positive act that inhibits selfhelp or private rescue; (2) by way of a state's positive act that exposes the plaintiff to danger; and (3) by way of an undertaking that worsens the plaintiff's position."[70] When governments take action to respond to asteroids or comets, given the lack of alternative plans citizens can adopt to protect themselves, these plans must be executed with some level of skill. In the context of planetary defense, simulations will help develop standard operating procedures that can be applied in a real situation, reinforcing the mandate of the precautionary principle to engage in planning in advance of the harm.

C. GOVERNMENTAL INACTION

If the government takes no action to protect against an asteroid threat that could be reasonably anticipated, it is likely that liability will attach. In *Ducey v. United States*,[71] survivors of a victim that died in a flash flood at a recreational park sued the government for failing to warn of the flood, as well as failing to rescue. The evidence showed that the government officials responsible for ensuring safety at the park were aware that floods generally occurred every hundred years. After that time, they failed to institute measures to prepare for the possibility. Even though the government argued that it could never anticipate the precise timing of a flash flood, the plaintiffs prevailed because the government was in a very unique position to track floods and develop measures that average citizens would never be capable of doing themselves.[72] Most importantly, the court rejected the idea that the government could not be liable since the flood was an "act of God" many times greater than anyone could have predicted.[73]

By holding that the government had a duty to anticipate natural harm and institute precautionary measures, the *Ducey* court suggested that governments must take action to prepare for and mitigate asteroid and comet threats. Unlike the flash flood scenario addressed in *Ducey*, the few documented cases of earth impacts suggest that a somewhat serious asteroid or comet strike with the

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69. *Cf., e.g., DeShaney v. Winnebago County Dept. of Social Servs.*, 489 U.S. 189, 196 (1989) (explaining constitutional ramifications: "[T]he Due Process Clauses generally confer no affirmative right to government aid, even when such aid may be necessary to secure life, liberty, or property interests . . .").

70. Thomas A. Eaton & Michael Wells, *Governmental Inaction as a Constitutional Tort: Deshaney and Its Aftermath*, 66 WASH. L. REV. 107, 147 (1991).

71. *Ducey v. U.S.*, 830 F.2d 1071 (9th Cir. 1987).

72. *Id.* at 1072.

73. *Id.*

potential to kill at least hundreds of people occurs even more frequently than every 100 years.[74]

V. LESSONS FROM PUBLIC HEALTH

In the area of planetary defense, there are currently more questions than answers available for framing the optimal policy approach.[75] It is tempting to categorize natural impact as an issue of "outer space policy," or "environmental policy," simply to make it easier for an agency to borrow decision frameworks from existing programs. But effective policy does not develop in this manner.

To a degree, the problem of natural impact shares common themes with the problem of infectious disease. Much like asteroid and comet threats, infectious diseases can spread with little or no advance warning.[76] Additionally, disease threats are similar to asteroid threats in the sense that their emergence is certain even though scientists cannot pinpoint exactly when: "[a]lthough we do not know where the next microbe or virus will appear . . . we know new outbreaks are certain."[77] Just as some space agencies have been content to suggest that they have identified a large percentage of asteroid threats simply by virtue of cataloguing known NEO asteroids, doctors have made similar errors in the field of infectious disease. On December 4, 1967, for example, the U.S. Surgeon General, Dr. William H. Stewart "informed a meeting of state and territorial health officials that infectious diseases were now conquered."[78] Of many lessons in the health policy area, the most important is that effective regulation of contagion requires the ability to design flexible policies that do not confine issues to any single category.

A. THE PROBLEM OF LABELING

The problem of labels has stifled the development of law and policy regarding infectious disease. In many states, laws previously addressed diseases piecemeal, based on specific characteristics of certain diseases while excluding others. Over the years, these laws became antiquated and inflexible.[79] As new strains of disease emerged, states were faced with outdated

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74. Seamone, *supra* note 22, at 752 n.82.

75. *Cf.* Worden, *supra* note 4 (raising unanswered questions).

76. ARNO KARLEN, MAN AND MICROBES: DISEASE AND PLAGUES IN HISTORY AND MODERN TIMES 2 (1995) ("For each new disease known to the general public, there are a dozen others; the wheels of biological change keep turning faster.").

77. *Id.* at 4 (citing Epidemiologist Robert Shope).

78. FRANK RYAN, VIRUS XL TRACKING THE NEW KILLER PLAGUES: OUT OF THE PRESENT AND INTO THE FUTURE 6 (1997).

79. Lawrence O. Gostin et al., *The Law and the Public's Health: A Study of Infectious Disease Law in the United States*, 99 COLUM. L. REV. 59, 109-10 (1999) (criticizing "outdated," "pigeonhole classifications" in the regulation of infectious disease).

laws that did not sufficiently address the most pressing symptoms of modern ailments.[80]

Scholars characterized the problem as one of categorization.[81] They realized that public health issues were ambiguous to the point where they could be defined broadly enough to encompass several disciplines or narrowly enough to exclude all but one specialty within a single discipline.[82] Medical scholars have realized the solution to this problem requires employing a different mindset. Rather than focusing on the source of an infection (*e.g.*, symptoms of specific diseases), policymakers must instead address the unwanted effects of these diseases that are common to all people regardless of the disease's name.[83]

In developing planetary defense measures, policymakers can learn a lesson from medicine by considering aspects of the harm threatened by asteroid and comet impacts and not only the fact that the threat involves space.[84] Space policy is only one consideration when mitigating the threat of natural impact. The Outer Space Treaty and existing space doctrines are not the only or ideal documents governing interagency responses to this harm.[85] These should be read only in concert with other disaster conventions and agreements, like the nuclear and radiological convention, which contain detailed technical guidance.[86]

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80. *Id.*

81. At the international level, critics of the International Health Regulations describe a similar limitation on the methods available to address exotic strains of infectious disease because the initial rules applied only to the narrow categories of plague, yellow fever, and cholera. David P. Fidler, *Emerging Trends in International Law Concerning Global Infectious Disease Control*, 9 EMERGING INFECTIOUS DISEASES 285, 286 (2003). The World Health Organization has begun to remedy this problem by focusing on common characteristics of all diseases not just the characteristics of certain types. World Health Organization, *The Revisions of the International Health Regulations*, 71 WKLY. EPIDEMIOLOGICAL REC. 233 (1996).

82. For example, "public health" has taken on such a broad meaning, it encompasses "communicable disease control, food and water quality protection, environmental and occupational risk reduction . . . [,] highway safety . . . [,] modification of chronic disease risks linked to behavior," and any event that impacts these areas of concern. Gostin et al., *supra* note 79, at 91; *see also* Obijiofor Aginam, *International Law and Communicable Diseases*, 80 BULL. WORLD HEALTH ORG. 946, 947 (2002): ("Multilateral governance of communicable diseases implicates other sub-categories of international law: international human rights law; humanitarian laws and laws of war; international environmental law; law of the sea and international maritime law; intellectual property law; and bioethics.").

83. Seamone, *supra* note 22, at 774-79 (describing the "source-effects" imbalance that characterizes policies regarding space).

84. *Id.*

85. Outer Space law is currently at the developmental stage, providing little guidance and too many uncertainties. *See* Reifarth, *supra* note 31, at 301, 302; John L. Remo, *Policy Perspectives from the UN International Conference on Near Earth Objects*, 12 SPACE POL'Y 13, app. at 17 (1999) ("International law and practice does not address this issue directly."); U.K. TASK FORCE REPORT, *supra* note 5, at 33 ("There are no obvious precedents . . .").

86. Convention on Early Notification of a Nuclear Accident, Sept. 26, 1986, *reprinted in* 25 I.L.M 1369 (1986); Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Sept. 26, 1986, *reprinted in id.* at 1377.

B. AGENCY OVER-INVOLVEMENT

Anytime the potential for serious, widespread harm is realized, more agencies will broadly interpret their charters to include the new harm. These agencies will regulate governmental behavior even if they had never before considered the threat. One example in infectious disease mitigation was the sudden involvement of the Occupational Safety and Health Administration (OSHA) into the law and policy forums addressing the Human Immunodeficiency Virus (HIV) when the virus became more widespread in the 1980s.

In 1987, OSHA "catapulted" itself into the domain of HIV by claiming that its statutory obligation to regulate hazards in the workplace included communicable disease.[87] Since then, the permanent standards developed by the Agency have complicated duties owed to the public and created inconsistencies in regulatory standards, which some criticize for being *ad hoc*.[88] While this additional involvement in the federal regulation of contagion has helped to develop new standards, it is also true that the accompanying requirements for perfunctory "risk assessments, feasibility studies, workplace surveys, regulatory and impact analyses, and cost benefit calculations" have limited the ability of the agency to respond quickly to a constantly changing social landscape.[89] The resulting problem for other agencies mitigating infectious disease is a new set of precedents to consider, which dilute the federal government's ability to take coordinated and prompt action.

This phenomenon of increasing involvement has many dimensions. Similar to the OSHA experience, at the international level, the World Health Organization (WHO) petitioned the International Court of Justice (ICJ) in 1996 and cited its own Constitution as grounds to attack the legal basis for the use of nuclear weapons by countries in armed conflict.[90] The WHO claimed that "harmful health and environmental effects" of such weapons were within their area of responsibility, causing the Court to determine the scope of the WHO's obligations.[91] Although the ICJ held that the WHO had no standing to raise this question, it reached this decision on the basis that the WHO's responsibility did not extend to determining the lawfulness of governmental actions. The Court declined to address the merits of the complaint because the WHO couched the issue in terms of law rather than specific practices. However, the ICJ still

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87. Paula E. Berg, *When the Hazard is Human: Irrationality, Inequity, and Unintended Consequences in Federal Regulation of Contagion*, 75 WASH. U. L.Q. 1367, 1368 (1997).

88. *Id.*

89. *Id.* at 1377.

90. Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, 1996 I.C.J. 66 (July 8), *reprinted in* 35 I.L.M. 809 (1996).

91. The specific question posed by the WHO was: "In view of the health and environmental effects, would the use of nuclear weapons by a State in war or other armed conflict be a breach of its obligations under international law including the WHO constitution?" *Id.*

recognized that the WHO had the responsibility to involve itself in preventive measures and policies involving activities that are hazardous to the world community.[92] The actions of the WHO foreshadow future attempts by numerous organizations to stake their own claims in planetary defense.

Natural impact threats raise a crucial point involving cooperation within and among different nations—unrestrained cooperation and interdisciplinary involvement can produce chaos rather than effectiveness.[93] On a continuum from short-notice threats to long-term ones, as the magnitude of a natural impact threat increases or the response time grows shorter, more agencies will petition for involvement in the decision-making process. While space and military agencies might dominate the initial stages of decision-making, law enforcement, health, environmental, and fiscal agencies will merge into the decision-making framework over time.

The influx of agency involvement can, of course, offer alternative perspectives. However, disruption, dilution, or ignorance of established frameworks will, no doubt, limit the overall effectiveness of joint efforts. The solution to this problem of coordination is not necessarily to give the lead to one agency and then prevent other agencies from meaningful modification of existing standards; nor is the answer carving out limited areas in which different agencies should legislate. Instead, the answer is to draw on the experience of all the agencies that could potentially become involved, identify their needs, exchange views, and then incorporate joint considerations into a single set of coordinating instructions. The National Response Plan incorporates many of these lessons.

VI. CONCLUDING REMARKS

The precautionary principle is a legal concept that deals with uncertainty. Natural impact threats are creatures of uncertainty. Even though the principle is silent regarding specific measures to mitigate natural impact, the principle tells nations how they should approach this threat. Under this grounded approach to planetary defense, agencies must understand their capabilities before committing to policy objectives. Ultimately, insights developed as the result of a process-oriented approach will be optimal because they will lead to clear and unambiguous policies. Furthermore, they will withstand the test of exigency, and, in so doing, maximize life and minimize collateral damage.

Planetary defense has emerged at an ideal time when agencies responsible for threat mitigation are reevaluating their capabilities and needs. Limiting this issue to the domain of "space" or the "environment" will defeat planetary defense. Planetary defense touches many different disciplines and cannot be dealt with properly by NASA or the Department of Defense alone. To understand exactly who is vested with specific responsibilities, agencies must turn to machinery that

92. *Id.* (especially Judge Weeramantry's dissenting opinion).

93. Inglesby et al., *supra* note 26, at 439.

has begun to resolve broader issues, such as the National Response Plan. They must also conduct independent investigations into the issue of natural impact since many response measures must be threat-specific.

For future development of natural impact policy, agencies must first develop a single Planetary Defense Plan that addresses each of their specific responsibilities in planetary defense. The Plan must also identify mitigation measures requiring the collaboration of multiple agencies. All agencies involved in the development of this Plan should identify their objectives when responding to natural impact threats and corresponding measures thought to satisfy those objectives. And, an organization responsible for coordinating planetary defense standards should assist agencies in implementing the Planetary Defense Plan.

Today, while agencies still lack a framework to deal specifically with natural impact, they should follow the above guidance. Before taking action, agencies must reject the notion that no one is officially accountable for responding to the threat of asteroid or comet collisions. The responsibility is shared between different agencies at each stage during which the threat manifests. When an organization spots an asteroid or comet threat, it should request the assistance of the Department of Homeland Security upon confirming that the threat is genuine. On the basis of HSPD-5, it should work in concert with DHS to develop a joint response.

In mounting this response, agencies should take various actions to ensure that they implement the most effective mitigation measures. Well before implementation of defensive measures, agencies should harmonize existing warning scales to guarantee interagency communication and communication with the public. They should also conduct simulations and training exercises for all of the defensive methods within contemplation. These precautions will avoid judgments that agencies were reckless in the deployment of technology. Such attempts to test the validity of operational plans before deploying strategic assets will also demonstrate due care on the part of governments, enabling them to reap the benefits of Good Samaritan Immunity and explore the full spectrum of options to destroy or deflect an oncoming asteroid or comet. Although many operational requirements are limited to the National Response Plan, they are still significant at the international level because most of the stated objectives can be accomplished only through international cooperation.[94]

Until governments develop a Planetary Defense Plan that conforms to the requirements discussed above, the earth's biggest threat is not simply the possibility of natural impact; it is a lack of urgency in taking preventive action against natural impact while uniquely positioned agencies are still capable of doing so.[95]

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94. Press Release, U.S. Department of Justice, State Department to Conduct Exercises Combating Weapons of Mass Destruction: State and Local Law Enforcement Emergency Responders From Illinois, Washington, and Canada to Participate (Oct. 8, 2002), *available at http://www.usdoj.gov/opa/ pr/2002/October/02_ag_585.htm*, at 2 (comments of Secretary of State Colin L. Powell and statement of objectives for the international exercise).

95. HYMAN, *supra* note 15, at 43.

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