Geospatial Integrated Problem Solving Environment

(GIPSE, pronounced *gypsy*)

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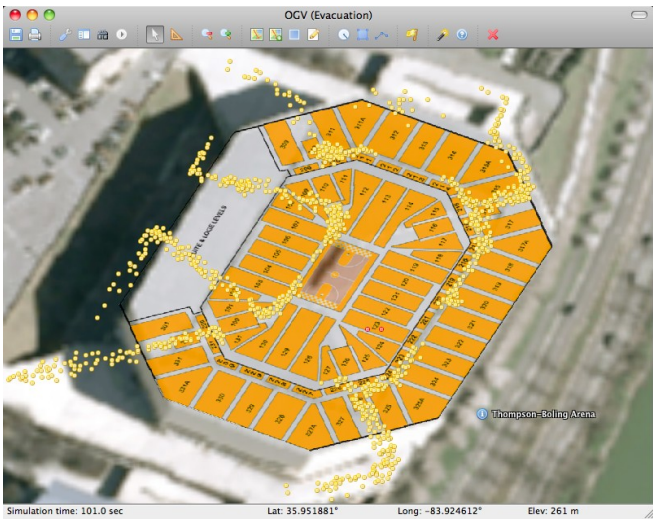
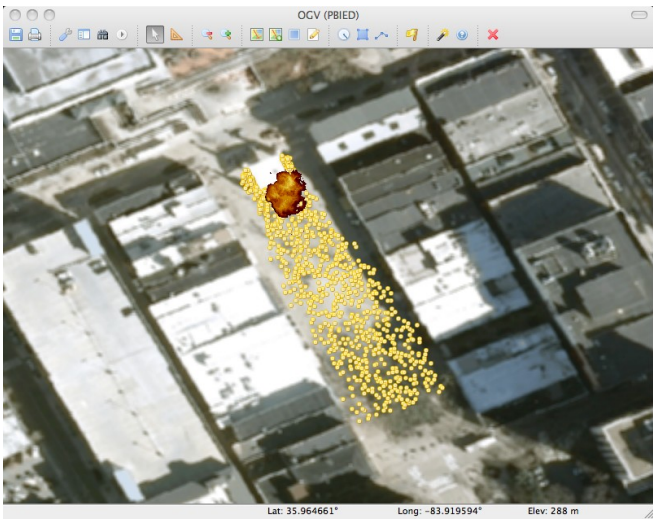
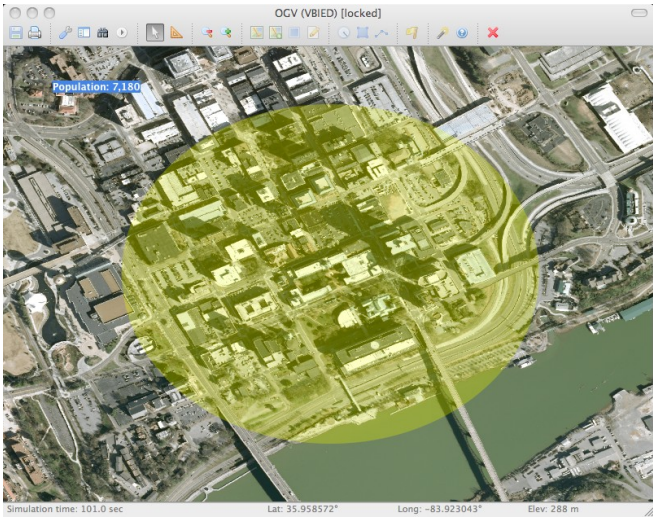
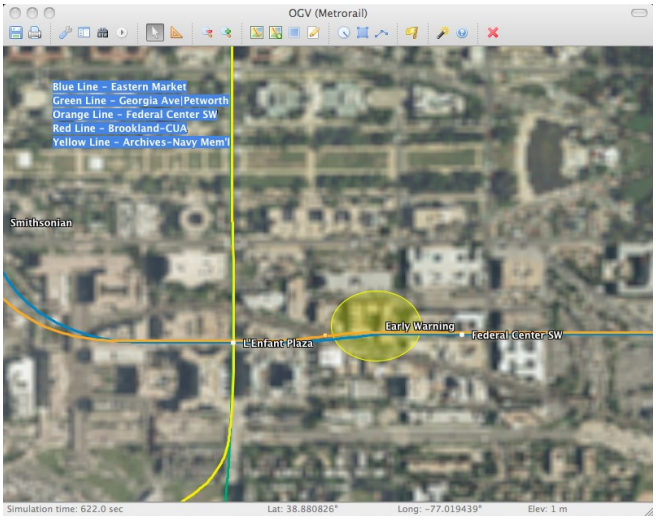
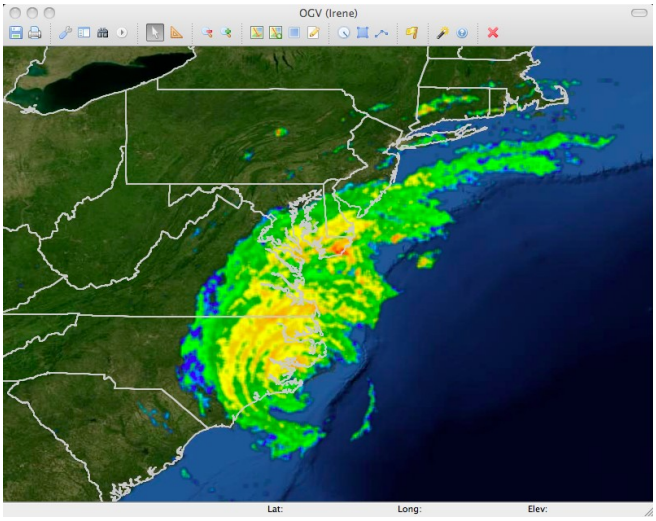
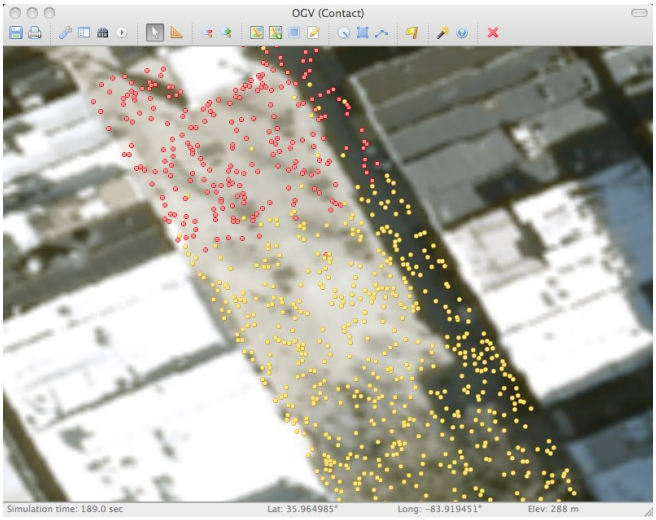
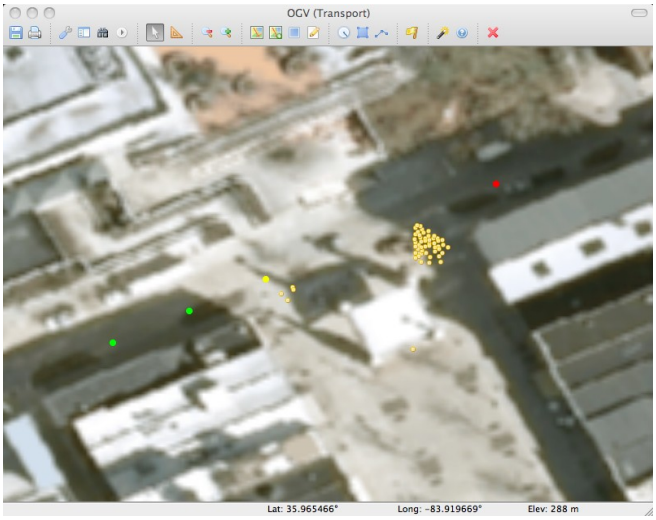
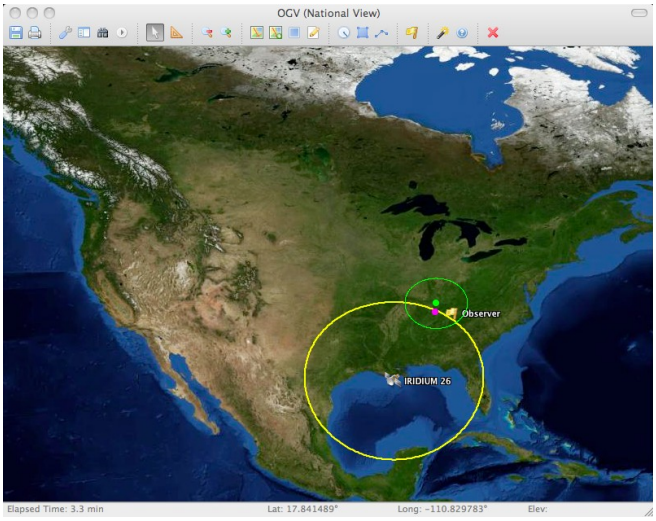
Effective emergency planning, response, and recovery (EPR&R) involving terrorist attacks or natural disasters come with a vast array of information needs. Much of the required information originates from disparate sources in widely differing formats. However, one common attribute the information often possesses is physical location. The organization and visualization of this information can be critical to the success of the EPR&R mission. Organizing information geospatially is often the most intuitive for the user. In the course of developing a field tool for the U.S. Department of Homeland Security (DHS) Office for Bombing Prevention, a geospatial integrated problem solving environment software framework was developed by Oak Ridge National Laboratory. This framework has proven useful as well in a number of other DHS, Department of Defense, and Department of Energy projects.

	Evacuation simulation of Thompson-Boling arena on the campus of The University of Tennessee, Knoxville. A user is able to designate the building enclosure, exits, and egress paths using simple drawing tools, as well as the number of occupants. Paths may be hidden for display purposes to avoid visual clutter. Each person is an object with independent parameters to allow realistic variation in movement. The total time to evacuate the building may be measured for different egress plans.
	Person-borne IED simulation in Market Square, downtown Knoxville. The person-objects first gravitate towards a stage. When the IED detonates, they must each locate the nearest exit taking into account the site of the explosion. Each must then find their own way to the exit without any designated paths. Collision avoidance is built into the simulation (which is not obvious from the viewing scale). Casualties are determined by the size of the IED and its corresponding lethality radius.

	Vehicle-borne IED simulation in downtown Knoxville. A car drives to the US Courthouse and detonates. An expanding ring (yellow) could represent the corresponding shockwave or fallout from a dirty bomb. As the ring expands, a LandScan population database gives the number of people enclosed by the ring.
	Simulation of the Washington, DC Metrorail. As each train reaches a station, it is displayed (white on blue). The Early Warning zone (yellow oval) represent a geofence. When a train enters or leaves the zone, an alert and/or an email is presented to the user. Assuming that vehicles can be tracked via GPS and location information is available from the Internet via GeoRSS or similar format, a real-time tracking dashboard with alerts could be constructed.
	Nexrad images from Hurricane Irene starting with landfall on Saturday, September 3, 2011 were captured in real time at intervals of one hour for approximately 30 hours. These images may be played back and used as the basis for calculations such as land area covered or population impacted. Storm cells may be grouped and tracked by pixel color (not shown).

	Contagion spread simulation. A single infected person is introduced into a bounded area. Over time, the infection spreads as person-to-person contacts are made. Infected persons are shown in red while uninfected persons are shown in yellow. The visualization may be driven by different epidemiological models.
	Mass transport simulation. Buses line up to evacuate people from an area. The person-objects determine the closest bus stop. A full bus is indicated in red, a loading bus in yellow, and an empty bus in green. Total simulation time may be used to determine the number of buses and loading points required.
	Satellite navigation simulation using the Iridium constellation. The true but unknown receiver position is marked with a yellow flag (Observer). The initial location estimate is marked by a green dot. The green circle shows the initial satellite antenna footprint. As a satellite passes overhead, its pseudorange ring is shown in yellow. The updated location estimate is marked by a magenta dot. An Extended Kalman Filter performs the calculations using two-line element files to describe the satellite orbits and timing measurements from their broadcasts.