

Testimony to the U.S. House of Representatives Committee on Science, Space and Technology

Hearing on Threats from Space: A Review of Private and International Efforts to Track and Mitigate Asteroids and Meteors

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My name is Ed Lu, and I am the CEO of the B612 Foundation. Thank you for the opportunity to testify before the House Science, Space and Technology Committee to describe the B612 Foundation Sentinel Space Telescope project and its importance. The B612 Foundation is a Silicon Valley based nonprofit that is building, launching, and operating the Sentinel Space Telescope, which will find and track threatening asteroids.

NASA's Spaceguard Survey has already discovered more than 90 percent of asteroids larger than 1km. Why must we identify and track asteroids smaller than this?

The impact of a 1 km or larger asteroid would have energy of 40 thousand megatons, and would likely end human civilization regardless of where on the Earth it occurs. However smaller yet still potentially catastrophic asteroids are still largely not tracked. For example, the impact of a 140 meter asteroid would release several times more energy than all the munitions used in WWII. Yet have only observed and tracked less than 10% of asteroids in this size range. The impact of a 40 meter asteroid "city killer" such as the one that struck Tunguska on June 30, 1908 obliterated nearly 1000 square miles. Yet we have only observed and tracked less than 1% of asteroids in this size range. We have the technology to deflect asteroids to prevent an impact on Earth, but this technology is useless until we find asteroids first. We cannot deflect (or for that matter capture, visit, or explore) an asteroid that we haven't yet found. We simply do not know when the next catastrophic asteroid impact will be, because we have not yet tracked the great majority of asteroids.

Why is an infrared space telescope needed to discover and track these smaller yet still dangerous asteroids?

Asteroids are not only small but are often as dark as charcoal. That makes asteroids difficult to spot with ground based optical telescopes because not only are they dim, but the background sky is bright. But the fact that asteroids are dark can be used to our advantage if we observe in infrared. Asteroids are much easier to detect in infrared because they are warmer and thus brighter than the background sky in these wavelengths, and can therefore be seen at much greater range using infrared as opposed to optical. Such infrared observations can only be made from space, as the Earth's atmosphere absorbs these infrared wavelengths of light. The National Academies Report "Defending Planet Earth" published in 2010 describes how finding a substantial fraction of "city killer" asteroids like the 1908 Tunguska asteroid will require a space based infrared telescope.

Finding and tracking the roughly 1 million asteroids of this size in a reasonable timeframe requires a system capable of finding tens to hundreds of thousands of asteroids per year. This cannot be done even by large ground based optical telescopes, and it especially cannot be done by small optical telescopes. That means amateur astronomers unfortunately will not substantially contribute to this effort, and neither will small space based optical telescopes which some commercial companies have proposed to operate. Such a task requires an infrared space telescope.

Why is it critical to place Sentinel in Solar orbit (similar to the planet Venus)?

Asteroids that will hit Earth have orbits that cross Earth's orbit, and therefore are sometimes located in the direction of the Sun when viewed from Earth. Earth based telescopes cannot observe these asteroids when they are located in their "blind spot", i.e. when they are interior to the Earth. However, Sentinel will orbit the Sun interior to the Earth, in a solar orbit similar to that of the planet Venus. From that vantage point, Sentinel will be able to continuously look outwards away from the Sun while scanning Earth's orbit. This vantage point combined with Sentinel's ability to track asteroids from greater distances, means that Sentinel will typically be able to track an individual asteroid for several months at a time, which allows the orbit of that asteroid to be determined accurately. This is critical because many asteroids will have orbits which at first may appear to pose a threat to Earth until further observations can be used to refine our knowledge of the asteroid orbit well enough to rule out an impact. This is problem for telescopes located on or near Earth, as many asteroids can only be observed for a few weeks and then cannot be observed for long periods of time (often many years) because these asteroids recede in their orbits to the other side of the Sun for extended periods. Sentinel will orbit the Sun every 8 months, and so it will be able to observed and track these asteroids much more frequently, and therefore will be able to refine the orbits of such asteroids much faster. This will reduce incidences of asteroids having long periods of uncertainty such as we witnessed for the asteroid Apophis from 2004 until about 2010 (when our data was insufficient to be able to rule out an impact with Earth).

What is the role of the B612 Foundation and what makes it unique?

The B612 Foundation is a Silicon Valley based nonprofit that is philanthropically funded. We are funding, building, launching and operating the Sentinel Space Telescope. Because the problem of asteroid impacts is inherently a worldwide problem, the B612 Foundation has donors and supporters from around the world.

Our prime contractor is Ball Aerospace, located in Boulder, CO. Ball has previously built the Kepler Space Telescope, and the Spitzer Infrared Space Telescope on which Sentinel is largely based. We do have some non-financial support from NASA, which is providing use of the antennas of the Deep Space Network for telemetry and tracking, in addition to some technical consulting.

One of the unique aspects of the Sentinel mission is the way it is being managed. We are procuring Sentinel under commercial fixed price terms, much like communications and Earth observing spacecraft are procured. This is the first interplanetary mission to be managed in this fashion. We believe this is possible because Ball Aerospace has substantial experience with similar missions and much of Sentinel is based on that hardware, because there are no fundamentally new technologies which must be developed, and because both B612 and Ball have assembled world class technical teams. The B612 Foundation is managing this project in an innovative Silicon Valley fashion but with the rigor of a NASA project.

What is the status of the Sentinel Space Telescope project?

Sentinel is planned to launch in July 2018. The technical and management teams at both B612 and Ball are largely in place. There are 8 major milestones between project inception and launch. The first major milestone, the Concept and Implementation Review, was completed in September of 2012. The next major milestone, the Systems Definition Review, is scheduled for late fall of 2013. Prototype infrared imaging detectors have been fabricated and are currently in test.