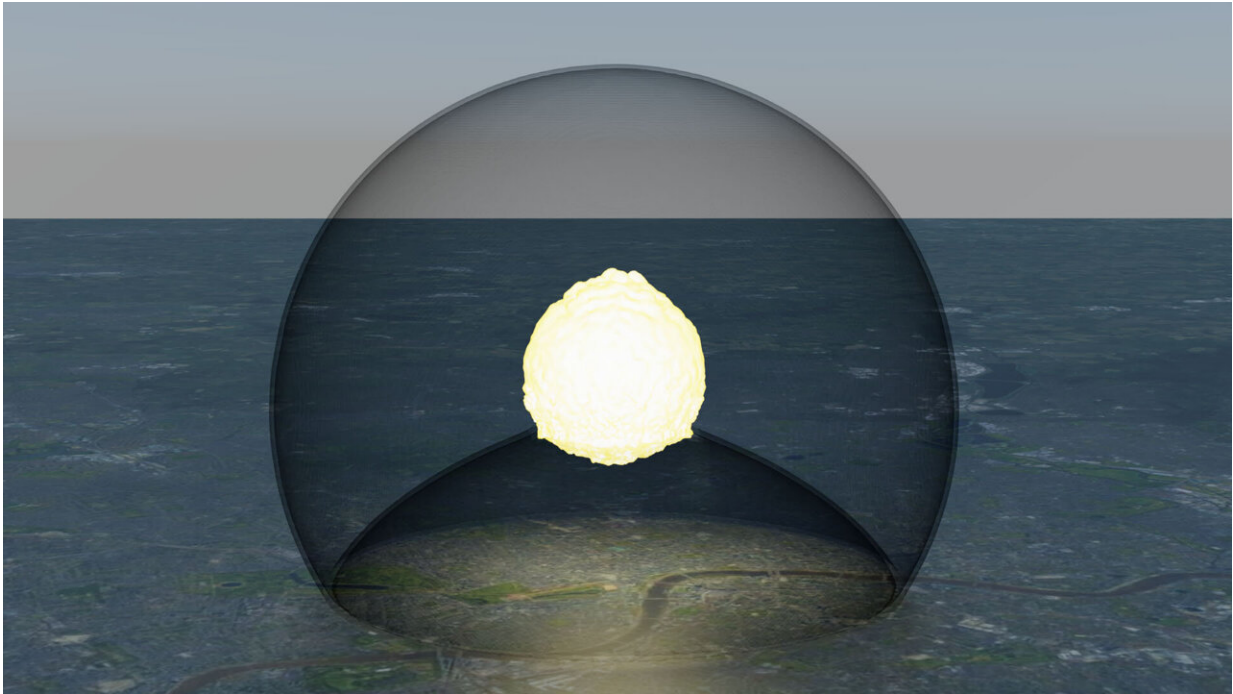


How to shelter from a nuclear explosion

January 17 2023



3D illustration of the simulated air blast and generated blast wave 10 seconds following the detonation of a 750 kT nuclear warhead above a typical metropolitan city; the radius of the shock bubble at ground level is 4.6 km.
Credit: I. Kokkinakis and D. Drikakis, University of Nicosia, Cyprus

There is no good place to be when a nuclear bomb goes off. Anything too close is instantly vaporized, and radiation can pose a serious health threat even at a distance. In between, there is another danger: the blast wave generated by the explosion, which can produce airspeeds strong

enough to lift people into the air and cause serious injury.

In the journal *Physics of Fluids*, researchers from the University of Nicosia simulated an atomic bomb explosion from a typical intercontinental ballistic missile and the resulting blast wave to see how it would affect people sheltering indoors.

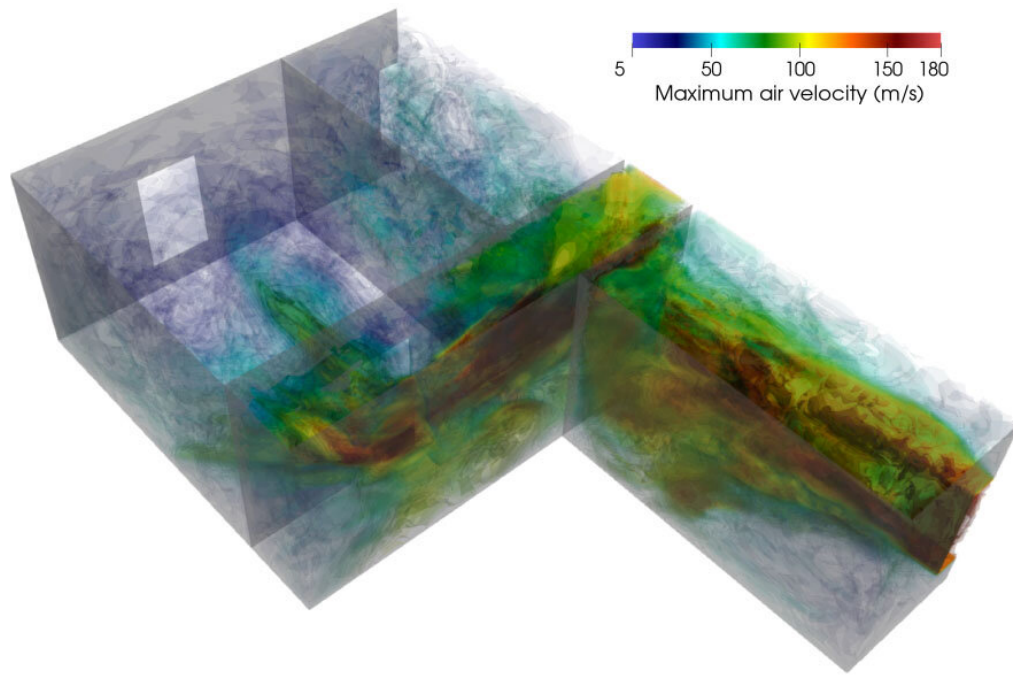
In the moderate damage zone, the blast wave is enough to topple some buildings and injure people caught outdoors. However, sturdier buildings, such as [concrete structures](#), can remain standing.

The team used advanced computer modeling to study how a nuclear blast wave speeds through a standing structure. Their simulated structure featured rooms, windows, doorways, and corridors and allowed them to calculate the speed of the air following the blast wave and determine the best and worst places to be.

"Before our study, the danger to people inside a concrete-reinforced building that withstands the blast wave was unclear," said author Dimitris Drikakis. "Our study shows that high airspeeds remain a considerable hazard and can still result in severe injuries or even fatalities."

According to their results, simply being in a sturdy [building](#) is not enough to avoid risk. The tight spaces can increase airspeed, and the involvement of the blast wave causes air to reflect off walls and bend around corners. In the worst cases, this can produce a force equivalent to 18 times a human's body weight.

"The most dangerous critical indoor locations to avoid are the windows, the corridors, and the doors," said author Ioannis Kokkinakis. "People should stay away from these locations and immediately take shelter. Even in the front room facing the explosion, one can be safe from the high airspeeds if positioned at the corners of the wall facing the blast."



Contours of the maximum airspeed attained during the first 10 seconds after the blast wave enters the window; overpressure of 5 psi. Credit: I. Kokkinakis and D. Drikakis, University of Nicosia, Cyprus

The authors stress that the time between the explosion and the arrival of the [blast wave](#) is only a few seconds, so quickly getting to a safe place is critical.

"Additionally, there will be increased [radiation levels](#), unsafe buildings, damaged power and gas lines, and fires," said Drikakis. "People should be concerned about all the above and seek immediate emergency assistance."

While the authors hope that their advice will never need to be followed, they believe that understanding the effects of a nuclear explosion can

help prevent injuries and guide rescue efforts.

The article "Nuclear [explosion](#) impact on humans indoors" is authored by Ioannis William Kokkinakis and Dimitris Drikakis. The article will appear in *Physics of Fluids* on Jan. 17, 2023.

More information: Nuclear explosion impact on humans indoors, *Physics of Fluids* (2023). [DOI: 10.1063/5.0132565](https://doi.org/10.1063/5.0132565)

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