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How NASA9s Planetary Defense Budget Grew by More Than 4000% in 15 Years: Lessons in Strategic Alignment

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Introduction

Between 2008 and 2023, U.S. expenditures on planetary defense activities grew by an astonishing 4175%, from 3.3 million USD to 137.8 million USD [1]. This growth allowed NASA's planetary defense activities to expand beyond ground-based surveys to in-space deflection and detection missions. Yet, during this period, the fundamental arguments for investing in planetary defense did not change; for decades it has been understood that getting hit by a large asteroid is bad. So what caused this extraordinary growth? And can it be generalized to other space agencies and nations beyond NASA and the U.S.?

This paper analyses the last 15 years of NASA budgets and finds that funding was not strongly associated with congressional legislation or high-profile external events like Chelyabinsk. Instead, budgetary growth primarily originated at the behest of NASA when planetary defense activities aligned with the needs of more established directorates, such as human spaceflight.

Timeline of Events and Policy Outcomes

Planetary defense has historically been a low priority of the U.S. government. Although there was increasing awareness of hazardous near-Earth objects (NEOs) in the 1970s and 1980s, NASA funded no sustained, directed program to seek out and characterize them until Spaceguard in 1998. Starting that year, and continuing for the next 12 years, annual expenditures for NEO observations and related activities were between 3 million USD and 5 million USD [2], roughly three times less than annual employee travel expenses at NASA Headquarters [3]. It was not until the 2010s that the agency began requesting more substantial sums, growing first into the tens of millions, and, beginning in 2019, hundreds of millions of dollars per year.

Though funding for planetary defense stalled in the 2000s, policy development did not. Congress, via NASA authorization legislation and annual appropriations reports, directed NASA to pursue an increasingly ambitious NEO survey program. Congress mandated pivotal studies that set the table for future program development, reaching its acme with the George E. Brown Survey Act in 2005 that established a 90% detection threshold for 140-meter and larger NEOs and amended NASA's official set of responsibilities to include NEO detection and characterization [4]. These policies were responsive to external events, notably the 4581 Asclepius close approach in 1989, the Shoemaker-Levy 9 impact on Jupiter in 1994, and the Apophis close approach in 2004 (see Table 1).

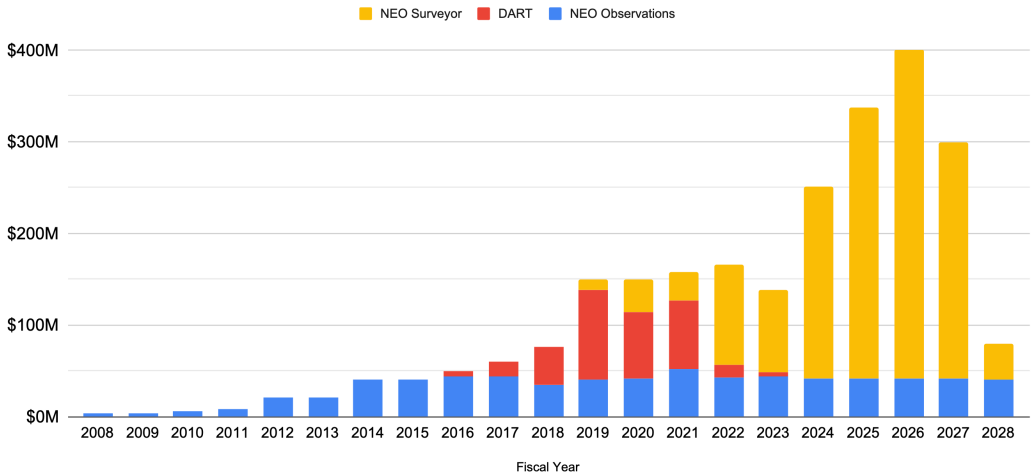

Figure 1. Obligations for NEO observations/planetary defense activities at NASA, by fiscal year. Amounts after FY 2023 are projections.

The establishment of policy, however, did not drive funding increases to NASA's NEO survey programs. It wasn't until five years after the George E. Brown Survey Act that NASA requested its first substantial increase for NEO observations, to 20.4 million USD. The request increased again to 40 million USD in 2014. Both increases align with the addition of asteroid initiatives to NASA's human spaceflight program.

Year	External Event	Policy	Funding Request
1989	4581 Asclepius close approach		N/A
1990	Discovery of Chicxulub impact crater	Congress mandates "Spaceguard" study in the 1990 NASA Authorization	N/A
1992	Comet 109P/Swift-Tuttle rediscovery		N/A
1994	Shoemaker-Levy 9 Jupiter Impact	Congress requests a 1-km NEO survey program in House 1994 NASA Authorization	N/A
1998	Armageddon and Deep Impact Released	NASA begins Spaceguard	~$4M/yr
2004	Apophis close approach		~$4M/yr
2005		140m NEO survey mandated in 2005 NASA Authorization. NASA Act amended with planetary defense responsibility.	~$4M/yr
2013	Chelyabinsk bolide		$20M
2014		House NASA Authorization reiterates 140m NEO survey mandate and calls for a budget to enable the 2020 goal.	$40M

Table 1. *Notable external events tend to correlate with subsequent policy action, though not with budgetary increases.*

In 2009, the Obama Administration convened the Review of United States Human Space Flight Plans Committee to evaluate NASA's human spaceflight efforts, including Constellation, which aimed to return humans to the Moon by 2020. The report, released later that year, declared the program "unsustainable" and proposed a "flexible path" for human exploration, notably proposing the exploration of a near-Earth asteroid as a destination for astronauts [5].

NASA's congressional budget justification for the fiscal year 2011, released months after this report, canceled Constellation and stated that NASA would lay "groundwork that will enable humans to safely reach multiple potential destinations, including the Moon, asteroids, Lagrange points, and Mars and its environs." It also contained a 400% increase in NEO observations funding. The connection to human spaceflight was made explicit: "the budget for NEO observations will significantly expand our efforts to find and characterize asteroids and comets approaching Earth which may be destinations and resources for our exploration of the solar system" [6]. Later that year, the Obama Administration released its national space policy, which contained the new directive for NASA to send humans to an asteroid by 2025 [7].

The fiscal year 2014 budget request contained the next major increase for planetary defense, doubling the NEO observations budget to 40 million USD. This was also explicitly tied to the agency's human spaceflight goals. The budget proposed the Asteroid Redirect Mission, which would have moved a small asteroid to lunar orbit to be explored by astronauts. To succeed, NASA needed to find a suitable near-Earth asteroid, a problem potentially solved by further expanding NEO searches, declaring that "information gathered in this effort will support the proposed mission to retrieve an asteroid" [8].

In 2019, NASA established the Planetary Defense Coordination Office and a distinct account line with NASA's Planetary Science Division budget. This budget line contained the program's first spacecraft development project: the Double Asteroid Redirection Test (DART). Funding effectively tripled to 150 million USD to accommodate the new flight line.

DART had already occupied the interest of Congress, which began appropriating unrequested project funding to NASA in 2017, likely due the Maryland delegation, location of the Johns Hopkins Applied Physics Laboratory (JHU-APL). JHU-APL had recently wrapped up the development of several spaceflight missions, including the Van Allen Probes and Parker Solar Probe, and had no other planetary missions in the pipeline. In addition to the project's inherent value, DART would help support their skilled workforce. Securing the project became a priority for the lab, which courted legislative and NASA support.

The DART proposal coincided with a new Administration and new NASA science leadership. It was a low-cost, short-term project philosophically aligned with their views on NASA's responsibilities to the public [9]. Additionally, the DART project cultivated technology demonstration opportunities from other NASA centers to build an invested constituency within the space agency itself. Though DART addresses an existential risk to humanity, it was sold to NASA as providing parochial and political solutions to near-term needs.

NEO Surveyor (née NEOCam), on the other hand, struggled for years to secure funding. Unlike DART, the NEO Surveyor project competed in NASA's Planetary Science Division Discovery program, which supports frequent planetary mission opportunities in the 500 million to 1 billion USD range. Despite multiple applications, reaching the final selection stage, and receiving funds for an "extended Phase A" study, NEO Surveyor was never selected as a Discovery program. Though it will provide good science, its primary purpose as a planetary defense mission made it uncompetitive against "pure" planetary science mission concepts. It was not until the establishment of a dedicated Planetary Defense Program budget line did the development of NEO Surveyor move forward.

Conclusions

Planetary defense is a relatively new field, even by space-age standards. It occupies a nascent foothold in a large bureaucracy organized around human exploration and science efforts. Despite this, it has secured significant funding increases over the past 15 years. Some lessons can be drawn from this history:

1. External events drive planetary defense policy
Major planetary defense policy developments in the U.S. are closely related to high-profile NEO flybys or impacts. Every close approach is an opportunity to establish better policy.

2. Supportive policy does not guarantee funding
Despite various planetary defense directives from Congress, funding did not increase for this effort until it aligned with internal NASA priorities.

3. Funding growth came at the behest of NASA
Congress was unwilling or unable to provide unilateral increases to NEO observation programs, even after establishing supportive policy. Funding increases primarily came from NASA in its annual President's Budget Requests.

4. ***Program alignment drove funding requests***
Planetary defense budgets generally increased when the program aided other, more established activities within the agency, including human spaceflight, technology development, or workforce needs.

5. Planetary defense could not compete with scientific initiatives for funding
While it has scientific merit, planetary defense activities were not competitive with "pure" scientific projects. Ultimately planetary defense had to be considered distinct from a budgetary and policy perspective to secure resources.

6. Outcomes are sensitive to individual initiative
The role of "champions" — both internal in the space agency and external in the legislative branch — was key to early growth in planetary defense funding.

Securing funding for a new program within an established bureaucracy is a distinct challenge requiring the actions of motivated individuals to present planetary defense as a solution to existing problems, rather than a problem to be solved. While high-profile external events such as near-Earth approaches can be leveraged to generate supportive policies, this is not a sufficient outcome for funding growth. Within the space agencies themselves, positioning planetary defense activities as tools to serve immediate needs of larger, more entrenched bureaucratic interests has been a successful strategy for securing funding increases.

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