

AMERICAN FOREIGN POLICY COUNCIL DEFENSE TECHNOLOGY PROGRAM BRIEF Clarifying the Planetary Defense Mission

By: Peter Garretson

BRIEFING HIGHLIGHTS

Bolides are a class of asteroid impacts. The pressure of Earth's atmosphere can cause some bolides to explode, creating a massive fireball releasing blast energies ranging from kilotons to megatons. Most bolides go unnoticed except from sophisticated sensors, but some, can make it low enough in Earth's atmosphere to create nuclear-blast-like effects which would flatten a city. A bolide's ability to mimic the effects of a nuclear weapon could result in confusion and trigger accidental escalation. (For reference, in 2019 there were 55 bolide events.)

RECOMMENDATIONS FOR CONGRESS

1. Specify that the U.S. Space Force will organize, train, equip and present forces capable of executing advance warning and planetary defense missions, and will be responsible for sustained long-term environmental surveillance of natural space-derived threats, to enable prompt warning, and to execute a prompt and sustained campaign to deflect or destroy potential Earth impacting objects.

2. Specify that the USSPACECOM will be responsible for planning and executing a deflection campaign, and serve as the lead national/international coordinator.

3. Task USSPACECOM to develop requirements for planetary defense for the Joint Capabilities Integration and Development System (JCIDS), including requirements for persistent surveillance to provide advance warning and notification of bolide events and interdiction of Earth-crossing objects which could cause substantial damage to life or property.

4. Task USSPACECOM with developing a Concept of Operations (CONPLAN) of sufficient detail to allow execution for a basic increment of capability.

5. Adequately resource USSPACECOM and the USSF for the above efforts.

6. Ensure NASA continues S&T support through its DART and NEOSM programs.



Since 2005, Congress has recognized that an asteroid impact represents a serious threat to national security. Though Congress tasked NASA to survey hazardous asteroids larger than 140m by 2020, sixteen years later it remains incomplete.¹ In 2008, in Public Law No 110-422, Congress tasked the Executive Office of the President to recommend a federal agency to be responsible for protecting the United States from a near-Earth object anticipated to collide with our planet and implement a deflection campaign.² Five Presidential administrations have failed to respond to this tasking.

Today, however, Congress is in a position to take action to secure the lives and property of American citizens against the real and preventable disaster of asteroid strikes. Now that a Space Force and dedicated U.S. Space Command exist, it is appropriate for Congress to author legislation affixing these responsibilities to the agencies statutorily tasked to "protect the interests of the United States in space"³ and conduct operations in, from, and to space to defend U.S. vital interests.⁴

While very large asteroid strikes represent an existential risk, they are relatively infrequent, and at least the majority of such objects have been identified. In contrast, only a tiny percentage of the asteroids smaller than 140m have been mapped, despite their increased frequency

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FIGURE 1: BOLIDE EVENT MAP⁵

Fireballs Reported by US Government Sensors (1988-Apr-15 to 2021-May-16)



and ability to cause significant injury or damage—including the potential to destroy an entire city.

The most common class of asteroid impacts are called bolides. These are asteroid strikes which do not make it all the way to the ground, but explode in the atmosphere. The phenomenon is significantly more common than is generally understood. In 2019, there were 55 bolide events.⁶ A bolide occurs when a small asteroid impacts the Earth's atmosphere and encounters growing heating and pressure. Some asteroids cannot withstand the pressure and explode, causing a massive fireball that releases blast energies ranging from kilotons to megatons. Most bolides happen high in the atmosphere and may go unnoticed, except by sophisticated sensors. But some, like the 1908 Tunguska explosion, can penetrate low enough to create nuclear-blast-like effects which

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would flatten a city. Their ability to mimic the effects of a nuclear weapon could result in confusion and, in turn, trigger accidental escalation—particularly if it happens in the midst of a terrestrial geopolitical crisis. Therefore, early detection of bolide impactors and early global reporting of bolides is a necessary step in ensuring global stability.

A GROWING CONCERN

For the U.S. government, the threat of bolides and asteroid strikes has been a consistent concern of space professionals since the problem was first articulated in the Air University futures studies of the mid 1990s.⁷ In subsequent years, an understanding of the problem has grown among policymakers. In 2002, General Simon "Pete" Worden, then the Director of Operations of

> the United States Space Command (USSPACECOM), warned Congressional lawmakers of a specific scenario where a bolide could cause nuclear escalation. In comments to the House Science Committee, Worden pointed out that such a bolide had occurred at the peak of a crisis between India and Pakistan, and indicated that this could

have been an escalation route for a potential nuclear war between the two countries.⁸

Exploration Technology (CDSET) has held annual meetings to "satisfy national strategic development

The potential of a bolide strike over a sensitive location is hardly hypothetical. Bolides have recently struck near sensitive locations in both Russia and the United States. In Russia, the 2013 Chelyabinsk bolide detonated just 60 miles from the Mayak nuclear storage and disposal facility, where dozens of tons of weapons grade plutonium are stored.

The potential of a bolide strike over a sensitive location is hardly hypothetical. Bolides have recently struck near sensitive locations in both Russia and the United States. In Russia, the 2013 Chelyabinsk bolide detonated just 60 miles from the Mayak nuclear storage and disposal facility, where dozens of tons of weapons grade plutonium are stored, and in Shchuchye, where 6,000 tons of Sarin and VX nerve gas are stored.⁹ The concerns of misattribution are not merely speculative; following the Chelyabinsk strike, one Russian politician blamed the explosions not on natural phenomena but on the testing of "new weapons" by the United States.¹⁰ Subsequently, In 2018, bolide strikes occurred over the Bering Sea, between the United States and Russia,¹¹ and over Thule, Greenland.¹² These represent sensitive locations where the United States maintains critical missile warning facilities to provide warning of an impending nuclear first strike.

In turn, foreign efforts to combat the bolide threat have potential dual-use implications for space domain awareness, counter-space, and the proliferation of nuclear capabilities to outer space. For instance, Russia's experiences in Chelyabinsk and Tunguska have led Moscow to launch several architecture studies, such as CITADEL, which include nuclear devices and hypervelocity impactors as potential responses to the bolide threat.¹³ If fully resourced, such a Russian architecture would have significant international security implications.¹⁴

The People's Republic of China (PRC) is similarly aware of the threat.¹⁵ China's government has signed (but not yet ratified) the Comprehensive Test Ban Treaty (CTBT),¹⁶ in part because it has argued that doing so would close the door to the use of nuclear explosives against a potential asteroid threat.¹⁷ Since 2011, the Chinese Academy of Sciences' Committee of Deep Space needs" including "asteroid detection and defense," and has sponsored an annual "Asteroids Detection and Defense Innovate Design Competition."¹⁸

Beijing's objectives are more ambitious, however. As part of its burgeoning space strategy,¹⁹ the PRC also intends to deliberately capture a bolide-sized asteroid in 2029 and return it to the Earth's surface via a guided impact in 2034.²⁰

For both defense and economic reasons, the PRC has likewise begun a program to develop nuclear space-craft²¹ which is explicitly designed to access and mine asteroids.²²

MISSION CONFUSION

Over the past two decades, the United States has become increasingly aware of—and concerned with—the asteroid defense mission.²³ The imperative was first echoed in the Final Report of the 2001 Commission on the Future of the U.S. Aerospace Industry, which stated that "planetary defense should be *assigned to DoD* in cooperation with NASA." The Commission," it continued, "believes that the nation needs a joint civil and military initiative to develop a core space infrastructure that will address emerging national needs for military use and planetary defense."²⁴

Unfortunately, the intervening two decades have not resulted in such a coordinated initiative, but instead the lack of legislative clarity has led to competing and often contradictory impulses. The dissolution of USSPACECOM in the early 2000s eliminated the most logical recipient of the anti-bolide mission, and key advocates (including Gen. Worden and Col. Lindley Johnson) migrated into the federal civilian space sector. The subsequent framing of the topic as a NASA/science issue under the purview of the relevant Congressional committees and the President's Office of Science and Technology Policy (OSTP), rather than as a space control or defense issue (under Armed Services committees and the National Space Council and National Security Council), has resulted in it receiving less attention and urgency than it deserves.

For its part, OSTP has regrettably perpetuated the framing of the planetary defense narrowly as a science issue, while failing to recommend a federal agency to

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implement a deflection campaign consistent with Congressional tasking of 2008.²⁵ In 2010, OSTP Director John Holdren recommended to Congress that NASA take the lead in conducting foundational analysis and simulation activities and assessment of technologies [only] for NEO mitigation and deflection.²⁶ That determination effectively marginalized the U.S. military and its

constituent entities (such as the United States Space Force) to a potential future support position—making it difficult for its principals to argue for resources or priority within the Pentagon in order to enable a more robust planetary defense response.²⁷

This is where the situation remains. While NASA is tasked with advancing detection and foundational analysis, until Congress or the President decide to clearly assign the mission of planetary defense, both NASA and DoD exist in a state of limbo where it is unclear if the U.S. military is legally permitted to expend funds for such a purpose. This has previously proved a barrier for institutions like the Air Force Research Lab in developing advanced space propulsion technology, thereby foreclosing opportunities

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> to develop military advantage in space access and maneuver.

There is, however, a growing awareness of the asteroid threat. The inherent synergies between space control and missile defense, for instance, has led a number of authors, including celebrity astrophysicist Neil deGrasse Tyson, to suggest it as an appropriate mission for the U.S. Space Force, and one that would help with public acceptance and recruiting, as well as international cooperation.²⁸ Others have noted that assigning asteroid defense missions to DoD would push advanced technology.²⁹ Technologies such as space-based radar, Cis-Lunar space domain awareness (SDA), and advanced propulsion (such as Nuclear Thermal Propulsion³⁰) simultaneously create capabilities that reduce the risks of crisis escalation, aid in

More Americans view monitoring climate or asteroids 2002 2005 Space Goal as top NASA priorities than do so for sending astronauts to the moon or Mars Build satellites in Earth orbit to % of U.S. adults who say each of the following should be a top priority for 32% 35% collect solar energy to beam to NASA utilities on Earth Top priority Develop the technology to deflect Important but lower priority 17% 23% asteroids or comets that might Not too important/should not be done destroy the Earth Monitor key parts of the Earth's 25 11 63 climate system 10% Send humans to Mars 4% Monitor asteroids/objects that 29 9 could hit Earth 2% 7% Search for life on other planets Conduct basic scientific research 40 12 to increase knowledge of space 7% 6% Build a human colony in space Develop technologies that could 44 14 be adapted for other uses Build a base on the moon for Conduct research on how space 20 5% 4% travel affects human health humans to use for exploration of the moon Search for raw materials/natural 22 resources for use on Earth Develop a passenger rocket to send 6% 3% Search for life and planets that tourists into space 27 could support life None of the above, we should stop Send astronauts to Mars 18 37 2% 11% spending money on space 13 Send astronauts to the moon 44 13% 10% No Opinion Note: Respondents who did not give an answer are not shown 1% 2% None of the above Source: Survey conducted March 27-April 9, 2018. "Majority of Americans Believe It Is Essential That the U.S. Remain a Global Leader in Space"

2002 Survey - National Space Goals Matula & Loveland, 2006

TABLES 1 & 2: PUBLIC SUPPORT FOR PLANETARY DEFENSE MISSION^{31,32}

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global stability, and secure life on Earth from asteroid threats. They create dual-use technologies that enable economic strength and a multi-trillion-dollar space economy,³³ as well as provide a military logistical advantage.³⁴ Moreover, the U.S. Space Force requirements for Cislunar Space Domain Awareness³⁵ are synergistic with asteroid surveillance and warning.³⁶ Recent studies even suggest it is now possible to both warn of and protect against bolide-size to city-killer-size impactors with existing military technology.³⁷ Once roles are clarified, progress can move from one-time science missions to catalog large objects to an architecture for continuous surveillance and warning of every Earth-crossing object which could injure or damage U.S. and allied interests.

Technologies such as space-based radar, Cis-Lunar space domain awareness (SDA), and advanced propulsion (such as Nuclear Thermal Propulsion) simultaneously create capabilities that reduce the risks of crisis escalation, aid in global stability, and secure life on Earth from asteroid threats. They create dual-use technologies that enable economic strength and a multi-trillion-dollar space economy, as well as provide a military logistical advantage.

CLARIFYING ROLES

Today, however, America's response to the asteroid defense mission is still mostly marked by inaction. Because this is an environmental, as opposed to human-generated, threat, and because it would appear to currently be an unfunded mandate, there is significant uncertainty over whether it constitutes a core warfighting / national security mission, or whether this should belong to a civilian agency such as NASA or DHS/ FEMA. Even within DoD, there is a lack of clarity about responsibilities between NORTHCOM, STRATCOM, USSPACECOM, USSF, MDA, and DTRA.³⁸

Here, Congress can help the situation. In its updates to the *National Defense Authorization Act* (NDAA), Capitol Hill can help to delineate responsibilities and priorities through language that would empower the nation to address the asteroid and bolide threat. Specifically, Congress should:

 Specify that the U.S. Space Force will organize, train, equip and present forces capable of executing advance warning and planetary defense missions, and will be responsible for sustained long-term environmental surveillance of natural space-derived threats, to enable prompt warning, and to execute a prompt and sustained campaign to deflect or destroy potential Earth impacting objects.

- Specify that the USSPACECOM will be responsible for planning and executing a deflection campaign, and serve as lead in coordinating with other federal agencies and international bodies.
- Task USSPACECOM to develop requirements for planetary defense for the Joint Capabilities Integration and Development System (JCIDS) in that calendar year, including requirements for persistent surveillance to provide advance warning and notification of bolide events and requirements for persistent surveillance and in-

terdiction of Earth-crossing objects which could cause substantial damage to life or property.

• Task USSPACECOM with developing a Concept of Operations (CONPLAN) of sufficient detail to allow execution for a basic increment of capability.

- Adequately resource USSPACECOM and the USSF for the above efforts.
- Direct NASA to continue its Planetary Defense Coordination Office (PDCO)³⁹

activities of foundational analysis, simulation and evaluation, and provide adequate funding for the Double Asteroid Redirect Mission (DART)⁴⁰ and the Near-Earth Object Survey Mission (NEOSM),⁴¹ which is the most expeditious way to accomplish the overdue 2005 Congressional survey tasking.

EYES TO THE FUTURE

Unlike other disasters, asteroid strikes are preventable. However, the ambiguity of who should be in charge has stymied progress and U.S. leadership in addressing the threat. Now, however, organizational changes—including the establishment of the U.S. Space Force and U.S. Space Command—have paved the way for the planning and execution of the asteroid defense mission to be entrusted to the Department of Defense.⁴² Doing so will end the two-decade period of ambiguity and inaction, advance the stability of the entire planet, and create comparative advantage against our key competitors. Time, however, is of the essence. Congress should most swiftly to incorporate the above recommendations in the 2021 NDAA.

ENDNOTES

- Section 321 of the NASA Authorization Act of 2005 (Public Law No. 109-155) charged NASA with detecting, tracking and characterizing 90% of Near-Earth Objects (NEOs) with diameters greater than 140 m which could potentially strike Earth, by the end of 2020. This goal is still unmet, and likely will not be achieved until NASA launches NEOSM, www. govtrack.us/congress/billtext.xpd?bill=s109-1281
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- 3. Public Law 116-19 tasks the Space Force with the functions of organize, train and equip to provide "(1) freedom of operation for the United States in, from, and to space; and (2) prompt and sustained space operations" with specified duties to: "(1) *protect the interests of the United States in space*; (2) deter aggression in, from, and to space; and (3) conduct space operations."; Congress.gov, "S.1790 National Defense Authorization Act for Fiscal Year 2020" (Subtile D—United States Space Force Chapter 908, section 9083 Became Public Law No: 116-92) accessed February 3, 2020, <u>https://www.congress.gov/bill/116th-congress/senate-bill/1790/text?format=txt</u>
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- Simon P. Worden, "The Threat of Near-Earth Asteroids," Statement before the House Science Committee, October 3, 2002, http://www.spaceref.com/news/viewsr.html?pid=6723 He stated:

"Two and a half months ago, Pakistan and India were at full alert and poised for a largescale war, which both sides appeared ready to escalate into nuclear war. The situation has defused-for now. Most of the world knew about this situation and watched and worried. But few know of an event over the Mediterranean on June 6th of this year that could have had a serious bearing on that outcome. U.S. early warning satellites detected a flash that indicated an energy release comparable to the Hiroshima burst. We see about 30 such bursts per year, but this one was one of the largest we have ever seen. The event was caused by the impact of a small asteroid, probably about 5-10 meters in diameter, on the earth's atmosphere. Had you been situated on a vessel directly underneath, the intensely bright flash would have been followed by a shock wave that would have rattled the entire ship, and possibly caused minor damage. The event of this June received little or no notice as far as we can tell. However, if it had occurred at the same latitude just a few hours earlier, the result on human affairs might have been much worse. Imagine that the bright flash accompanied by a damaging shock wave had occurred over India or Pakistan. To our knowledge, neither of those nations have the sophisticated sensors that can determine the difference between a natural NEO impact and a nuclear detonation. The resulting panic in the nuclear-armed and hair-triggered opposing forces could have been the spark that ignited a nuclear horror we have avoided for over a half century." [Emphasis added]

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- 17. Patrick Tyler, "Chinese Seek Atom Option to Fend Off Asteroids," *New York Times*, April 27, 1996, <u>https://www.nytimes.com/1996/04/27/world/chi-</u> <u>nese-seek-atom-option-to-fend-off-asteroids.html</u>
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- 19. Namrata Goswami, Statement before the U.S.-China Economic and Security Review Commission, April 25, 2019, <u>https://www.uscc.gov/sites/default/</u><u>files/Namrata%20Goswami%20USCC%2025%20</u> <u>April.pdf</u>; Kevin Pollpeter, Timothy Ditter, Anthony Miller, and Brian Waidelich, "China's Space Narrative: Examining the Portrayal of the U.S.-China Space Relationship in Chinese Sources and its Implications for the United States," China Aerospace Studies Institute, October 2, 2020, <u>https://</u><u>www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20 Space%20Narrative.pdf?ver=FGoQ8Wm2DypB-<u>4FaZDWuNTQ%3d%3d</u></u>
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- 24. Presidential Commission on the Future of the United States Aerospace Industry, "Final Report of the Commission of the Future of the United States Aerospace Industry," November 2002, <u>https://history.nasa.gov/AeroCommissionFinalReport.pdf</u>
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The Aerospace study further suggests that existing ground-based radar technology could provide adequate advanced notice to enable a single site in CONUS could protect all of the United States from smaller city-killing asteroids from a single site, using missile-defense interceptor derived technology.

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DEFENSE TECHNOLOGY PROGRAM BRIEF

June 2021 | No. 24

ABOUT THE DEFENSE TECHNOLOGY PROGRAM

A revolution is taking place in the nature of warfare. The proliferation of ballistic missiles and weapons of mass destruction has given rogue states and terrorist groups unprecedented access to potentially devastating capabilities, while space and cyberspace have emerged as distinct new arenas of strategic competition. The American Foreign Policy Council's (AFPC) work in these areas is aimed at helping U.S. officials understand and respond to this new, and increasingly complex, threat environment.

For more information about the program, please contact Richard Harrison, Vice President of Operations and Director of Defense Technology Programs at Harrison@afpc.org.

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For close to four decades, AFPC has played an essential role in the U.S. foreign policy debate. Founded in 1982, AFPC is a 501(c)(3) non-profit organization dedicated to bringing information to those who make or influence the foreign policy of the United States and to assisting world leaders with building democracies and market economies. AFPC is widely recognized as a source of timely, insightful analysis on issues of foreign policy, and works closely with members of Congress, the Executive Branch and the policymaking community. It is staffed by noted specialists in foreign and defense policy, and serves as a valuable resource to officials in the highest levels of government.

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- arranging meetings and facilitating dialogue between American Statesmen and their counterparts in other countries; and
- fostering the acceptance and development of representative institutions and free market economies throughout the world in a manner consistent with the Constitution, the national interest, and the values of the United States.



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