



The Strategic Analyses and Assessments (SAA) Office at Los Alamos National Laboratory provides the defense and intelligence communities across the Federal government with timely, relevant information about nuclear weapons effects and emerging national security challenges. We focus on building partnerships through collaboration, integration, education, and outreach.

## Education and Outreach

We work with DoD and other federal organizations to understand the tactics, techniques, and procedures that are considered when planning for a nuclear exchange. We also advise and participate in wargames and other exercises, providing insight to consider gaps and future mission capabilities and options.

- Wargaming, including DEGRE, FUTURES, and Global Engagement
- Tabletop exercises
- Nuclear weapons effects briefings and workshops
- EMP and high-altitude nuclear explosion briefings

## Analyses

We facilitate analyses that focus on technical or scientific capabilities that impact U.S. deterrence.

- Resiliency vulnerability
- Cyber risk
- Impacts and options
- NNSA weapons laboratories coordination and response

## Integration and Collaboration

The SAA Office connects stakeholders to subject matter experts who can help them identify and solve nuclear weapons deterrence challenges.

- Nuclear weapons effects coordination
- Inter-laboratory coordination
- U.S. government engagement
- Performance and Effectiveness Strategic Collaboration

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# Nuclear Weapons Effects

SAA Office: [www.lanl.gov/saa](http://www.lanl.gov/saa)

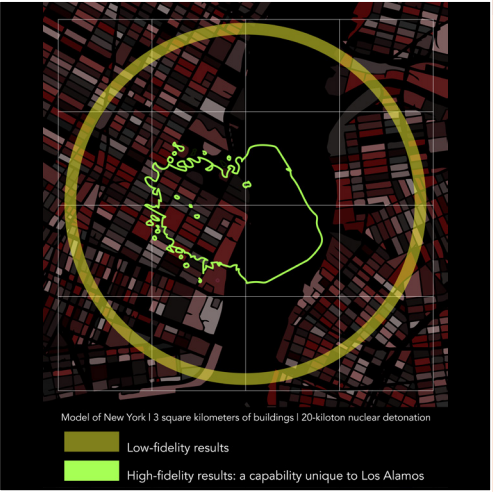


Since 1945, Los Alamos has been the leader in state-of-the-art nuclear weapons design, outputs, and effects. Los Alamos uses its unique interdisciplinary skills, computational expertise, and supercomputing resources to model, in high-fidelity and 3D, the various effects of nuclear weapons on infrastructures, resources, and civilian populations. These models are critical to defensive and offensive strategic planning.

## Electromagnetic Pulse

The EMP created by a nuclear detonation at the Earth's surface, in the air, or in space will damage electronics and electrical power systems and grids. High-fidelity and 3D modeling of EMP effects using accurate infrastructure data regarding locations, heights, and the lengths of buildings and streets reveals, for example, where EMPs will be reflected, absorbed, or unimpeded. This information significantly improves EMP effects estimates and betters strategic planning so resources can be allocated to the most good.

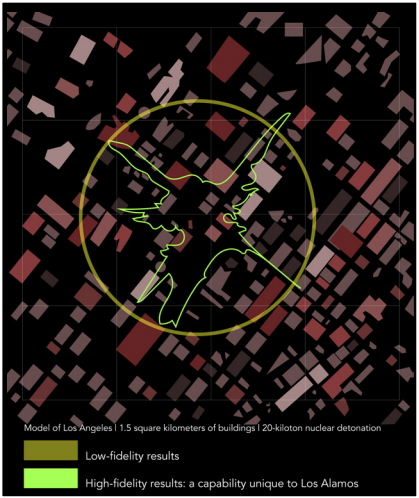
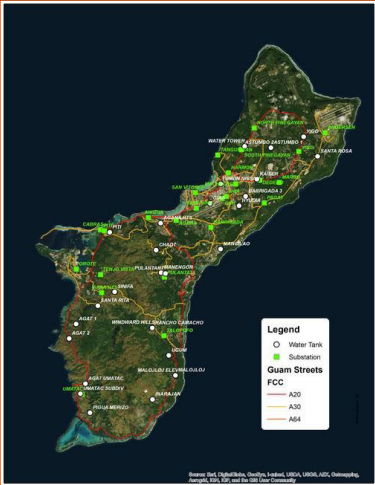
High-fidelity modeling in 3D of EMP effects (green) shows a significant increase in predicted accuracy over low-fidelity 2D modeling (yellow).



## Infrastructure Damage

Nuclear weapons effects will damage critical infrastructure systems including power, natural gas, petroleum, water, communication, and transportation systems. Multiple systems failure is synergistic, the combined negative effect is much greater than the failure of any single system. High-fidelity modeling supports allocating resources on improving the resiliency of key assets and systems to damage.

Understanding weapons effects on infrastructure can inform hardening decisions.



High-fidelity modeling of radiation effects (green) on a population center provides greater predicted accuracy over low-fidelity 2D modeling (yellow) that assumes no buildings or boulevards.

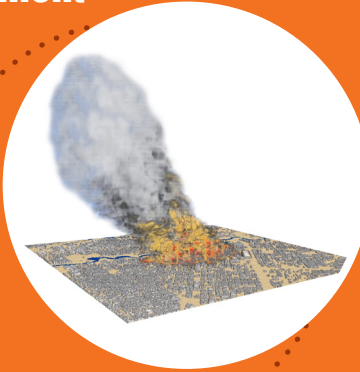
## Radiation and Debris

High-fidelity models with 3D representations of urban infrastructures can show how cities and other environments will be affected by a detonation's neutron, gamma, and X-ray radiation and by the post-detonation fallout. For example, modeling how a radiation dose might spread into a population center down wide, open boulevards—but then be blocked by large buildings on either side—allows decision-makers to accurately prepare for the numbers of people affected and the degree to which they might be exposed. As a result, resources can be strategically allocated to mitigate an event.

## Fire Damage, Growth, and Development

Los Alamos uses high-fidelity and 3D modeling to simulate the effects of shock waves, fireballs, and X-rays from different nuclear detonations on various targets. For example, using climate and infrastructure models, Los Alamos can produce detailed 3D representations of nuclear-induced firestorms, simulating fire initiation and growth at both local and global scales.

High-fidelity and 3D modeling, using current climate and infrastructure data, supports accurate strategic planning for the effects of nuclear-induced firestorms in urban environments (Atlanta, GA, shown here).



## Space Assets

High-fidelity models can assess the effects of neutron, gamma, and X-ray radiation from different high-altitude nuclear detonation. Results from these models support decision about which assets should be hardened or otherwise defended.

Fission products from high-altitude nuclear detonations create radiation belts that can kill satellites. High-fidelity modeling of these evolving belts enables improvements to satellite-hardening standards and other defensive measures.

