Planetary Defense: Findings and Recommendations from The National Academies Planetary Science and Astrobiology Decadal Survey 2023 - 2032

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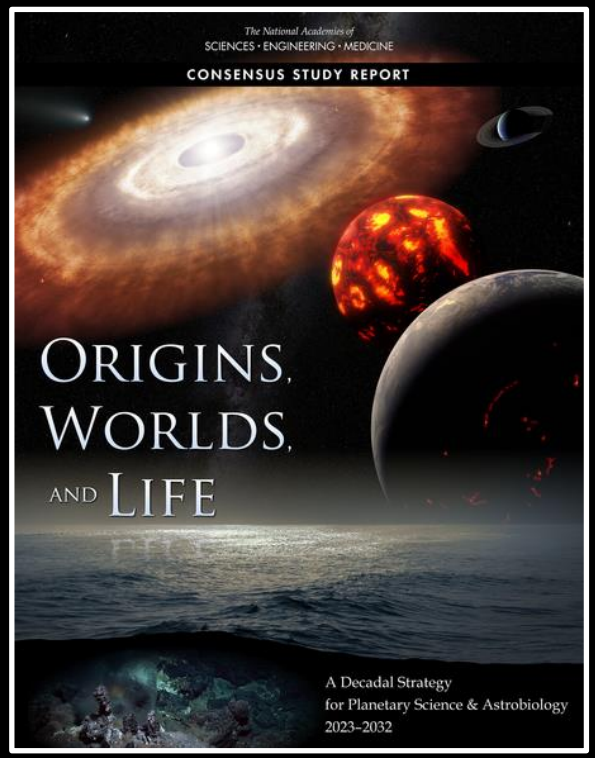
  - Released on April 19, 2022 as "*Origins, Worlds, and Life: A Decadal Strategy for Planetary Science & Astrobiology 2023-2032*"



Planetary Defense in The Decadal Survey

- The statement of task specifically calls out the topic of Planetary Defense to be addressed and included in the Decadal Survey for the first time
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- Planetary Defense activities recognized as a key element that falls under the direction of the NASA Science Mission Directorate's Planetary Defense Coordination Office

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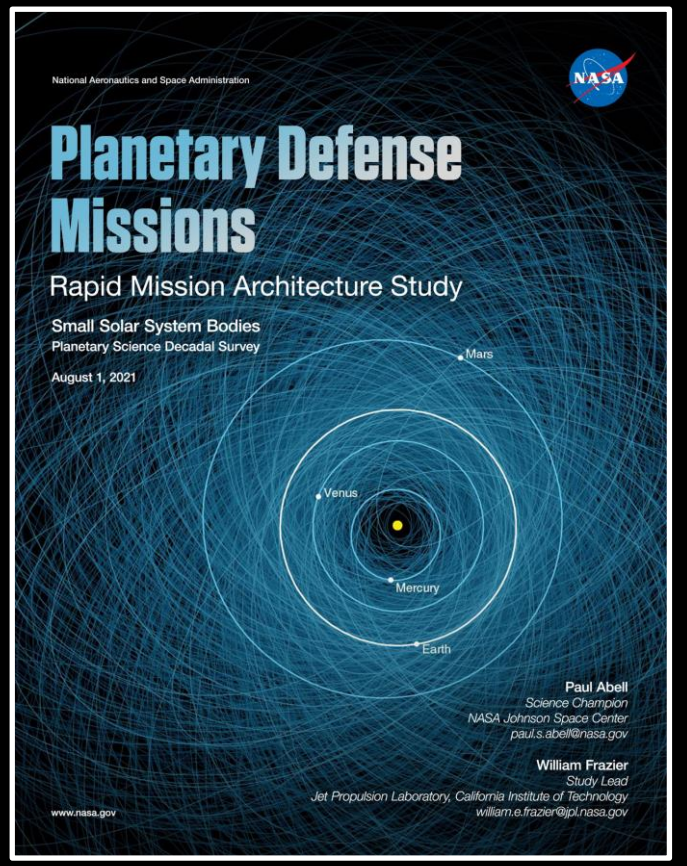

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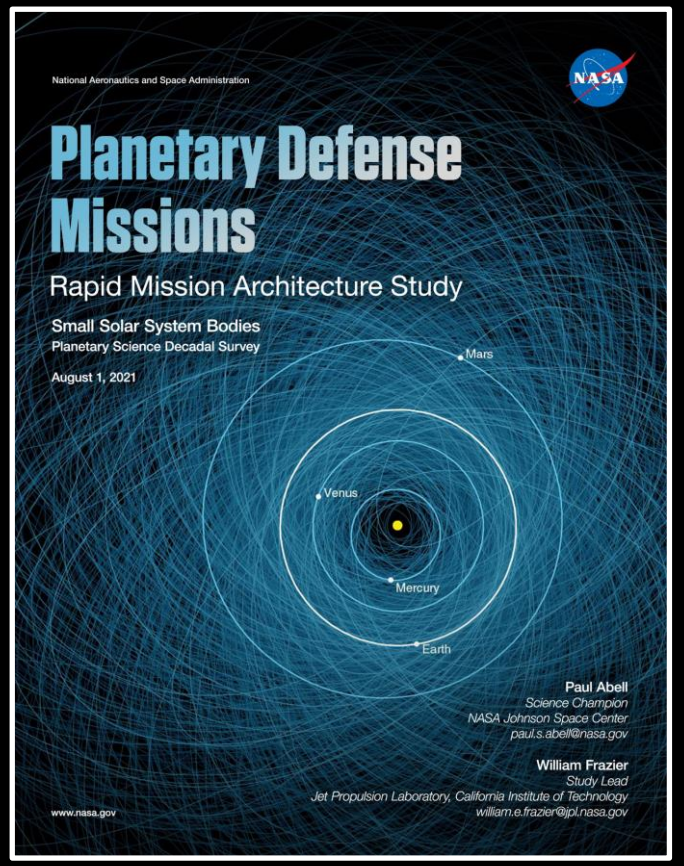
  - 30 different options for in-situ missions were examined and evaluated



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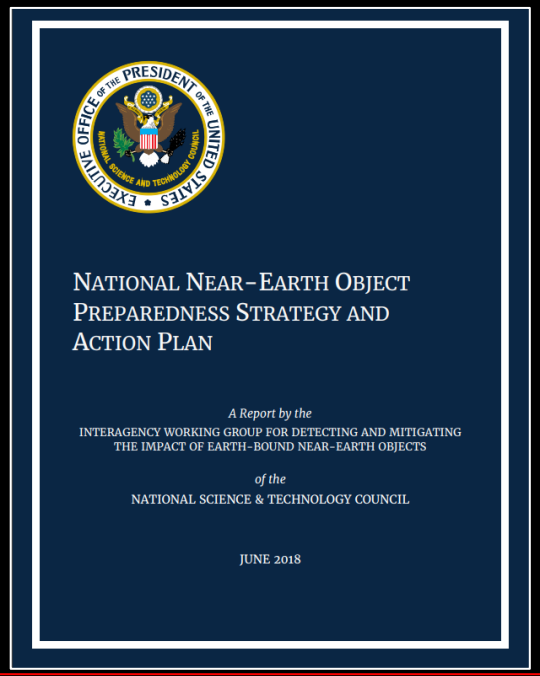

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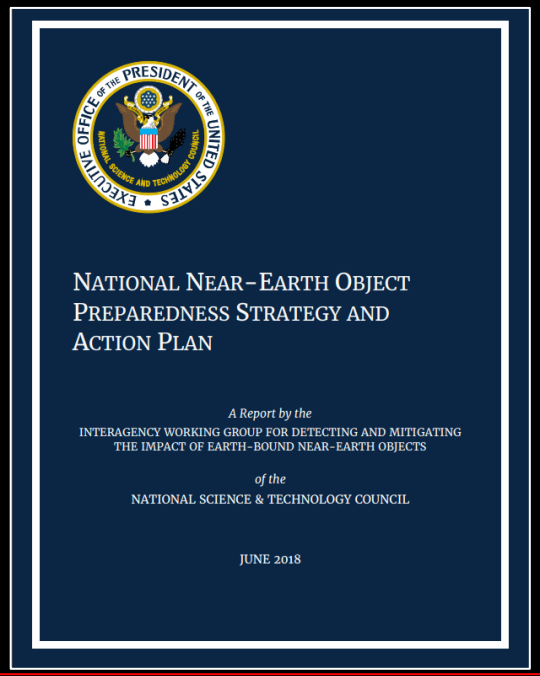

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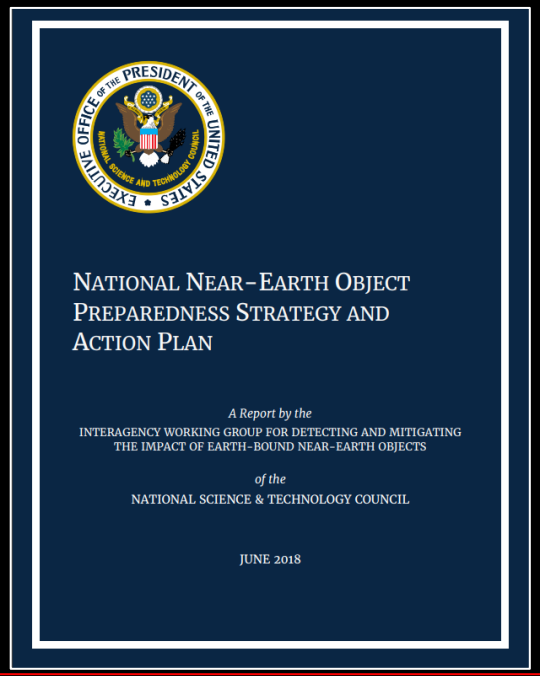

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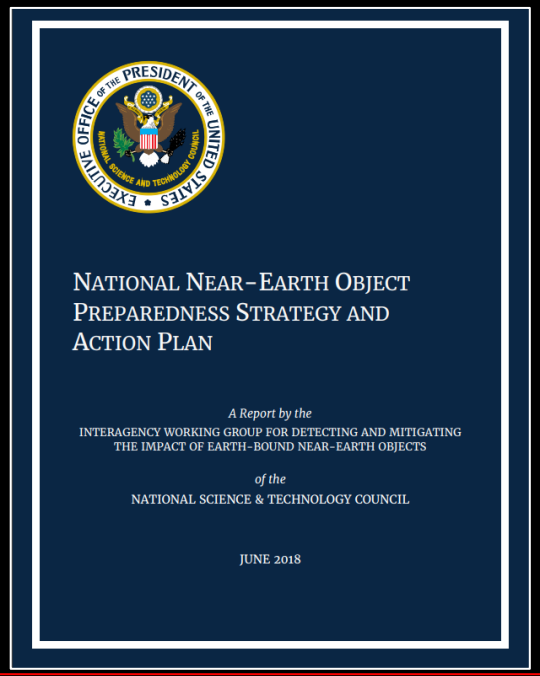

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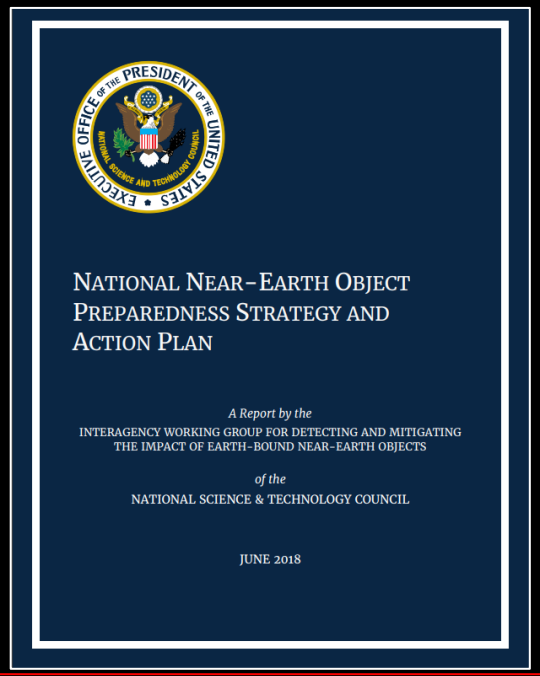

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- Improve NEO Modeling, Prediction, and Information Integration
- Develop Technologies for NEO Deflection and Disruption Missions
- Increase International Cooperation on NEO Preparation
- Strengthen and Routinely Exercise NEO Impact Emergency Procedures and Action Protocols

KEY FINDINGS AND RECOMMENDATIONS – PD MISSIONS

Finding: The recommendation of the 2019 NASEM report, Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes, remains valid and important to follow for the next decade and beyond:

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Finding: The recommendation of the 2019 NASEM report, Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes, remains valid and important to follow for the next decade and beyond:

"Missions meeting high-priority planetary defense objectives should not be required to compete against missions meeting high-priority science objectives."

KEY FINDINGS AND RECOMMENDATIONS – NEO SURVEYOR

Finding: The first priority in planetary defense is early detection, tracking, and characterization, of NEOs, whose impact may cause widespread regional damage. NEO Surveyor, in development by NASA for this purpose, is the most timely and effective means to complete the survey goal of detecting 90 percent of NEOs greater than 140 m in diameter.

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Recommendation: NASA should fully support the development, timely launch, and subsequent operation of NEO Surveyor to achieve the highest priority planetary defense NEO survey goals.

KEY FINDINGS AND RECOMMENDATIONS - APOPHIS

Finding: The Apophis flyby of Earth creates an opportunity to observe a potentially hazardous asteroid via a coordinated ground-based campaign, potentially supplemented via space-based observations from flyby or rendezvous missions.

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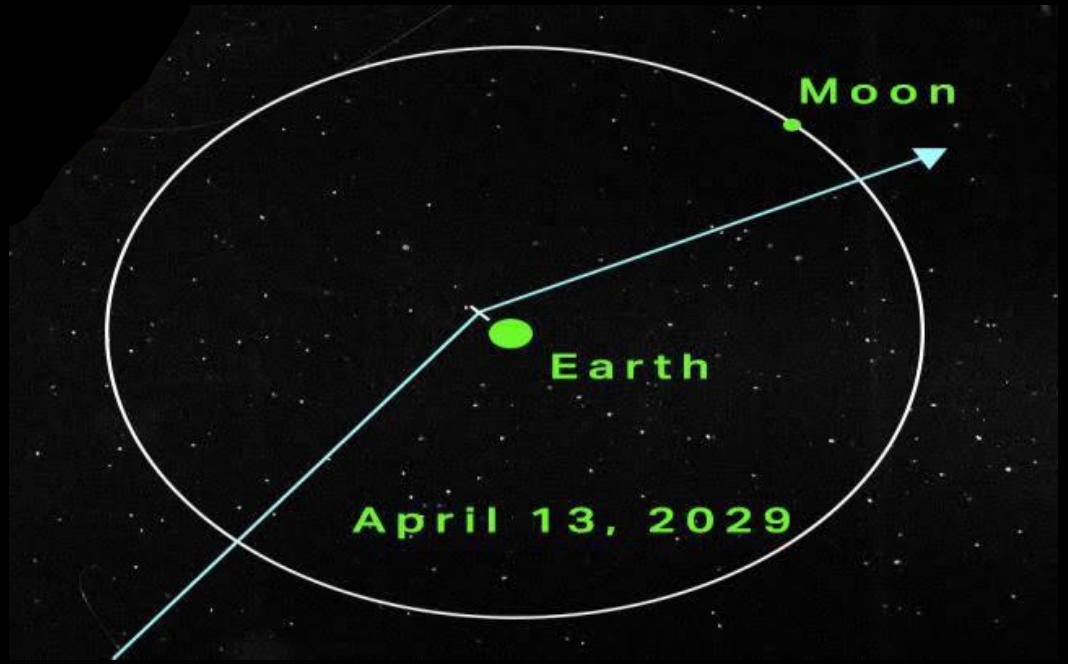

Recommendation: NASA should study all relevant observing opportunities surrounding the unique Apophis encounter, using both ground and space-based assets. To maximize the scientific and planetary defense return, NASA should develop plans for making the best use of these identified assets during the Apophis encounter and support international cooperation in carrying out these valuable observations.

KEY FINDINGS AND RECOMMENDATIONS – AFTER DART

Finding: Due to the diversity of possible NEO threats, including variation across individual object characteristics and differences in warning time before Earth impact, significant deflection technology questions will remain even after a full analysis of a successful DART experiment in 2022.

KEY FINDINGS AND RECOMMENDATIONS – AFTER DART

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Finding: Sustained investment in planetary defense mission technology and development of additional demonstration missions beyond DART would enable NASA to accomplish critical planetary defense characterization and mitigation objectives for a variety of impact scenarios and build upon the lessons learned from the DART mission.

Key Findings and Recommendations – Rapid Recon

Finding: Prior characterization of a hazardous NEO via an in situ reconnaissance mission is advisable to determine its physical characteristics and to develop an appropriate mitigation response based on the available warning time. Although rendezvous missions are preferred, fast flyby missions may be required to obtain timely characterization data for short warning time scenarios.

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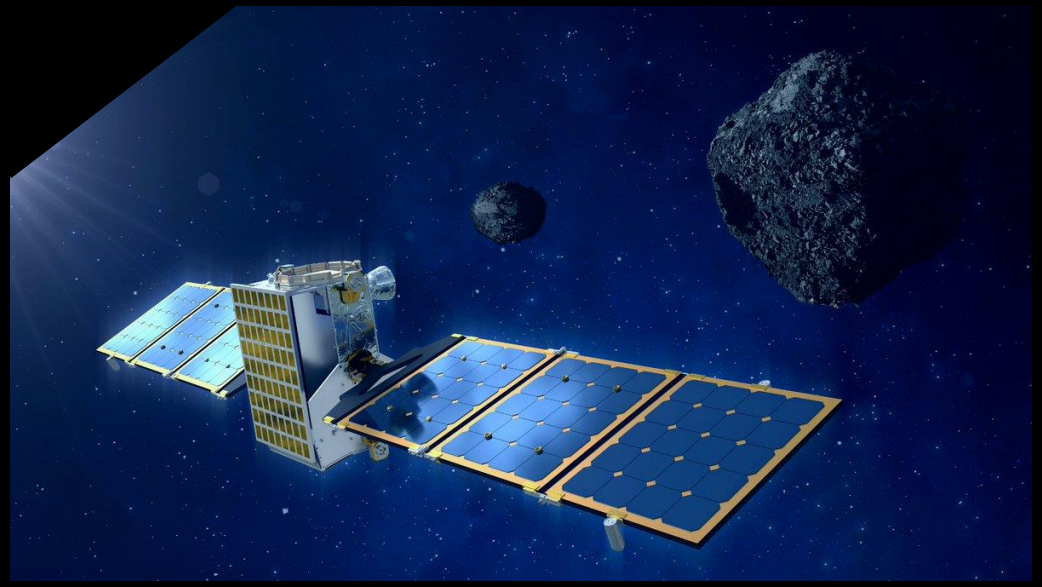

Recommendation: The highest priority planetary defense demonstration mission to follow DART and NEO Surveyor should be a rapid-response, flyby reconnaissance mission targeted to a challenging NEO, representative of the population (~50-to-100 m in diameter) of objects posing the highest probability of a destructive Earth impact. Such a mission should assess the capabilities and limitations of flyby characterization methods to better prepare for a short-warning-time NEO threat.

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Finding: Impact scenarios may vary widely given the diverse range of NEO physical characteristics and potential warning times. As such, it is important to have several mature technologies available and optimized for possible planetary defense characterization and mitigation situations before they arise.

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DART
Double Asteroid Redirection Test

AIDA
Asteroid Impact &
Deflection Assessment

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Such information is vital for developing a long-term integrated planetary defense capability able to protect humanity in the decades to come.