Tunguska's Blast: Less is More

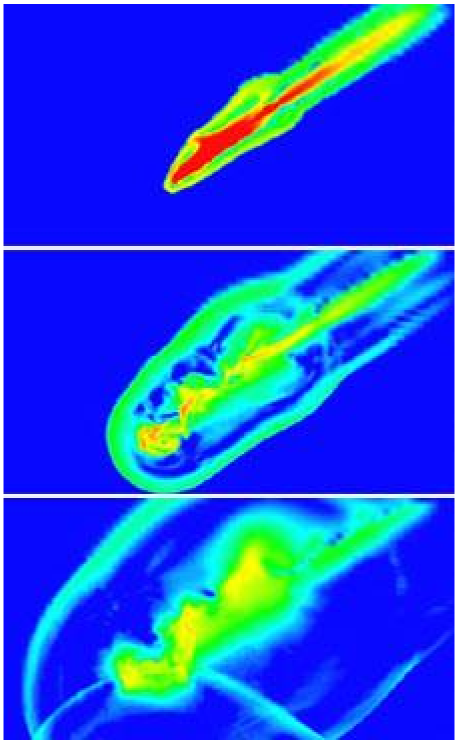
Next summer marks the centennial anniversary of one of Earth's most famous "close encounters" with an extraterrestrial object. On June 30, 1908, something big exploded in the sky over a remote section of Siberia near the Podkamennaya Tunguska River. The blast leveled about 800 square miles of forested taiga.

Trees near the Podkamennaya Tunguska River in Siberia still looked devastated nearly two decades after a large meteorite exploded above the ground in June 1908. The Tunguska event, which ranks as one of the most violent cosmic impacts of this century, leveled nearly 800 square miles of forested taiga.
Smithsonian Institution

That much scientists can agree on.

But for decades they've debated what exactly caused the airburst — wild speculations have included everything from mini black holes to exploding alien spacecraft. The general consensus is that the impactor was a chunk of asteroid or perhaps a small comet, but there's still disagreement on how big a kinetic-energy punch it delivered. Most estimates for the blast's energy range from 10 to 40 megatons of TNT, consistent with an impactor roughly 150 to 300 feet across.

The problem is that evidence has been piling up that objects of that size shouldn't hit Earth very often, once every couple thousand years or so. This has forced researchers to try to explain Tunguska's widespread devastation with something smaller and thus likely to strike Earth more often.



These three frames are from a computer simulation of the 1908 Tunguska event. An impactor with 5 megatons of kinetic energy disintegrates and explodes 8 miles up, sending a supersonic blast wave downward to the ground.
M. Boslough & D. Crawford / Sandia National Laboratories

In one of those "doh!" moments, two explosion modelers from Sandia National Laboratories realized that the Tunguska event wasn't simply a big bomb going off 5 miles up. Instead, argue Mark Boslough and David Crawford, the incoming mass exploded while still headed toward Earth at hypersonic speed. This means more of the blast wave was directed downward (in what Boslough terms "supersonic white-hot mega-tornado rings").

So a smaller impactor packing just 3 to 5 megatons of kinetic energy, something well under 100 feet across, would do nicely. The bad news is that uninvited guests of this size strike our planet every few centuries, on average.

The key to this downsizing was using powerful supercomputers to grind out high-resolution 3D simulations that more realistically model the blast's effects. In fact, Boslough told me, the Tunguska blast could not have been due to a more powerful (15-megaton) event, because the new simulations show that ground zero for the blast wave would have been completely incinerated.

For an impact junkie like me, this is fascinating stuff. It raises the possibility that the explosion's effects extended farther downrange than had been believed. Maybe the Italian-led team that claims to have found a crater-shaped lake downrange from the blast's epicenter is onto something.

Boslough and Crawford's full article should appear soon in the *International Journal of Impact*

Engineering, but you can get more details (and see video clips of the computer simulations) by checking out the Sandia press release issued earlier this week.

Posted by Kelly Beatty, December 20, 2007