Exceptional service in the national interest

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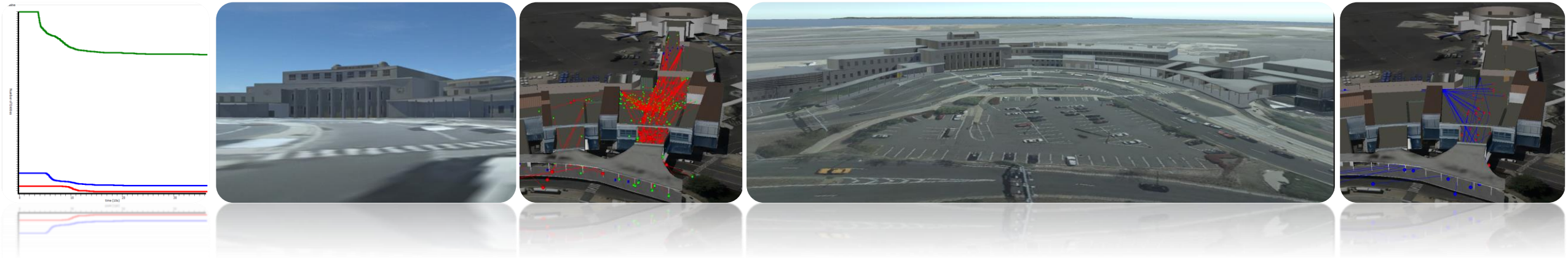

DANTE: Operational Studies of Technology, Tactics, & Procedures at Soft Targets

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U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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Bottom Line Up Front

- **Context:** Recent terrorist attacks in the West have shown increased interest in publically accessible locations and “soft targets” (e.g., Brussels Airport, Istanbul Airport).

- **Problem:** Adaptive adversaries have large and varied attack space while defensive resources (e.g., hardening measures, protective forces, detection technologies) are cost constrained; allocation of defenses requires prioritization with imperfect and uncertain information of the threat.

- **Solution:** Technology developed for and used by the DoD and DOE physical protection missions allows decision makers to understand the potential effectiveness of current or future technology, attacker and defender tactics, or procedures for soft targets in a quantitative, multi-scenario approach.

- Decision makers can rapidly explore:
  1. “what-if” scenarios and explore effectiveness of current defenses to evolving portfolio of threats;
  2. requirements of future technologies;
  3. tactics to threat shift and drive adversaries to strengths of defense

Method

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3D Terrain Environment

Assets

Tactics

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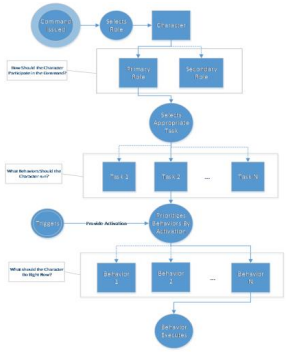
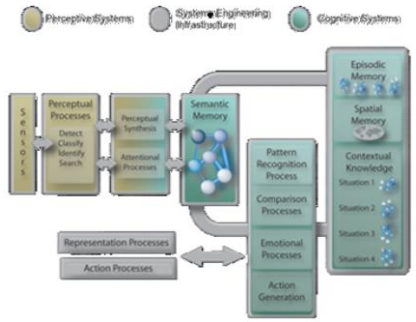
Artificial Intelligence / Behavior Framework
Batch/Interactive: Monte Carlo Techniques





- **Batch Statistical Analysis**
  - Insights into "key" players and events with statistical distribution
  - Probability of neutralization computation
- **Post Processing Output**
  - Data capture
    - XML files
    - Database enabled
  - Graphs and Plots
- **Replay Mode**
  - 3D Scenario Replayer
  - Navigate and Query Data

3D Terrain Environment

- Terrain Surface
  - Openflight Terrain format
  - GeoTiff Imagery
- Buildings, Barriers
  - Import various geometry formats
- Fences, Roads, Water, etc…
  - Import as linear data, polygonal data, imagery

Assets

- People and Teams
- Vehicles (Mounted Weapons DOFs)
- Weapons (Type of weapon, type of ammo, # of rounds)
- Lethality (weapon and target data)
- Facility Sensors

Tactics

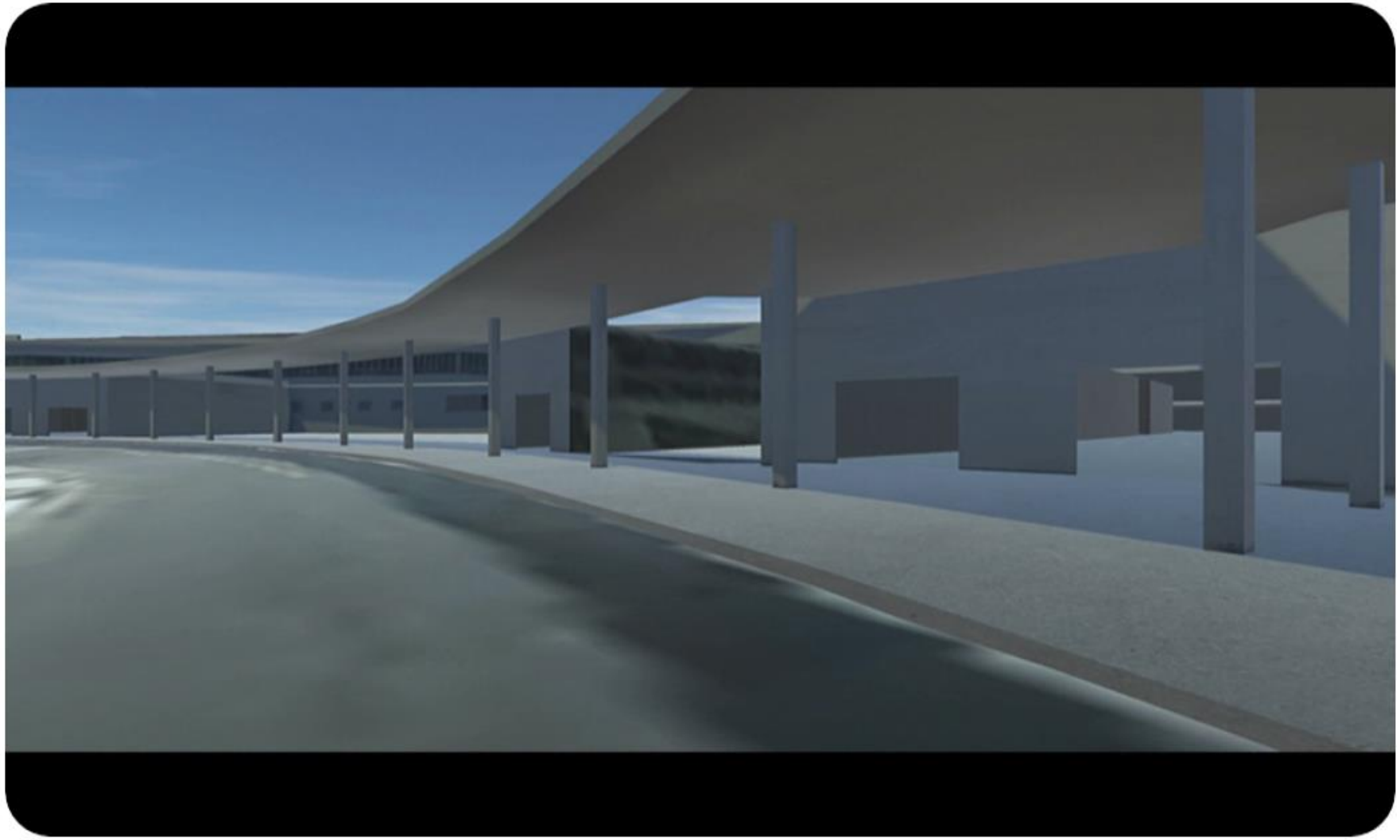
- Primary Plan which is a sequence of actions to perform mission
  - Examples of Actions: Move, Drive, Patrol, PermissionToEngage, Breach, Delays, Suppress, Investigate,…
- Behaviors or Roles of People
- Secondary or Backup Plans
- Termination conditions
  - Success and Failure

Facility Model Overview - Exterior

Physical models can be rapidly created with publically available information

Facility Model Overview – Interior

Physical models can be rapidly created with publically available information



Illustrative Case Study:

Explore effectiveness of security options through scenario comparisons that capture variability and uncertainty of adversaries

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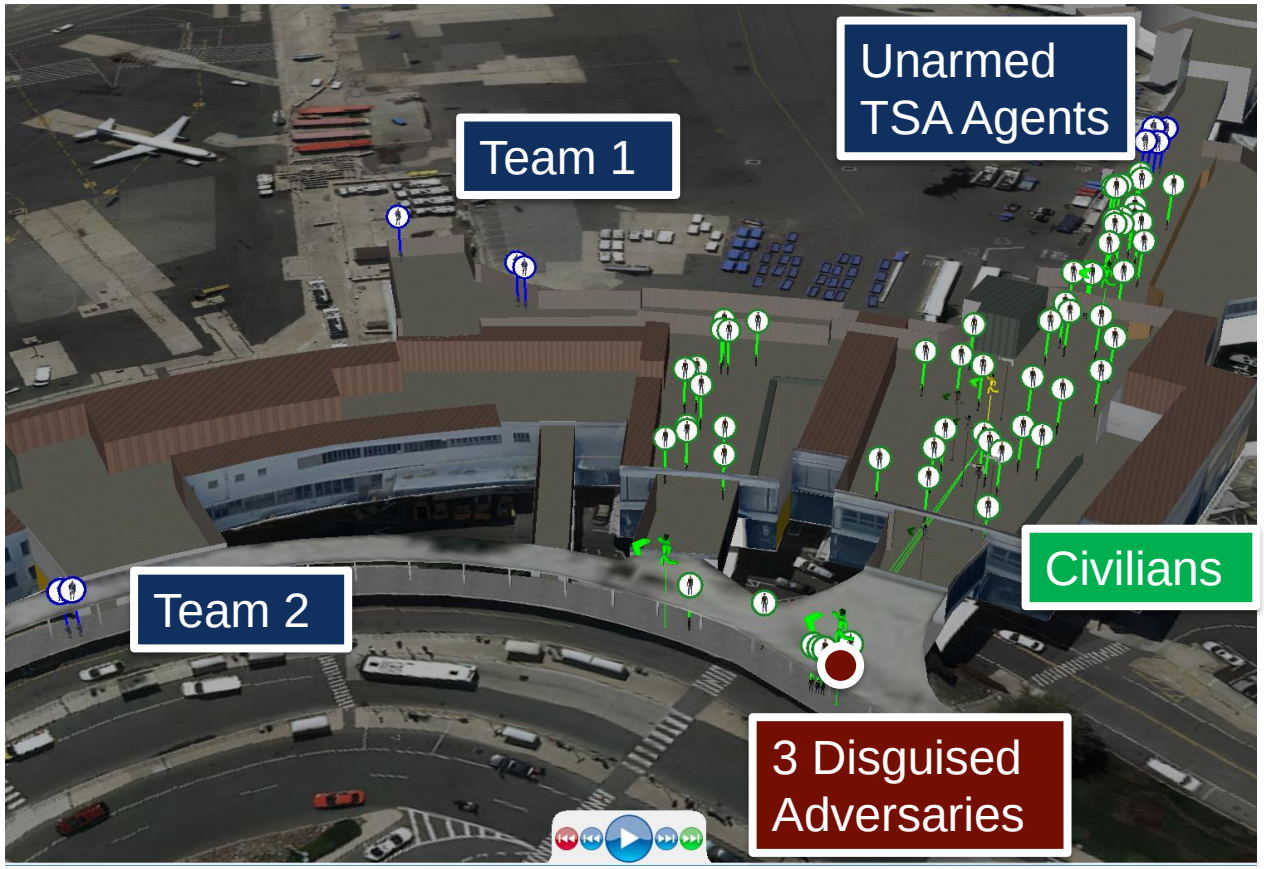
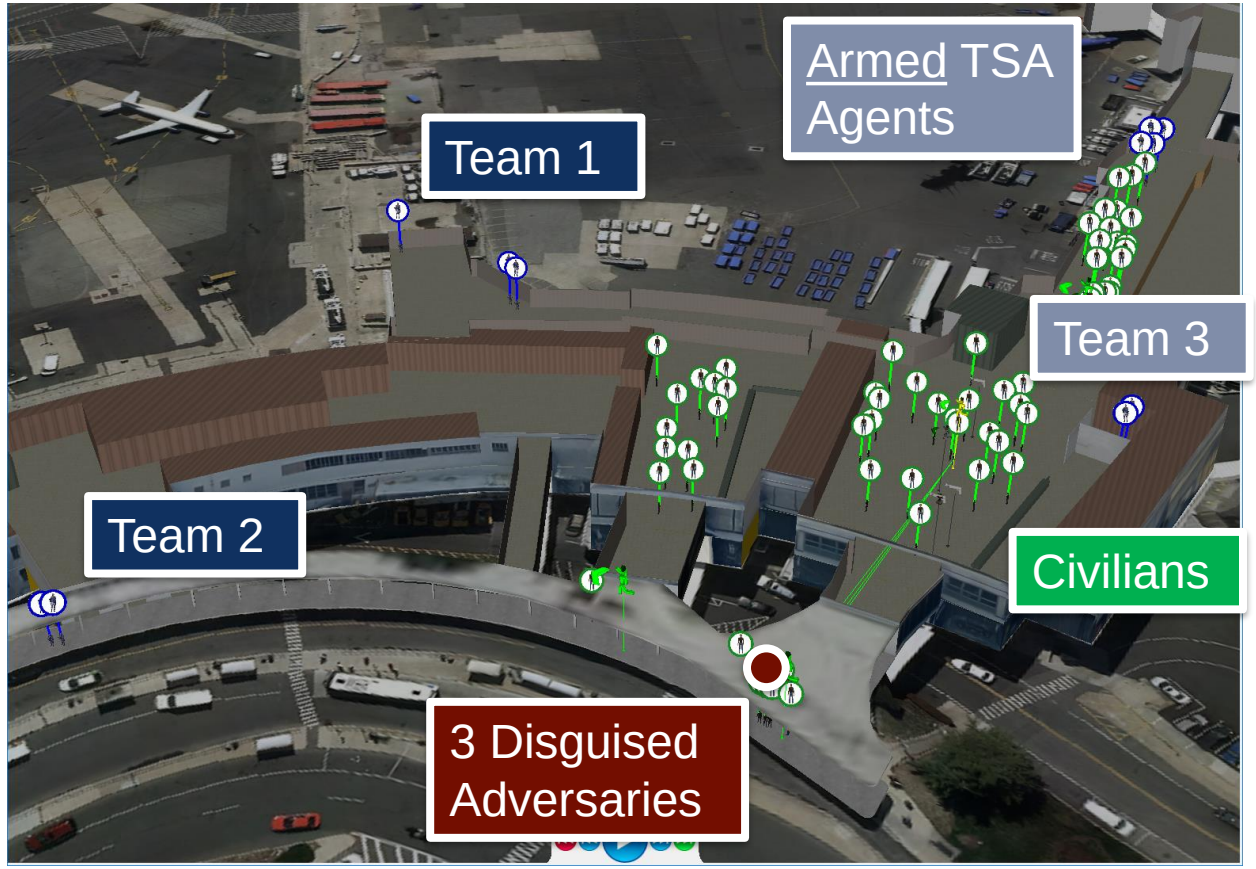
Scenario #1: Active Shooter Baseline

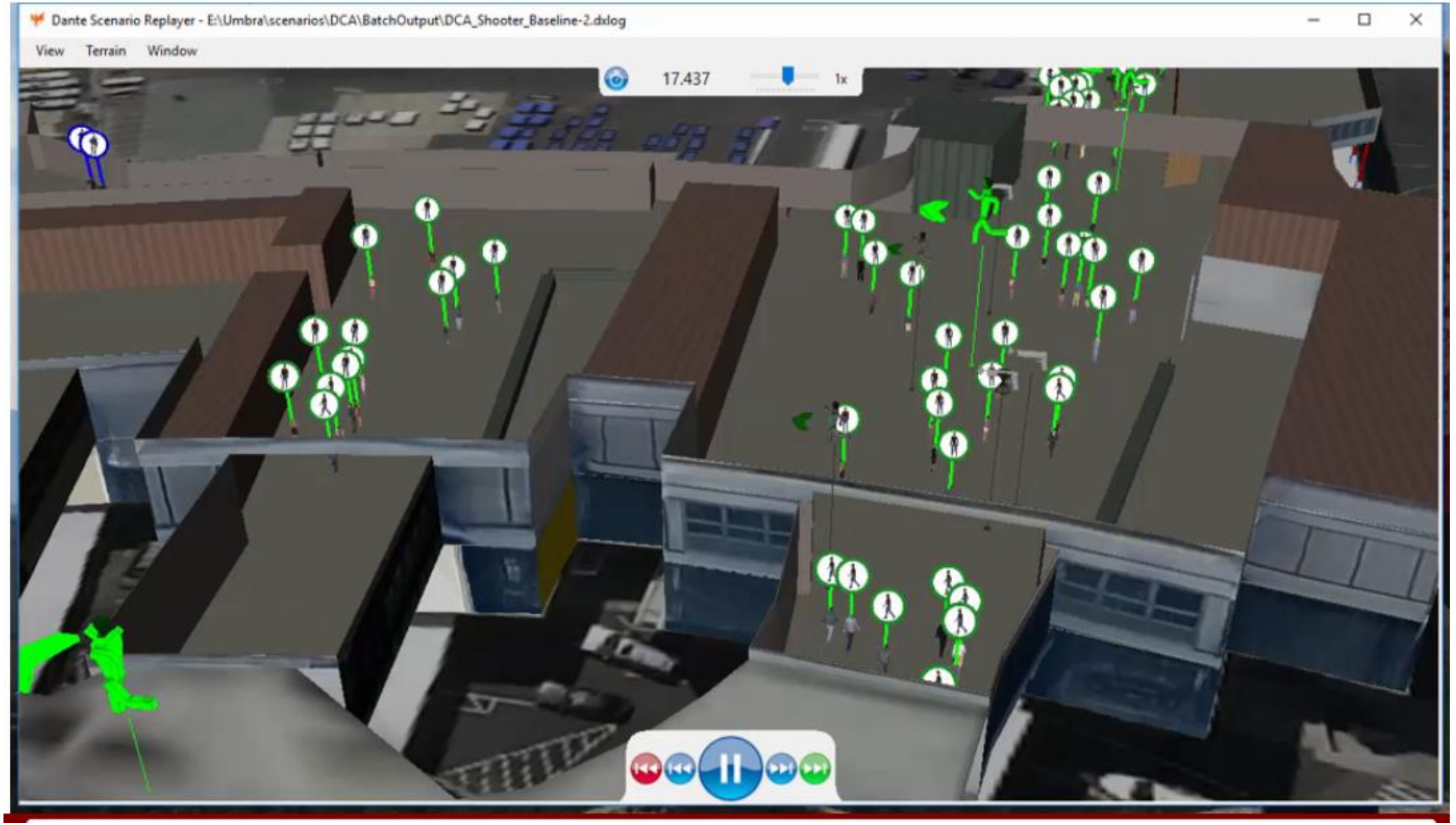


Scenario #2: Active Shooter with Enhanced Security

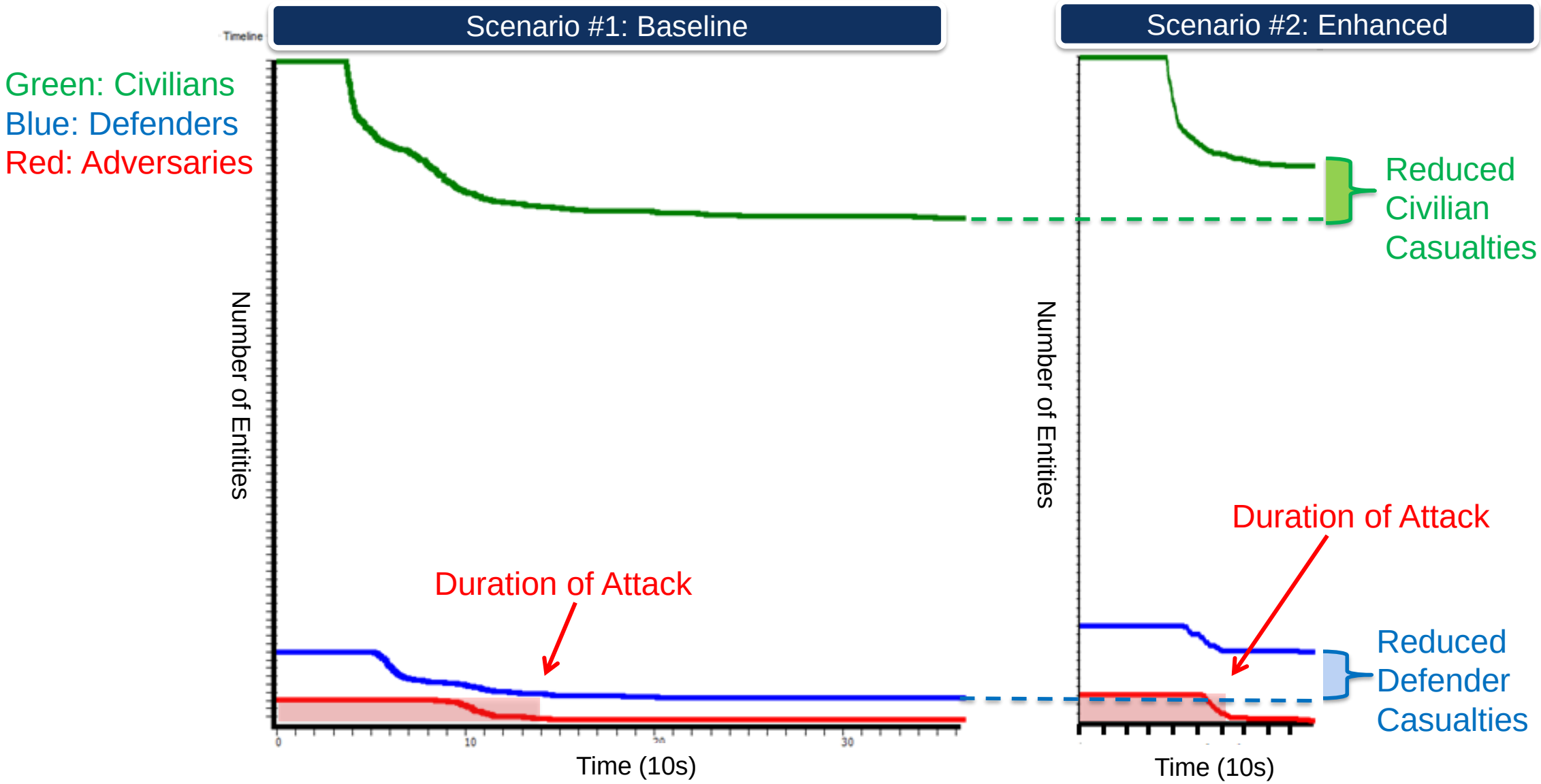


Twenty (20) simulation runs varying different locations of agents, behaviors, and adversaries

Visualization of scenarios gives insight into how can events unfold



Analytics allows deeper understanding of collection of complex attacker/defender factors



Analytics and Visualization allow deeper understanding of results

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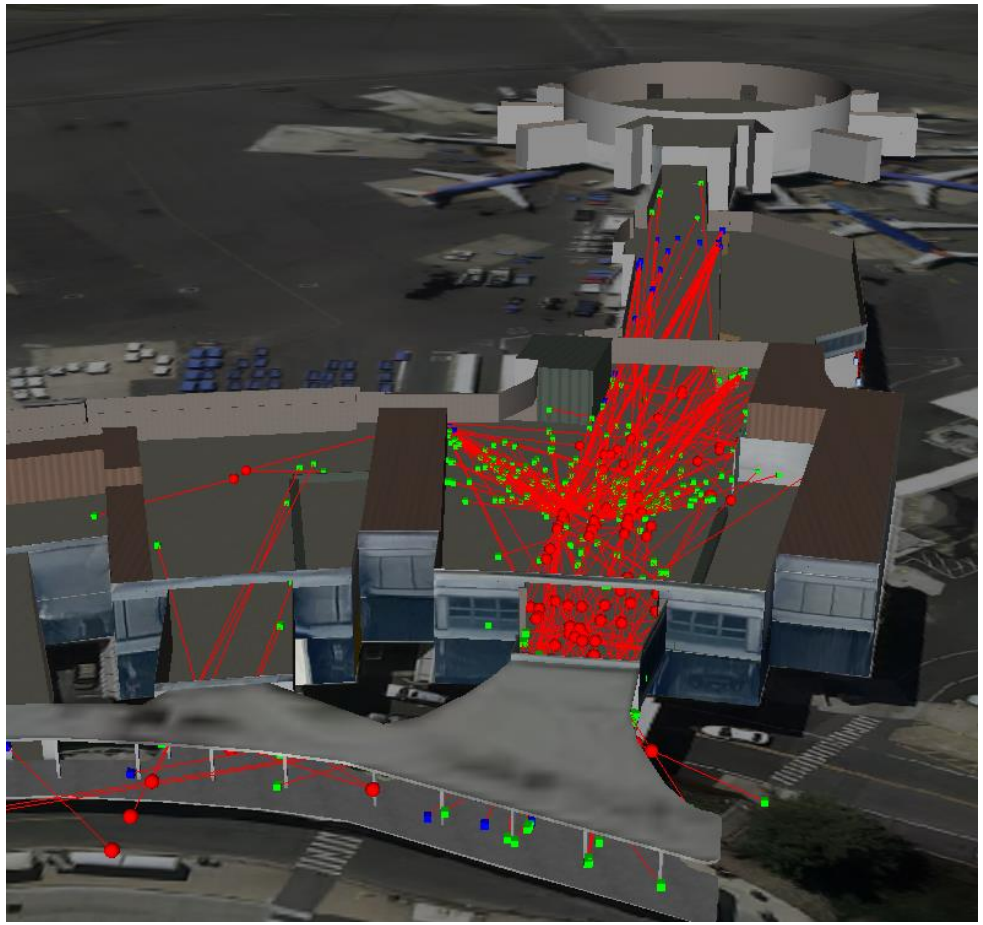
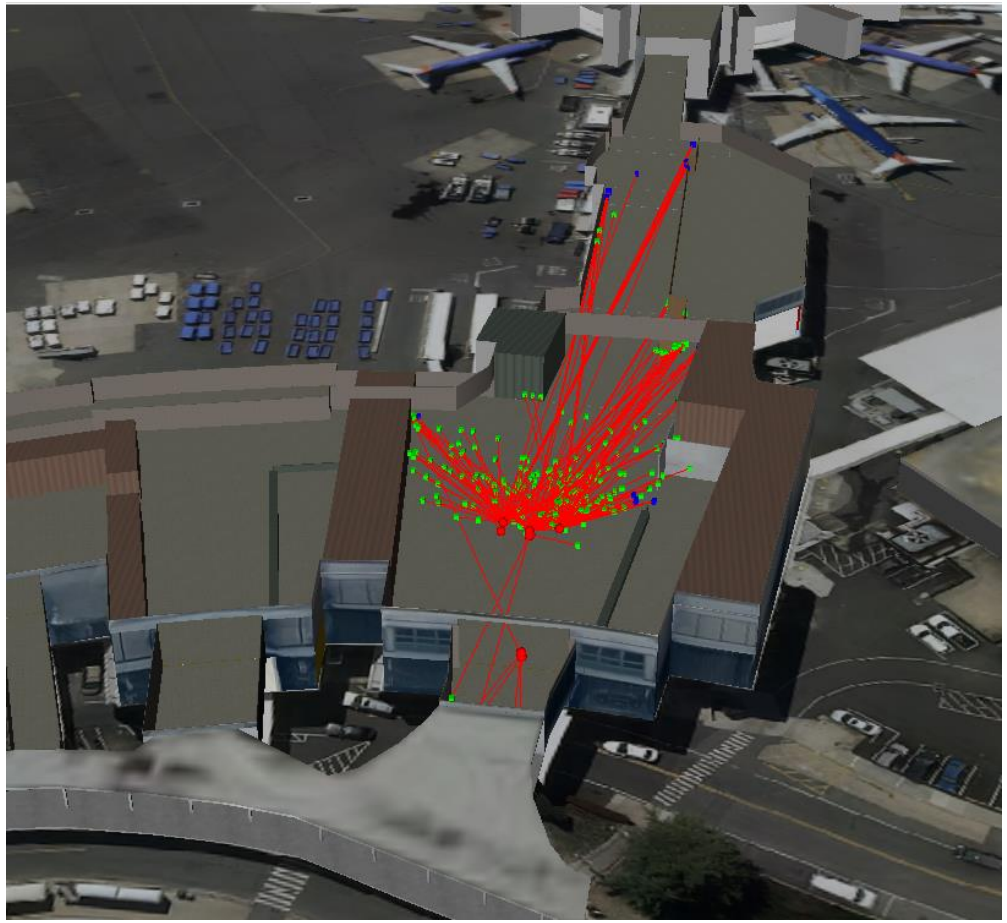
Adversaries Shots and Kills of **Civilians** and **Defenders**

Scenario #1: Baseline *(Notional)*



Scenario #2: Enhanced



Adversaries moved freely in terminal in baseline, engaged by law enforcement team #1

Visualization allow deeper understanding of results

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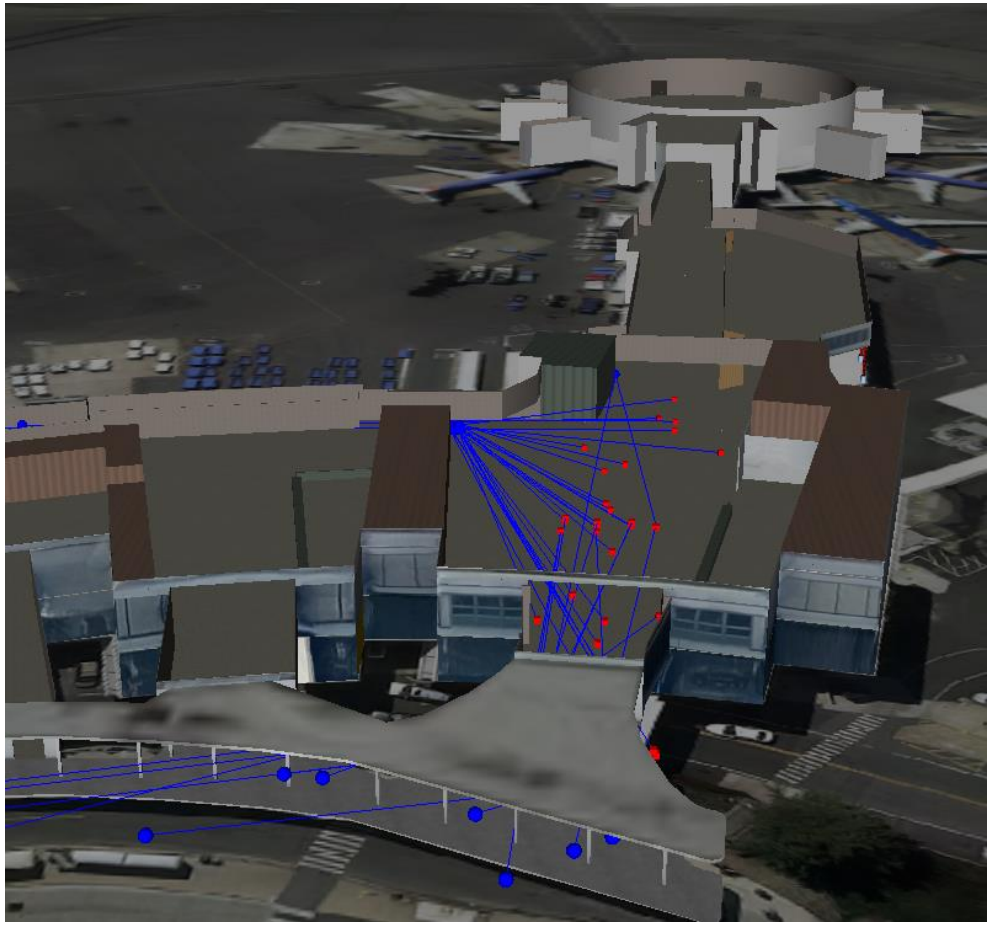
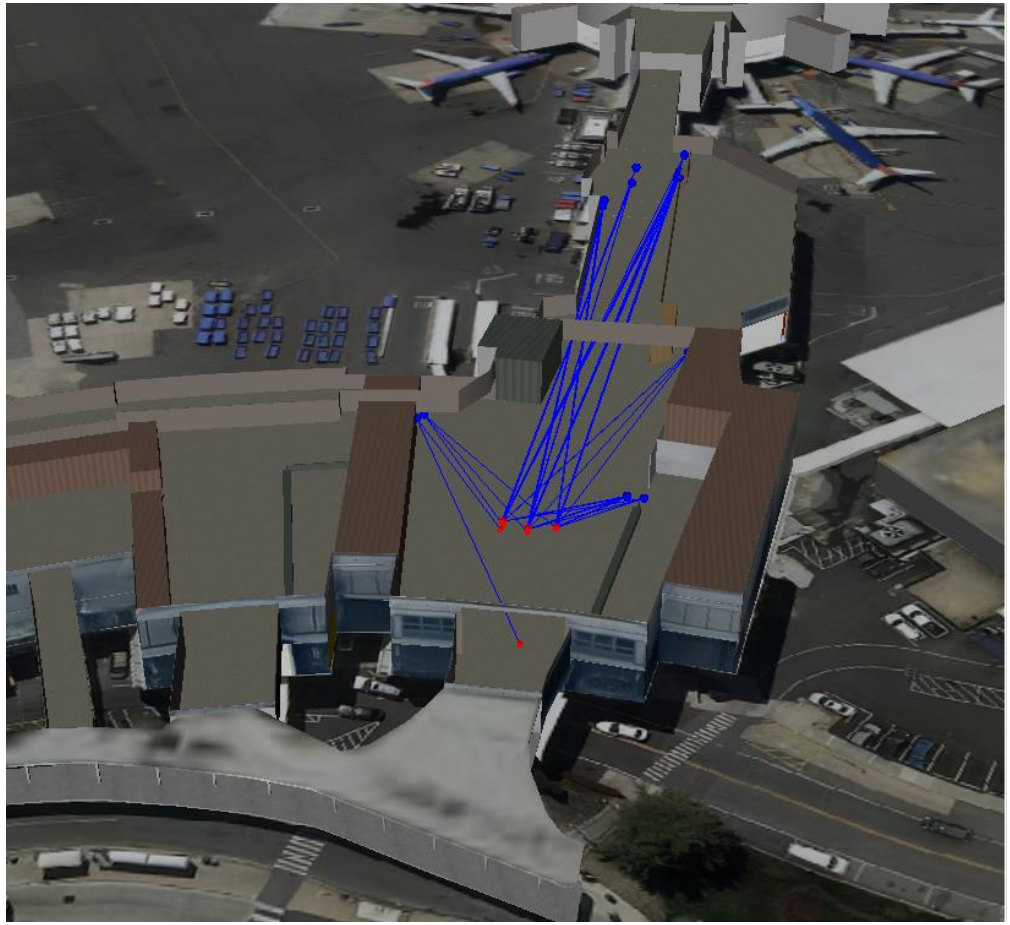
Defender Shots and Kills of **Adversaries**

Scenario #1: Baseline *(Notional)*

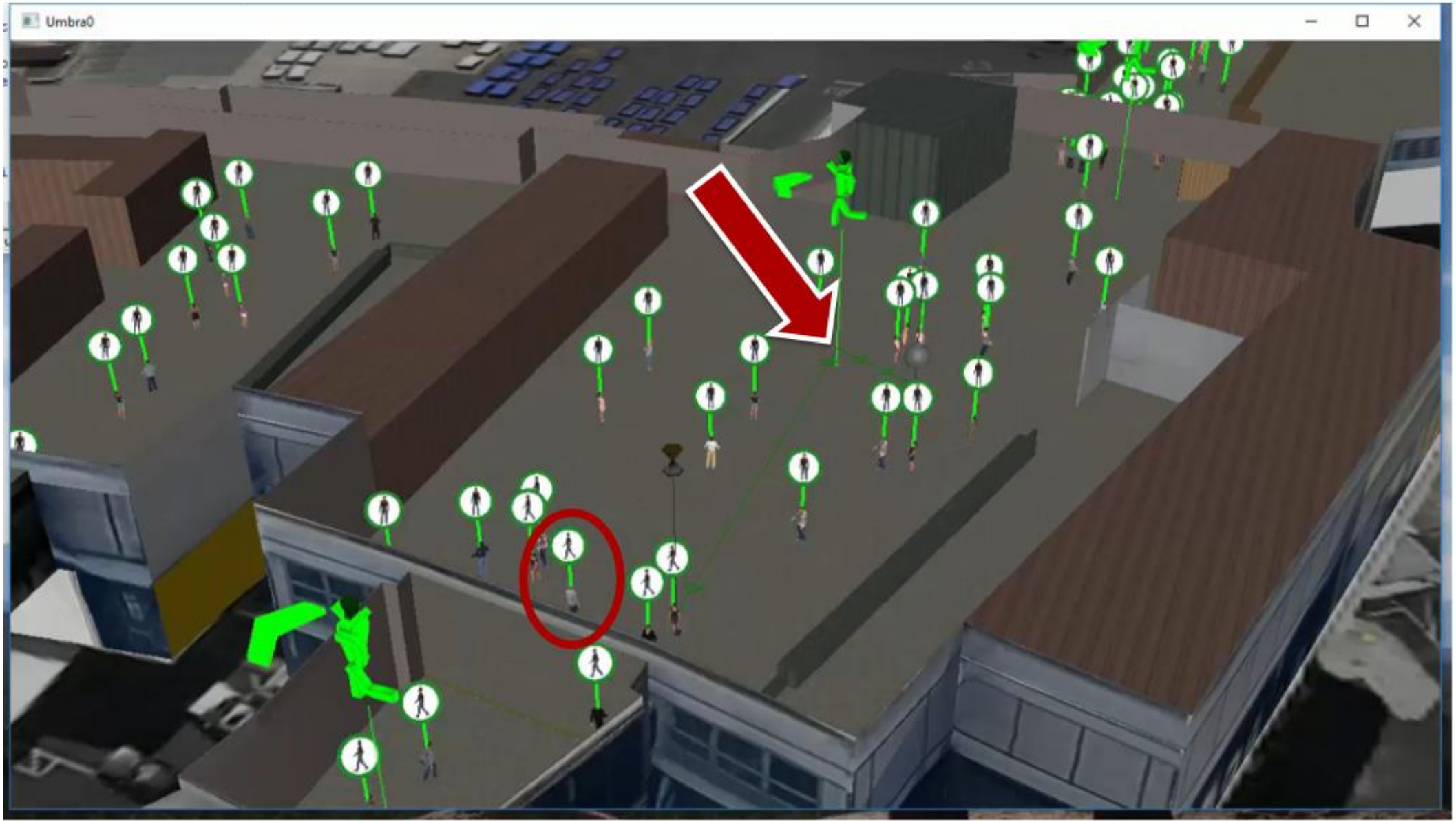


Scenario #2: Enhanced



Adversaries engaged rapidly by armed TSA agents and additional law enforcement team #3

Additional threats can be considered; on-person IED Movie



Potential Analyses/Applications

- What-If Analysis
  - Are there actions that can be taken to **shift adversaries** to strength of defense?
  - What is the **marginal benefit** for each additional armed guard or technology added?
  - How do security metrics change if additional **hardening structures** were deployed?
  - How does security change if **adversary shifts tactics**, technology type, or behaviors?
  - How do the various **security layers interact** with each other?

- Technology Requirements
  - What is the **trade-space** of equivalent performance for technology performance parameters (e.g., sensitivity, speed,..) and operational deployment factors (e.g., # of units, locations,…)?
  - Where would a stand-off explosives detector best be **located**? Where is it acceptable?

- Exercises and ConOps
  - Valuation of scenarios can **support development of policy and CONOPS** and act as documentation and supporting justification for decisions.

Requirements for Adaption to Aviation Security

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- The Dante capability was developed for DoD/DOE applications around nuclear physical security, and there would need to be some adaptation of the capability to apply to new domains.

- In particular, the model would have to be include
  - More insight into **civilian behaviors**, as most current behaviors are based on DoD actions.
  - More insight into **law enforcement response/detain/confrontation behaviors**. In demo, responders are currently shooting to recognition of threat.
  - Inclusion of more **civilian detection and defense technologies**.
  - Understanding of **key metrics** for evaluation, which might require development of additional backend tools.

http://umbra.sandia.gov/

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Method

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3D Terrain Environment

Assets *(people, equipment, sensors)*

Tactics

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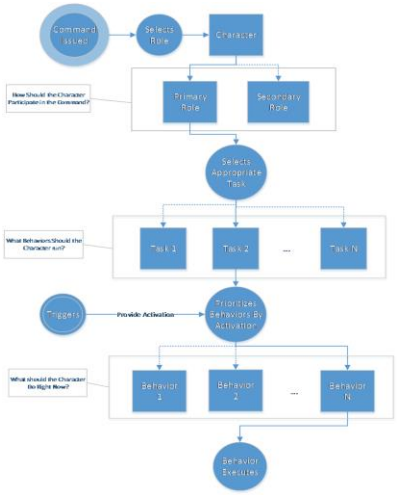
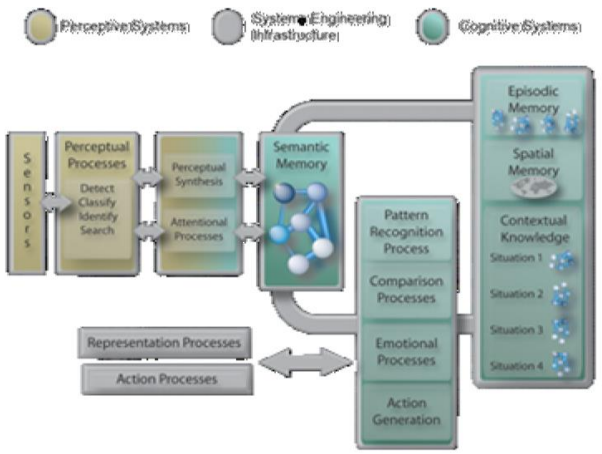
Artificial Intelligence / Behavior Framework





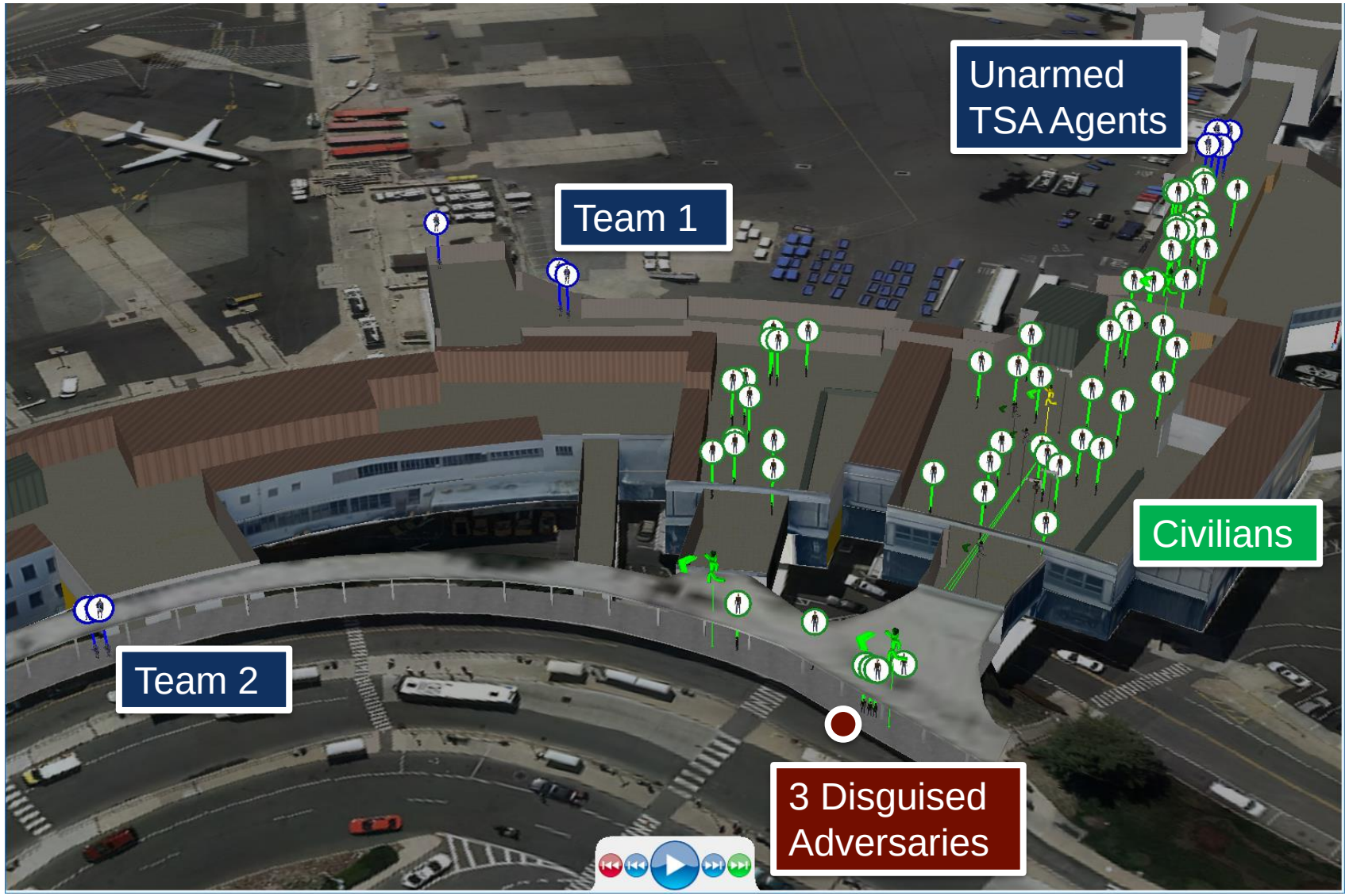
- Security Metrics (*Graphs and Plots)*
- Batch Statistical Analysis
- Replay Mode via Visualization

Scenario #1: Baseline *(Notional)*

Threat: Three (3) Active Shooters

Defense: Two (2) law enforcement teams and unarmed TSA

Analysis: Twenty (20) simulation runs varying different locations of agents, behaviors, and adversaries



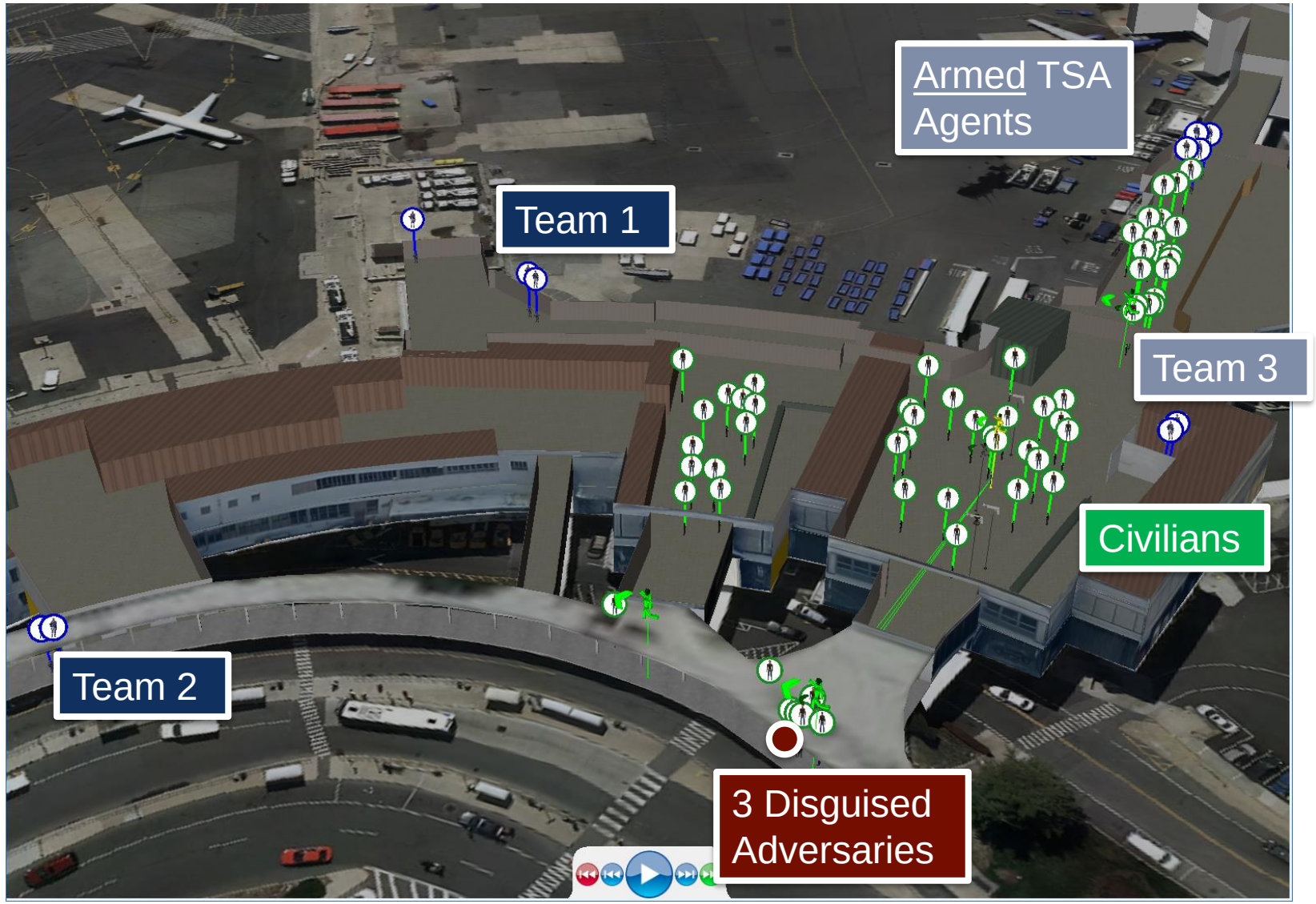
Scenario #2: Additional Response Teams/Armed TSA Agents

Threat: Three (3) Active Shooters

Defense: Three (3) law enforcement teams and armed TSA

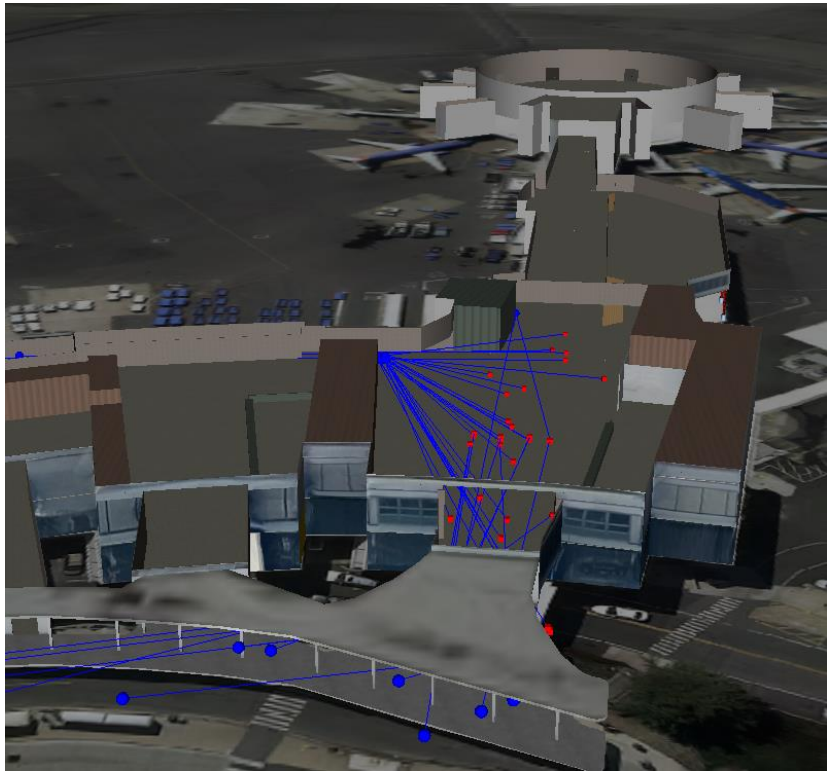
Change Over Baseline: Additional law enforcement team (e.g., Team 3) and armed TSA

Analysis: Twenty (20) simulation runs varying different locations of agents, behaviors, and adversaries

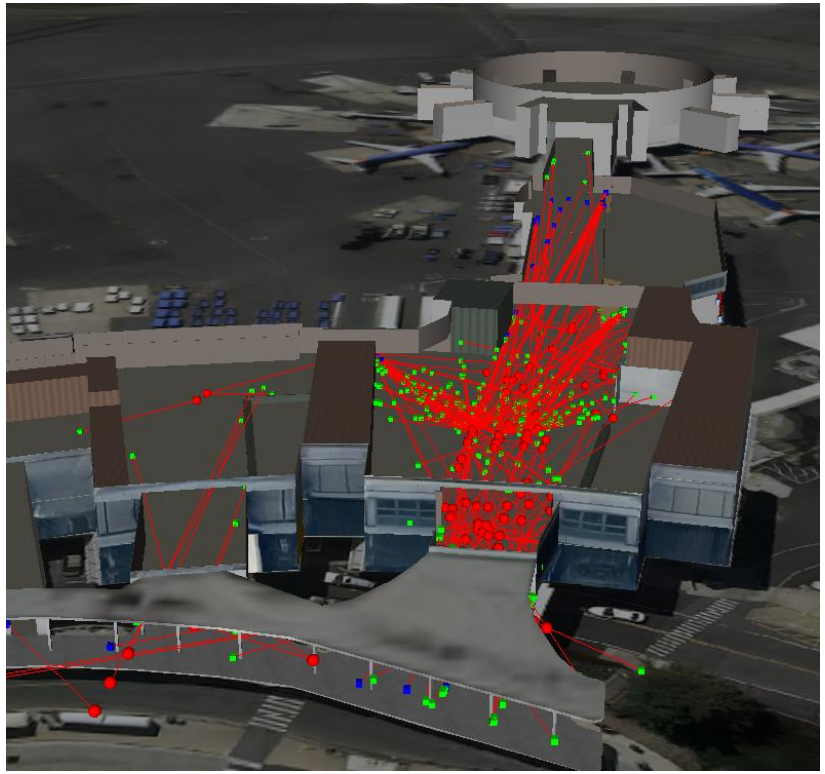


Visualization allow deeper understanding of results

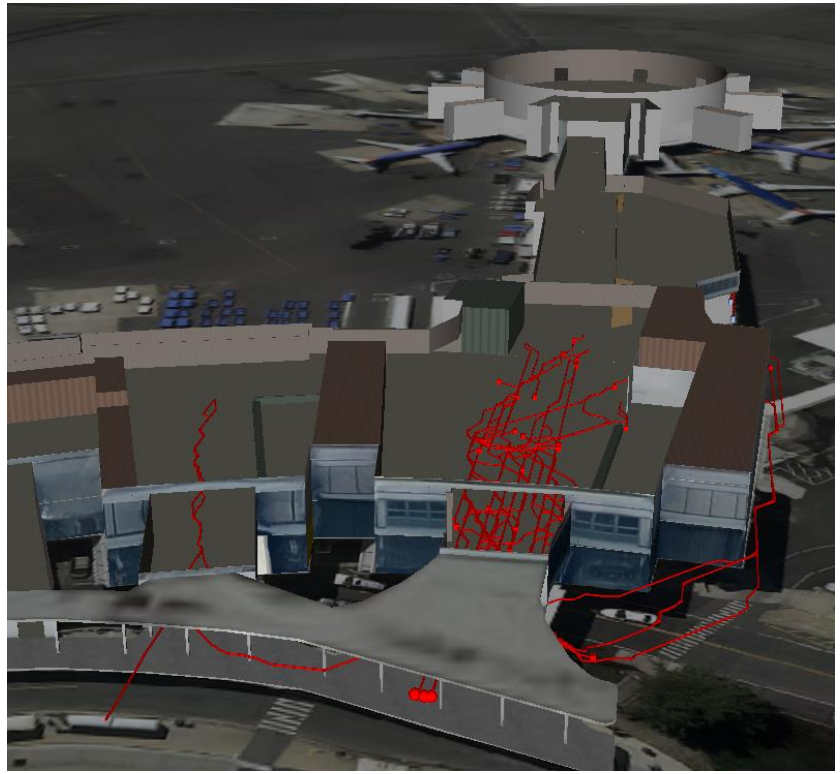
Scenario #1: Baseline *(Notional);* *Summary of ALL 20 Simulation Conditions*



Defender Shots and Kills of **Adversaries**



Adversaries Shots and Kills of Civilians and **Defenders**



Adversary Movements

- Adversaries moved freely in terminal, engaged by law enforcement team #1

Analytics and Visualization allow deeper understanding of results

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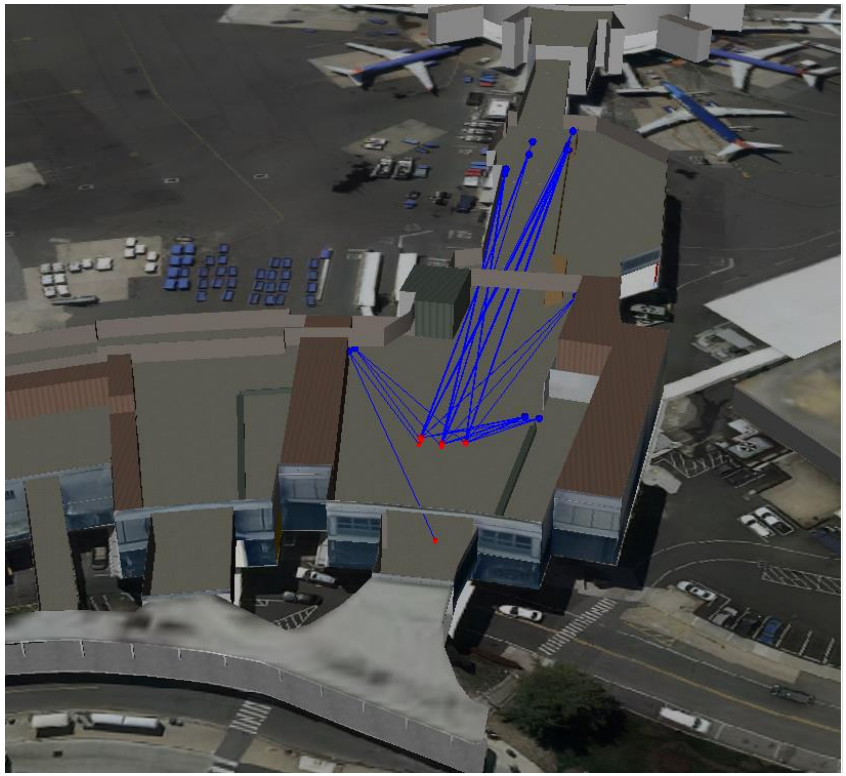
Scenario #2: Additional Response Teams/Armed TSA Agents; *Summary of ALL 20 Simulation Conditions*



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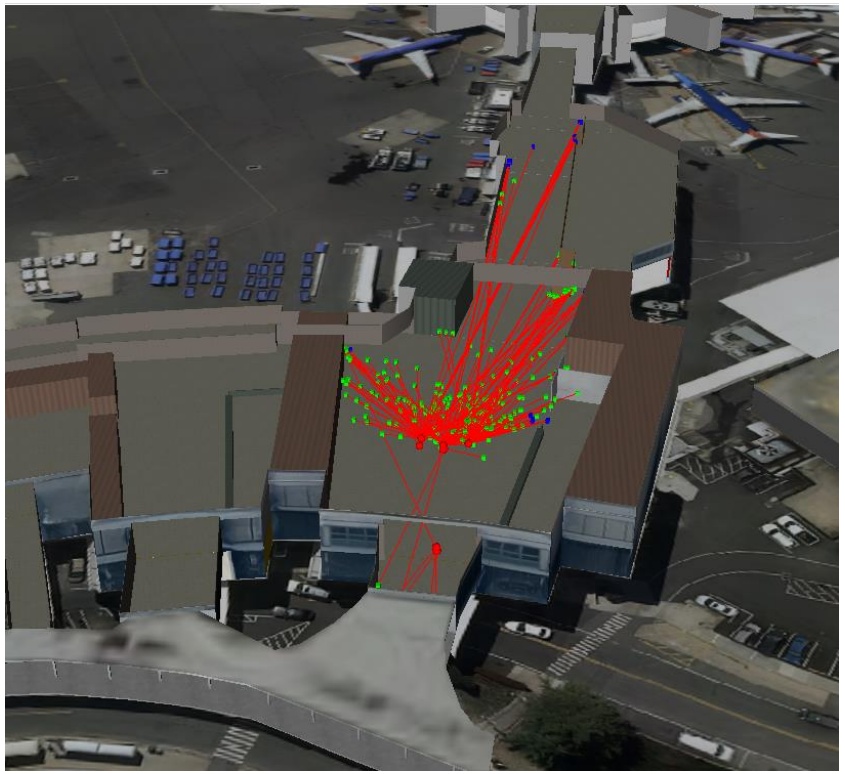
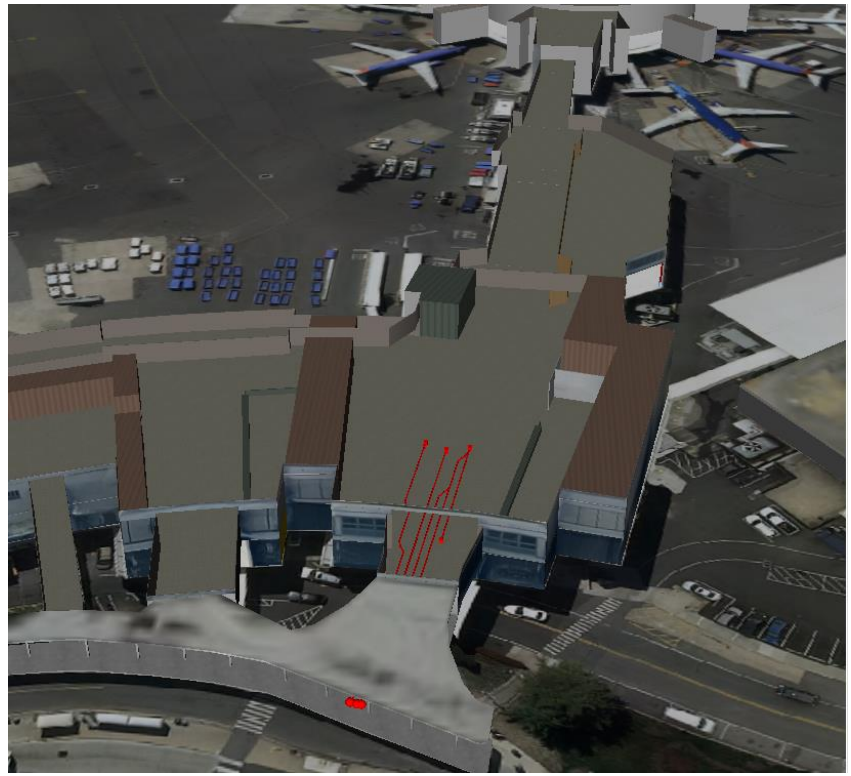


Adversaries Shots and Kills of Civilians and **Defenders**



Adversary Movements

- Adversaries engaged rapidly by armed TSA agents and additional law enforcement team #3

Threat Shifting: Attacks on Soft Targets/Areas Attractive

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22 March 2016, Brussels Airport

28 June 2016, Istanbul Airport

20 March 2015, New Orleans Airport

4 July 2002, Los Angeles Int'l Airport

Reagan National Airport (DCA)