Consensus Study Report
HIGHLIGHTS
June 2019

Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes

Near Earth objects (NEOs) are asteroids or comets ranging in size from tens of meters to tens of kilometers with trajectories that potentially intersect with Earth's orbit. Although large impacts with Earth are exceedingly rare, the early detection of hazardous asteroids is important for preparing possible countermeasures. NASA is currently tracking nearly all the kilometer-sized asteroids large enough to cause a global extinction event and has determined that they are not on collision courses with Earth; however, smaller asteroids that are more numerous and difficult to detect still have the potential to cause significant destruction at a regional level.[1] The 2005 George E. Brown Act charged NASA with detecting 90% of asteroids 140 meters in diameter or larger by 2020. Having only catalogued about one third of the estimated 24,000 NEOs larger than 140 meters after two decades, NASA is still far from achieving this goal and will not be able to accomplish it with currently available resources.

The National Academies of Sciences, Engineering, and Medicine was commissioned by NASA to evaluate the strengths and limitations of space-based infrared and visible wavelength telescopes for detecting and tracking asteroids. ***The study found that if NASA is to achieve the asteroid detection goals set out in the George E. Brown Act within a reasonable period of time,[2] the agency should fund a dedicated space-based infrared survey telescope that would work with ground-based telescopes to detect asteroids.*** While both infrared and visible wavelengths can detect NEOs, infrared measurements can determine asteroid size with greater speed and accuracy, making an infrared telescope a better option for NEO detection.

CREATING A NETWORK OF GROUND-BASED AND SPACE-BASED NEO OBSERVATIONS

Currently, NASA uses several ground-based telescopes located in the United States for detecting and tracking NEOs, but these telescopes have limited capabilities due to the day-night cycle, weather, and the effects of Earth's atmosphere. A dedicated space-based infrared telescope, working in conjunction with current ground-based telescopes would greatly improve data collection and detection efficiency. Therefore, if NASA develops a space-based NEO telescope, it should also continue to fund both short- and long-term ground-based observations that can be used to refine the orbits and properties of NEOs in order to assess the risk they might pose to Earth.

PRIORITIZING PLANETARY DEFENSE

Past space-based NEO survey mission proposals such as NEOCam have been required to compete with scientific programs for selection within NASA. This has put them at a competitive disadvantage because of fundamental differences in their objectives. Therefore, missions meeting high-priority planetary defense objectives should compete in separate funding opportunities from missions meeting high-priority science objectives.

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[1] *See Table 1.1 on the next page for a breakdown of various types of near Earth objects by size, quantity, and estimated damage.*

[2] *The committee defines a "reasonable amount of time" as within ten years from the launch of a dedicated space telescope.*

TABLE 1.1 The Likely Consequences of an Asteroid Impact as a Function of Asteroid Size

Characteristic Diameter of Impacting Object	Approximate Average Impact Interval (years)	Estimated Number of Objects	Energy Released (megatons TNT)	Estimated Damage or Comparable Event
25-30 m	80-180	2.6-5.5 million	2	Fireball, airburst, shockwave, minor damage
50 m	1,500	>~310,000	10	Local damage comparable to that of largest existing thermonuclear weapon
140 m	20,000	~24,000	~500	Destruction on regional/ national scale
300-500 m	≥64,000-130,000	3,500-7200	≤10,000	Destruction on continental scale
1 km	520,000	~900	80,000	Global effects, many millions dead
10 km	120 million	4	80 million	Complete extinction of the human species

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This Consensus Study Report Highlights was prepared by the Space Studies Board based on the report *Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes* (2019). The study was sponsored by NASA. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of the sponsors. Download the report at nap.edu.

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