

Small asteroids can do great damage, study predicts

by World Science Staff

An asteroid whose fiery encounter with our atmosphere incinerated a swath of Siberian forest, in 1908, was only a fraction as large as previously thought, new research suggests. That would mean such devastating events are more common than estimated and might happen every two to three centuries, if a recent NASA analysis is correct.

Researcher Mark Boslough points out details of a "fireball" that a simulation shows would result from an asteroid bursting in the atmosphere. (Photo by Randy Montoya)

As with ordinary rocks, small asteroids outnumber big ones. Thus events like the Siberian blast are not as improbable as we had believed, said Mark Boslough of Sandia National Laboratories in New Mexico, principal investigator in the new study. "We should be making more efforts at detecting the smaller ones." The June 30, 1908 explosion over Tunguska, Siberia, flattened some 60 million trees over about 2,000 square km (500,000 acres) of unpopulated forest. Boslough and colleagues ran supercomputer simulations to re-enact what happens when an asteroid bursts in the sky, as is believed to have occurred then. The simulations "which the U.S. government laboratories currently conducts are the best to date" show the blast shooting a hot fireball downward faster than sound. Compared to an explosion that stays where it started, Boslough said, this causes stronger blast waves and blinding light pulses, or thermal radiation, at the ground level. "Our [previous] understanding was oversimplified," he said. Now, "we no longer have to make the same simplifying assumptions, because present-day supercomputers allow us to do things with high resolution in 3-D." The research offers one encouraging revelation, Boslough said: the blast caused less devastation than previously thought, because extraneous factors likely amplified the damage. For one, forests believe the affected woodland was unhealthy at the time. None-the-less, Boslough and colleagues said, the most important finding was the small size of the asteroid, and this should prompt a new look at current asteroid detection efforts. What really demystifies an asteroid's destructive potential, he wrote in an e-mail, is its kinetic energy, or mass times velocity squared. But the new findings indicate that for a given speed "estimated to have been more than five times that of sound, in this case" the asteroid needed to be only one-third to one-fourth as heavy as previously estimated. "If the White House were made out of a solid rock, it would have just about the right mass," Boslough wrote; so would a stone ball 30 to 40 meters (33 to 44 yards) wide. The necessary size also depends on the object's precise makeup, added Boslough, who with colleagues drew worldwide attention in the 1990s by correctly predicting that comet Shoemaker-Levy 9 would create a fireball visible from Earth when it hit Jupiter. The new Tunguska simulations indicate that an incoming asteroid is compressed by resistance from Earth's atmosphere. As it pushes deeper, the growing resistance blasts it apart, leading to the downward flow of hot gas. Because this enhances the destruction, the blast probably needed to release only three to five megatons of power, the researchers said "not the previously estimated 10 to 20. Such a re-evaluation of the power would mean Tunguska-type events happen around three times as often as previously believed, according to a 2003 report by NASA's Near-Earth Object Science Definition Initiative Team. Specifically, the report said, such revised estimates would suggest Tunguska-type events happen every 250 years or so on average, rather than every 600 to 1000. Boslough's work was presented at the American

Geophysical Union meeting in San Francisco on Dec. 11, and accepted for publication in the International Journal of Impact Engineering.

Courtesy of World-Science

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