GLOBAL SECURITY

LAWRENCE LIVERMORE NATIONAL LABORATORY

Modeling and Simulation for Improved School Safety

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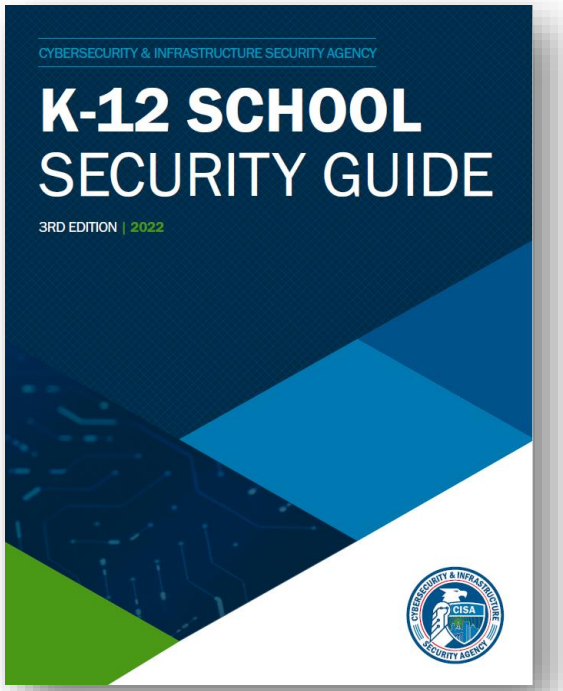
Identifying high-value school safety measures and guidance though quantitative modeling and simulation of active shooter scenarios.

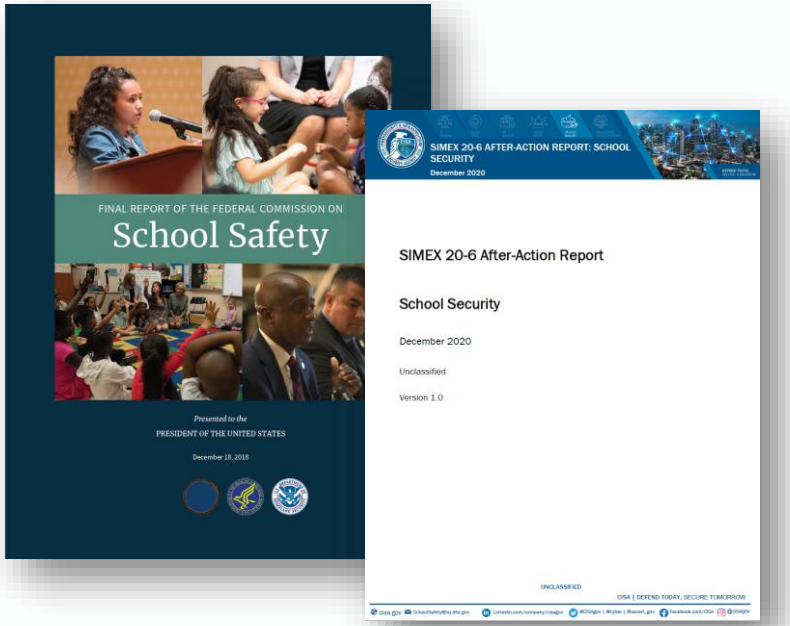
- **Space:** ***Mitigating impacts of active shooter scenarios in schools.***
- **Problem:** ***Need to quantitatively assess the effectiveness of school safety measures in active shooter scenarios to identify highest value potential measures to inform guidance and recommendations for schools and communities.***
- **Solution:** ***Joint Conflict and Tactical Simulation (JCATS) tool scenario-based analysis of the effectiveness of various mitigations in reducing casualties during active shooter events.***
- **Results:** ***Analysis underway, results not yet available for this application.***
- **TRL:** ***9 for the JCATS tool, which has been used extensively in a variety of applications.***

This project complements existing work on school safety to help inform continuous improvement to guidance on school safety and security.

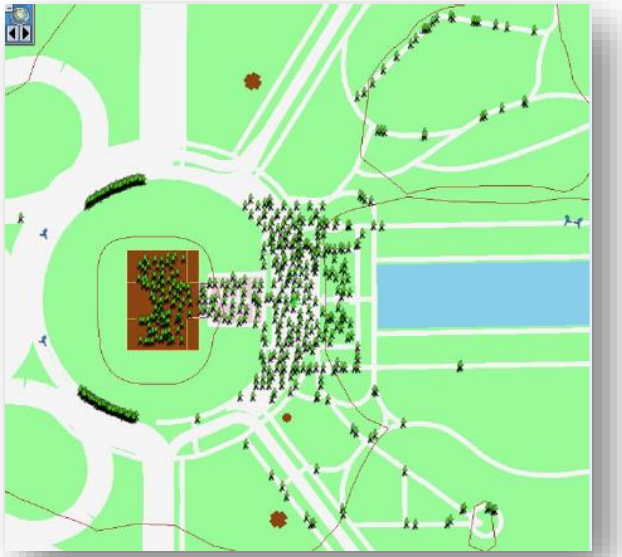
The need: ***inform continuous improvement and validation of government-issued guidance***



What exists: ***SME-based studies and simulated virtual experiments considering technology options***



This project: ***complementary quantitative analysis using advanced modeling and simulation tools***

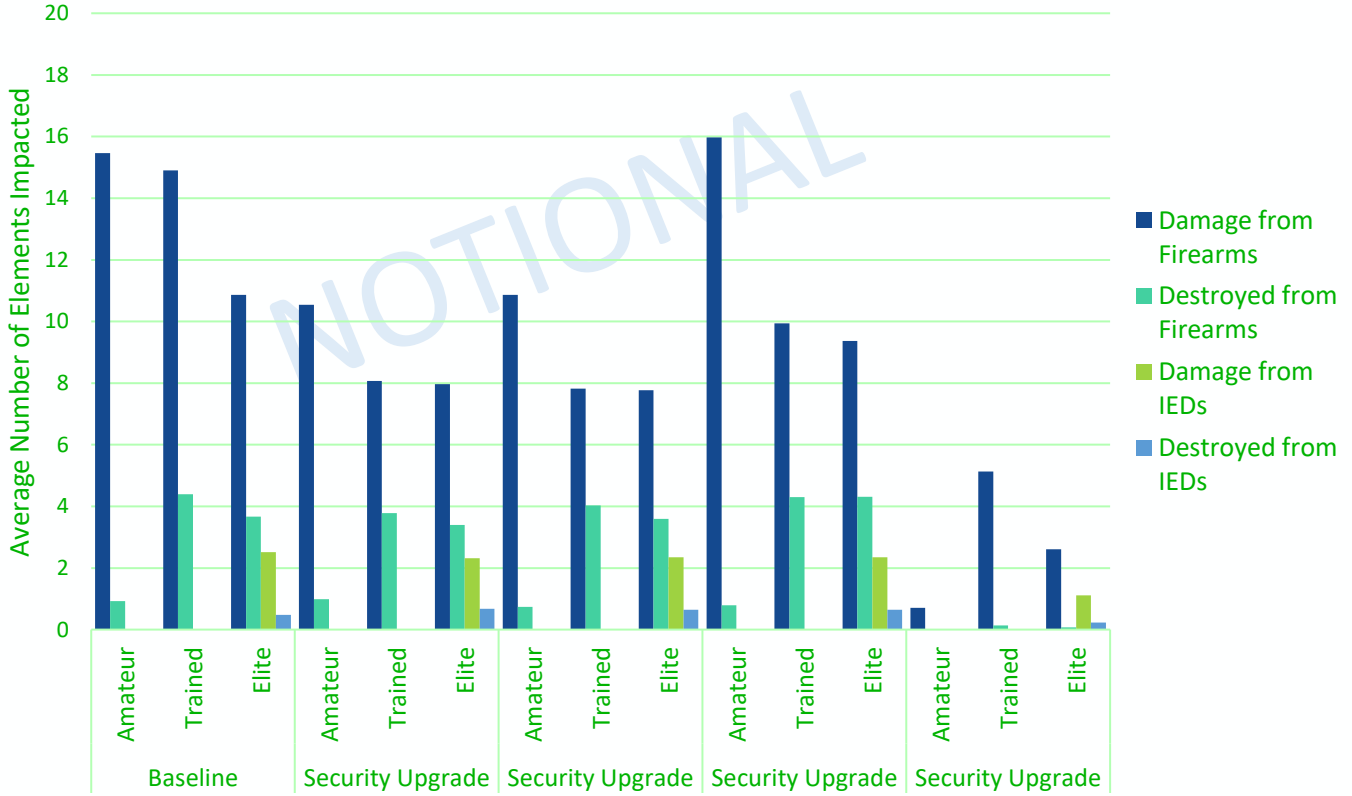


This work is sponsored by DHS Cybersecurity and Infrastructure Security Agency (CISA)'s Infrastructure Security Division (ISD)

Joint Conflict And Tactical Simulation (JCATS) provides quantitative data from large batches of scenarios that enable comparison of security mitigations.

- **What it is: Validated, high-fidelity, entity-based conflict simulator capable of running large quantities of scenarios to produce quantitative assessment data**
  - Highly adaptable and flexible for varied scenarios and entities
- **What it is not:**
  - Not a quick-start tool, requires substantial data and model development
  - Not plug-and-play, requires trained developers and users
- **How it is used:**
  - Quantitative assessment of security measure recommendations/ requirements using typical facility layouts
  - Player-in-the-loop analysis to assess decision impacts on scenario outcomes

What it outputs: statistical data from large numbers of simulations for relative analysis and scenario playback



This plot shows notional results of two different types of attacks (firearms or improvised explosive devices (IEDs)) on an example infrastructure site by three different levels of attackers (amateur, trained, elite) under baseline and four different upgrade conditions to show the impact of different levels of upgrades.

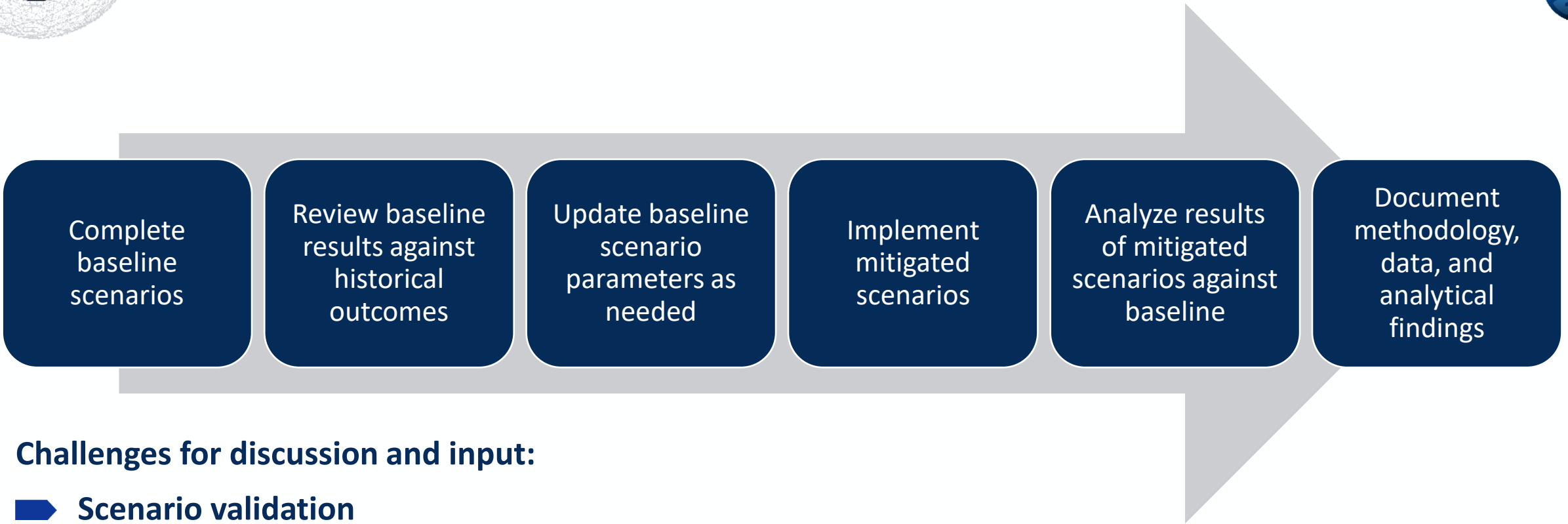
JCATS is a flexible platform for assessing diverse scenarios that can include many types of data-driven entities

- **Platform/distribution: licensed software package that runs on RedHat Linux machines**
  - Software be distributed to trained end users to develop models and simulations in-house, or
  - Results can be provided analysis-as-a-service
- **Previously used in diverse civilian assessments:**
  - Security effectiveness against defined scenarios at Salt Lake City Olympics
  - Evacuation scenarios for chemical attacks at public places
  - Potential consequences associated with different attack types on soft targets and crowded places
  - Physical security upgrade evaluation for electrical substations (academic research)
  - Physical security effectiveness at LLNL to inform exercises

How it works

1. Define analytic question and scenarios
2. Build the terrain (layout, structures, materials, etc.)
3. Define the entities (people, tools, vehicles, etc.) and their behaviors (objectives, movements, etc.)
4. Populate entity and terrain data (speeds, accuracy, material properties, etc.)
5. Run batches of simulations
6. Analyze data

Next steps and challenges



Challenges for discussion and input:

- **Scenario validation**
- **Clear, comprehensive, and consistent data**
- **Addressing diversity of school structures, layouts, and environments**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