Mississippi State University

Multi-Fidelity Tools for Blast Analysis in Urban Environments

Dr. David Thompson, dst@cavs.msstate.edu, 662-325-2068

Prevent, Protect, Respond, Recover

Homeland Security Challenge:

Blasts in urban environments, whether intentional or accidental in origin, typically result in serious injury and loss of life as well as extensive property damage. This research project responds directly to a relevance area identified by DHS as a high-priority technology need associated with the DHS Infrastructure Protection Integrated Product Team (IPT) for effective and affordable blast analysis. Secondarily, it responds to a high-priority need associated with the Counter-IED IPT for the capability to characterize improvised explosive device (IED) threats, including IED design, assembly, detonation, and effect.

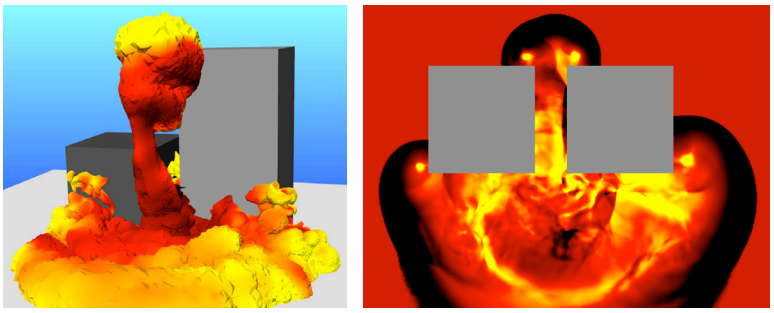
Research Project Solution:

The objective of this research project is to develop a suite of multi-fidelity blast analysis tools for computing blast loading on structures. This prototype toolset will provide a multi-fidelity capability to quantify the effects of different IED threats in urban environments. The toolset will also offer the capability for a time- and resource-appropriate response based on the situation at hand. The prototype toolset to be developed includes:

- Loci/BLAST a high performance computing (HPC) environment tool that can be used to predict blast loadings on buildings.
- BlastScape an interactive, PC-based tool used to define the urban geometry to be imported into Loci/BLAST.
- MeshScape an HPC-based tool that is used to generate meshes about the geometries defined in BlastScape
- UrbanFX an interactive, PC-based engineering tool to predict blast loadings on buildings in urban environments.

National Implications:

This research project is relevant to IED attacks and infrastructure protection against IED attacks in urban environments. One of the products of this research will be a library of explosives that will provide flexibility in modeling a variety of IEDs. The PC-based tools developed under this research will provide first responders time-critical capabilities to: i) conduct rapid assessment of the effects of a possible explosive device such as a car bomb; and ii) conduct preliminary blast forensics of an IED detonation in an urban environment to estimate the IED type, size, and location. The HPC-based tools will provide high-fidelity capabilities for situations in which rapid response is not the driving factor such as to assess potential blast effects on new and existing infrastructures (e.g., hospitals, hotels, and government facilities). The expected impact of the project is enhanced capabilities for analyzing the effects of blasts in urban environments.



Loci/BLAST simulations of blast near buildings

Rapid assessment of the effects of a possible car bomb.

Blast mitigation for new or existing buildings.

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For More Information on SERRI, contact;

Warren Edwards, Director, SERRI
865-574-8277, edwardswc@ornl.gov

Ben Thomas, Operations Manager
865-574-5438, thomasbjr@ornl.gov

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