SAND2006-0197P

Department of Homeland Security's Information Analysis and Infrastructure Protection

National Infrastructure Simulation & Analysis Center

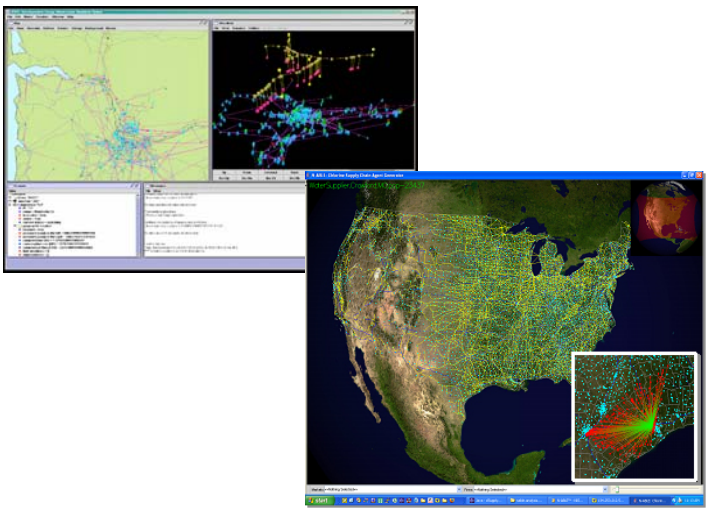
The National Infrastructure Simulation and Analysis Center (NISAC), a program under the Department of Homeland Security's (DHS) Infrastructure Protection/ Risk Management Division (IP/RMD), provides advanced modeling and simulation capabilities for the analysis of critical infrastructures, their interdependencies, vulnerabilities, and complexities.

NISAC is a partnership between Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL). It was established in the year 2000 to integrate the laboratories' expertise in the modeling and simulation of complex systems for evaluating national security problems.

Program Basis

America's critical infrastructures provide the foundation for the nation's economic vitality, national security, and way of life. They frame citizens' daily lives and support one of the world's highest living standards.

The systems, facilities, and functions that comprise critical infrastructures are sophisticated, complex, and highly interdependent. They are comprised of physical, human, and cyber assets, and have evolved over time to be economical and efficient systems. The increasing interconnections and complexity of these systems, coupled with the new threat environment, have created the need for a focus on interdependencies and the consequences they propagate.

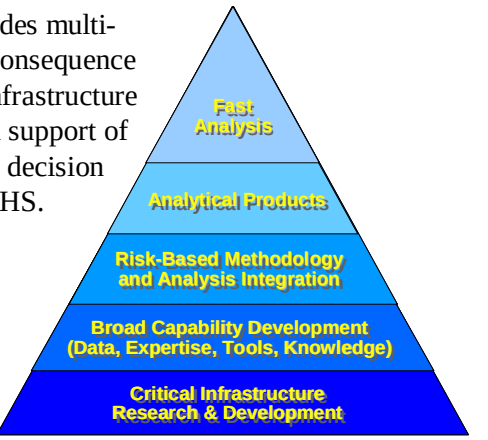


NISAC's objective is to support the protection of our nation and society by providing analyses of the technical, economic, and national security implications of infrastructure protection, mitigation, response and recovery options.

To do this, we must first understand the infrastructures' performance under unusual conditions, the effects of interdependencies, and the dynamics of their interconnections. To better understand the complexities of the interconnected infrastructures, we collaborate with private sector infrastructure experts to develop methodologies and tools for characterizing and simulating their performance.

Program Capabilities

NISAC provides multi-disciplinary consequence analyses of infrastructure disruptions in support of risk informed decision making for DHS.



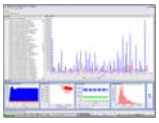
The complexities of modeling interdependent, national infrastructures are significant. NISAC is developing a wide range of modeling capabilities that can be used alone or in combination. These models include stock-and-flow process based system dynamics models, mathematical network optimization models, physics-based models of existing infrastructures, and high-fidelity agent-based simulations of systems of individual elements and their performance and behaviors.

Dynamic Infrastructure Interdependencies Simulation & Analysis

System dynamics modeling to quantify and evaluate the effects of infrastructures and their interdependencies on supply and demand under different conditions (e.g., time of day, time of year, unusual event, new regulations, incentives, market structures).

Port Operations and Economic Conditions Simulators

National Petroleum System Simulator

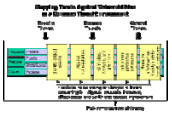


NISAC Agent-Based Laboratory for Economics

A large-scale microeconomic simulation tool that captures complex supply chain and market dynamics of businesses in the U.S. economy for a better understanding of the impacts of vulnerabilities and disruptions on national economic security.

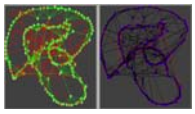
Railroad Network Analysis System

Mathematically sound non-linear optimization techniques are applied to railroad networks to understand their behavior under normal and disrupted situations, to examine commodity flow disruptions due to destruction of assets, and to study policy options concerning the movement of toxic chemicals by rail.



Methodologies for Asset Prioritization

Development of methodologies and tools to assist in quantifying asset threat, vulnerability, consequence, and risk data for prioritization of protection and funding activities. NISAC's Waterways project for the US Coast Guard is providing a tool to map threats against vulnerabilities in a dynamic threat environment.

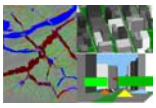


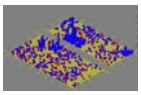
Advanced Modeling & Techniques Investigation

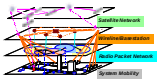
A long-term investment to identify and develop theories, methods, and analytical tools that are useful for understanding the structure, function, and evolution of complex interdependent critical infrastructures.

Interdependent Energy Infrastructure Simulation System

A comprehensive simulation environment for interdependent energy infrastructures representation and analysis (focused especially on electric power and natural gas systems) based on the physics of the infrastructures, and resolved to the infrastructure component level.







The Urban Infrastructure Suite (UIS)

A set of seven interoperable modules that employ advanced modeling and simulation methodologies to represent urban infrastructures and populations. These simulation-based modules are linked through a common interface for the flow of information between UIS sector simulations to model urban transportation, telecommunications, public health, energy, financial (commodity markets), and water-distribution infrastructures and their interdependencies.

Urban Population Mobility Simulation Technologies (UPMoST) Module

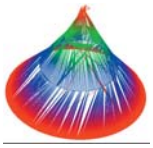
Epidemiological Simulation Systems (EpiSims) Module

Telecommunications Sector: AdHopNet Module

Transportation Analysis Simulation System (TRANSIMS) Module

Water Infrastructure Simulation Environment (WISE)

Generic Cities Project



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