CT-ANALYST™

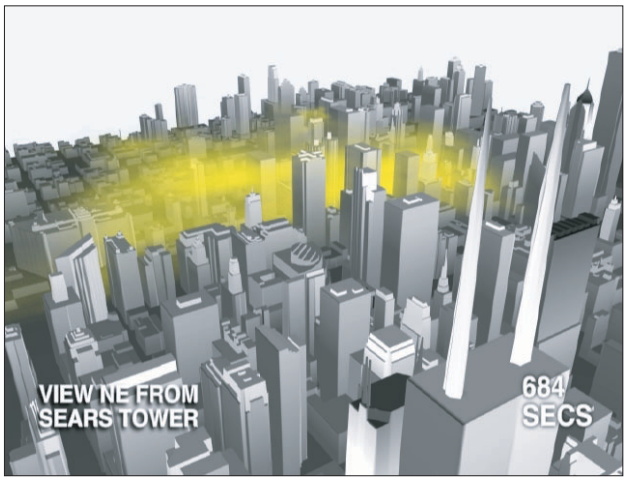
Dispersion Prediction with Zero Delay and High Fidelity for Urban Settings

DESCRIPTION

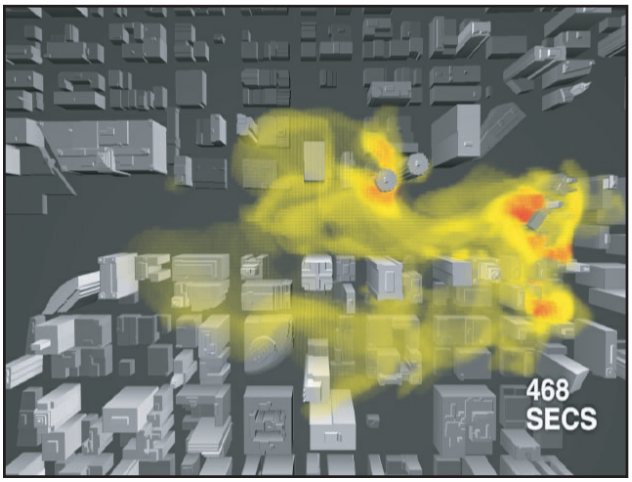
CT-Analyst provides accurate, instantaneous, 3D predictions of CBR agent transport in urban settings. In the past, more accuracy has always meant more computing and more computing means more delay. Waiting even a fraction of a minute for a simplified scenario computation can be far too long for timely situation assessment. Therefore, CT-Analyst uses the best computations possible prepared well ahead of time and captures their salient results in a highly compressed database to be manipulated and displayed instantly. A detailed, citywide model of dynamic urban airflow (called FAST3D-CT) supplies a cutting-edge 3D database of agent airflow to power CT-Analyst. The accuracy of full 3D fluid dynamics simulations with meter-scale resolution is placed at the fingertips of first-responders and emergency managers. In a visual, easy-to-comprehend form with zero time delay. The "transformational" new technology enabling this breakthrough capability is called "Dispersion Nomographs™."

APPLICATIONS

Versions of CT-Analyst can support emergency response of civilian and military personnel to CBR incidents and can be applied to the control and integration of sensor networks. On site and headquarters staff would use this tool for data fusion to give a minute-by-minute situation assessment including projected evacuation routes. It could also be used for war games, virtual reality training, site defense planning, and sensor placement optimization. Three or four appropriate sensor readings can be backtracked to an unknown source, and the downwind "Footprint" of the expanding plume can be determined in small a fraction of a second. The implementation also has sensor fusion capabilities with a "point-and-click" controller to select, morph, and manipulate user-constructed or sensor-driven CBR scenarios directly. Sources and sensors can be dragged across the screen as the resulting situation shifts instantaneously to follow. CT-Analyst is being incorporated into BAE Systems PEGEM software under Pentagon Missile Defense Agency sponsorship.



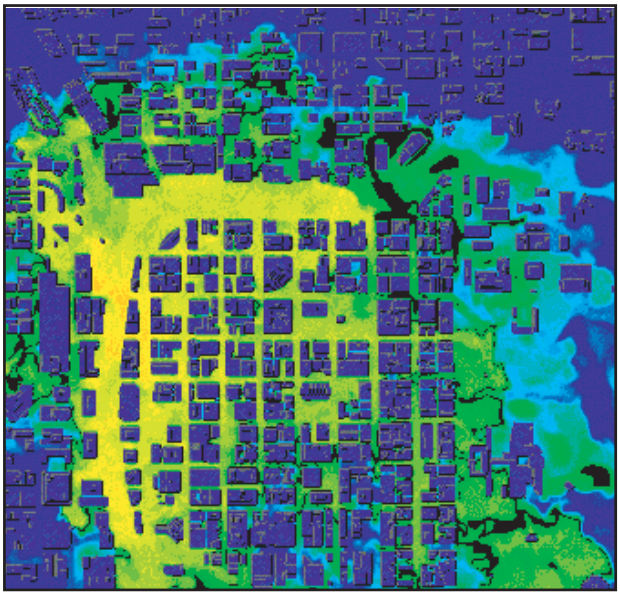
(a) View from the northeast



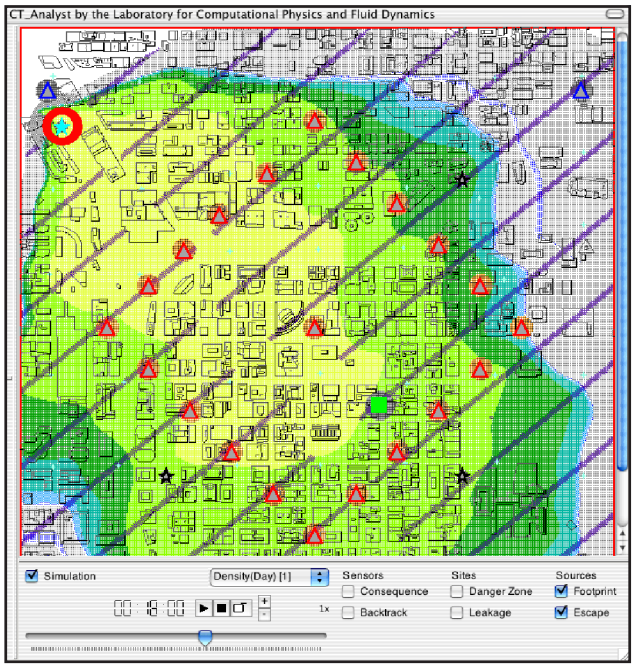
(b) View from above

Frames from a high-resolution video of a FAST3D-CT simulation of downtown Chicago computed using a 360 × 360 × 55 grid (6-m resolution). A 3-m/s wind off the lake from the east blows contaminant across a portion of the detailed FastCity urban geometry required for accurate flow simulations.

COMPARISON OF FAST3D-CT WITH CT-ANALYST (RIGHT) DOWNTOWN CHICAGO



FAST3D-CT simulation of a contaminant cloud in an urban area with the average wind from 320 degrees at 3 m/s. The time after release, source location, and conditions correspond exactly to the CT-Analyst scenario shown in the figure to the right.



CT-Analyst full screen display showing plume envelope (colored region), contamination footprint (grey), and evacuation routes (magenta/purple) overlaid on a city map.

REQUIREMENTS CHECKLIST

- ☑ **IMMEDIATE DATA FUSION USING**
  Anecdotal information, qualitative data and sensor data
- ☑ **IMMEDIATE CONSEQUENCES**
  Simple, instantaneous computation of exposed and soon-to-be exposed regions based on very limited data
- ☑ **SITUATION-BASED ESCAPE ROUTES**
  Quickly project optimal evacuation routes based on the current evolving situation assessment and support building defense
- ☑ **EMERGENCY MANAGEMENT TOOLS**
  - Web broadcast of results, connection to urban Geophysical Information Systems (GIS)
  - Coordinate remotes and backtrack to unknown sources

CT-ANALYST ACHIEVES

ACCURACY

80-90% as accurate as state-of-the-art 3D time-accurate CFD based on a quantitative Figure of Merit

FLEXIBILITY

Unique new features include graphical sensor fusion, forward and reverse plumes, rotate winds, source backtrack, evacuation and building infiltration

SPEED ("zero latency")

- 100 to 10000 × faster than real time
- Instant visual interpretation and comprehension

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