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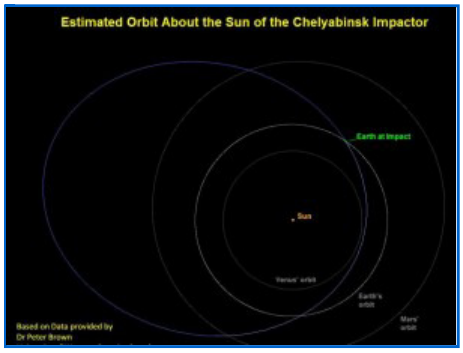
Could Another Chelyabinsk-Scale Meteor Sneak Up on Us?

By John Matson | February 20, 2013

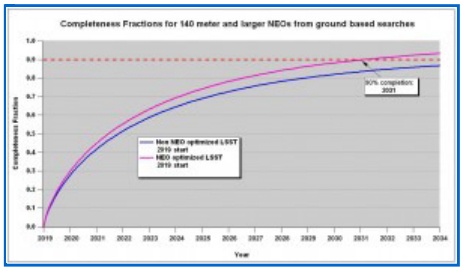


Credit: ESA

When a 17-meter asteroid barreled into Earth's atmosphere over central Russia on February 15, releasing a powerful shock wave that injured more than 1,000 people, many observers wondered how such a momentous event could arrive unheralded. The fact is, the object that exploded in a fireball over Chelyabinsk, releasing hundreds of kilotons of energy, was small potatoes. There may be millions of comparably sized objects in the inner solar system, only a small fraction of which have been discovered. The searches to date have been focused on tracking much larger dino-killers and other potentially catastrophic asteroids and comets—those objects larger than about one kilometer. So the door has been open to unpleasant but ultimately survivable asteroid surprises.

Several new and forthcoming projects will amass reams of new data about the near-Earth asteroid (NEA) population, but a comprehensive catalogue of Chelyabinsk-scale objects remains beyond the technological horizon. The asteroids are too numerous, and too faint, to be systematically tracked. Below is a rundown of some of the best tools that researchers currently have for asteroid detection and defense:

> The **Catalina Sky Survey** discovers about 600 NEAs every year from telescope sites in Arizona and Australia. Since the mid-2000s Catalina has been the leading NEA-detection project in existence, helping NASA to reach its goal of cataloguing 90 percent of all near-Earth asteroids larger than one kilometer in diameter. But its pace of discovery is too slow to make a significant dent in the much larger populations of smaller objects. Near-Earth asteroids larger than 100 meters likely number in the tens of thousands, whereas nearby asteroids 10 meters and up number in the millions.
>
> The first of four planned **Pan-STARRS telescopes** in Hawaii recently came online and is now the second-leading NEA search in existence, in terms of objects detected per year. In 2012, its second full year of operation, Pan-STARRS discovered 251 near-Earth asteroids, according to NASA statistics. It should help discover many asteroids with diameters in the hundreds of meters, but the bulk of smaller objects will remain out of reach.



Projected near-Earth object discoveries with LSST. Credit: LSST

> The **Large Synoptic Survey Telescope**, which should come online toward the end of the decade in Chile, will be a survey telescope of astonishing capability. The 8.4-meter telescope, equipped with a 3-gigapixel digital camera, will scan the skies every few nights to pick up moving objects or transient events. But even the LSST will have trouble picking up asteroids as small as the one that impacted the atmosphere over Russia last week. It will take decades of work (*right*) before the LSST has catalogued the vast majority of much larger objects—those 140 meters and up—thereby meeting NASA's next asteroid-detection goal.

If an asteroid were detected years in advance, the world's governments could take corrective action—detonating, nudging or tugging a hazardous object onto a safer orbit. The **Asteroid Terrestrial-Impact Last Alert System (ATLAS)** has a much simpler goal: detect asteroids just weeks before impact so as to warn or evacuate the threatened areas. ATLAS, which will comprise several small telescopes in Hawaii, is in development with financial assistance from NASA and may be operational by 2015. Its planners estimate that a 50-meter "city killer" could be detected one week ahead of impact.

The nonprofit B612 Foundation recently unveiled its plans to build the **Sentinel Space Telescope**, an asteroid spotter that would scan the inner solar system in the infrared from an orbit similar to the planet Venus. If the foundation can raise the hundreds of millions of dollars needed to build Sentinel, the spacecraft would launch in 2018 and make quick work of the truly dangerous asteroids out there. The Sentinel mission design calls for a telescope that would catalogue 90 percent of NEAs bigger than 140 meters over its 6.5-year mission. According to a recent statement from B612, the Sentinel would also spot more than half of the currently undiscovered asteroids larger than about 50 meters.

With limited resources, asteroid spotters have naturally focused on the largest asteroids that could cause the most mayhem. But the smaller, more frequent arrivals to our planet are likely to remain unpredictable for the foreseeable future. On the bright side, no deaths have been reported as a result of the Chelyabinsk incident, and the odds of the next significant meteor exploding over such a populous area are slim.

And, fortunately, impacts on the scale of the Chelyabinsk meteor are predicted to occur only once a century. So perhaps humankind will have figured out better techniques for discovery and tracking by the time the next one comes our way.

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