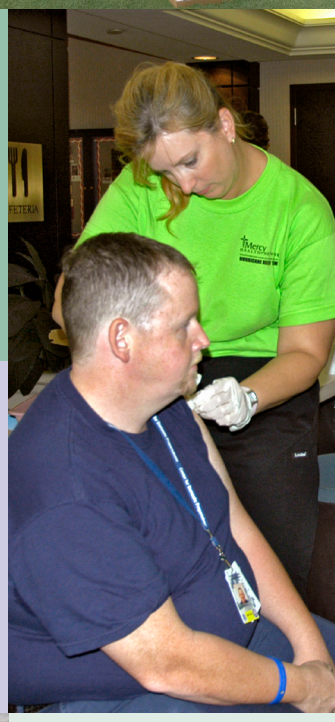
Argonne NATIONAL LABORATORY

Logistics and Process Analysis Tool (LPAT)

THE POWER OF COMBINING SOFTWARE

Supply Chain Analysis for Emergency Management and Public Health Professionals



Modeling provides a foundation for effective planning that is scientifically derived and uses objective assumptions. Effective models must be robust, user-friendly, and provide actionable estimates of the range and scope of potential responses. Successful models for emergency management and public health professionals should facilitate and help to finalize logistics planning.

Why LPAT?

Managing the movement of equipment, cargo, or personnel through a supply chain is a complex process, often hampered by conflicting priorities. Argonne National Laboratory has developed a portfolio of modeling tools to simplify this process at the macro- and the micro-levels. LPAT, under development at Argonne, combines the capabilities of two existing discrete modeling tools – ELIST *(Enhanced Logistics Intra-Theater Support Tool)* and PAT *(Process Analysis Tool)* – into one comprehensive analysis system.

- *ELIST – Mature Macro-level (Network) Logisitics and Transportation Planning Model*
  - Assists *emergency management and public health professionals* in providing efficient, effective logistics analysis for managing domestic incidents
  - Assists *planners* in evaluating and understanding the impacts of conflicting priorities
- *PAT – Activity Center Model for Micro-level Planning and Analysis*
  - Allows users to tailor simulations to reflect scenario- and site-specific functions
  - Makes it possible for users to model individual tasks inside a facility or among a group of facilities
- *LPAT – Building on the Strength of Proven Software*
  - Merges macro (ELIST) and micro (PAT) planning capabilities into a holistic logistics and process analysis system
  - Gives *emergency management and public health professionals* the ability to test, analyze, and understand the interactive elements of the supply chain

Why Argonne National Laboratory?

Argonne National Laboratory has worked with the emergency management community to advance its logistics response capabilities. The laboratory has extensive experience and an enviable track record:

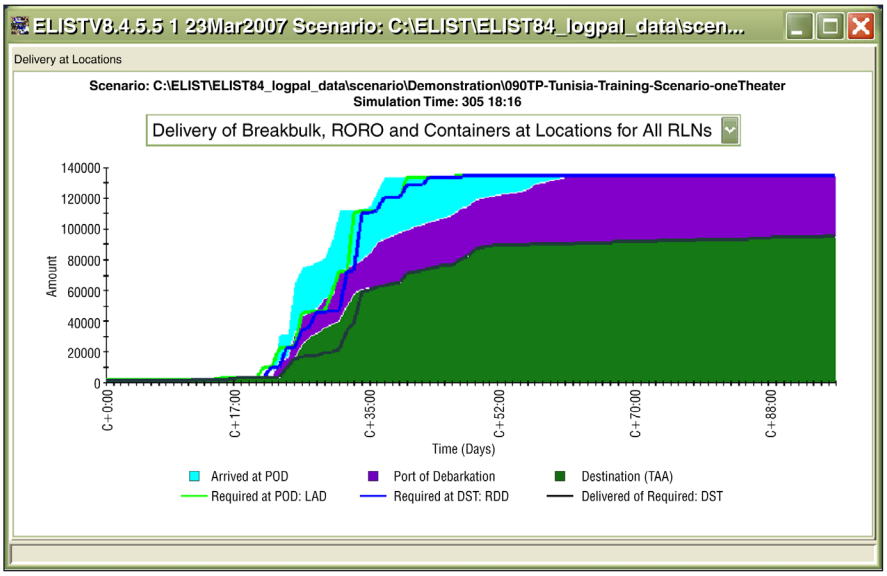
- *Experienced in Supporting Emergency Management Services Programs*
  - Supported federal, state, and local emergency management agencies for 30 years
  - Provided personnel to support emergency management, planners, and responders to counter technological and natural disasters and other emergencies
- *Years of Experience and a Proven Track Record*
  - An exemplary history of developing useful, usable, and used decision tools, models, and information systems to resolve issues of regional, national, and global significance
  - A strong foundation in systems-based emergency services planning, training, and exercises for emergency management activities

ELIST – Mature Macro-level (Network) Logistics and Transportation Planning Model

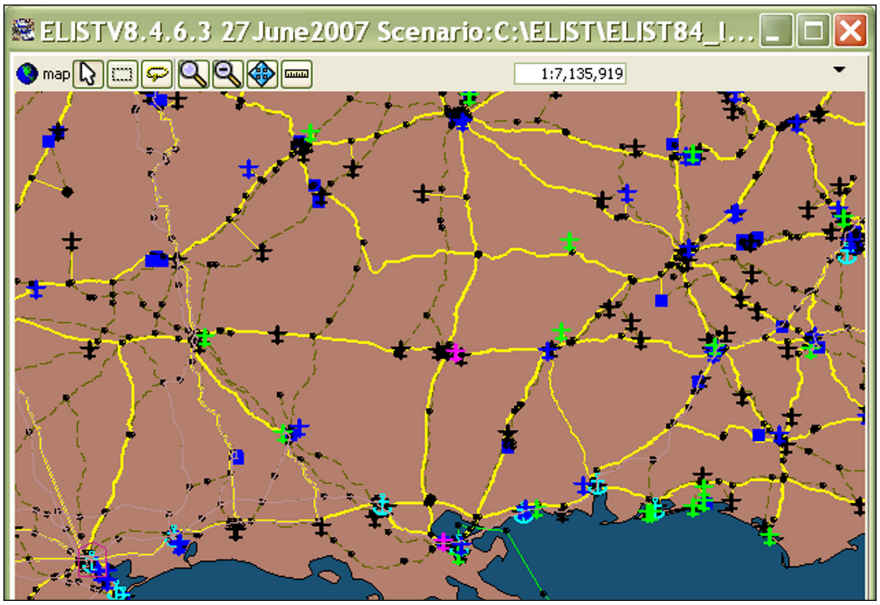
ELIST is a transportation analysis tool developed for the Department of Defense (DoD) to analyze force deployments. It employs user-defined transportation assets (e.g., trucks, trains, etc.) and cargo to be moved utilizing (1) existing transportation infrastructure (roads, rail, air, etc.) and (2) user-defined priorities of movement.*

ELIST performs a simulation of the required transportation plan and generates detailed reports and graphs that summarize movement requirements and asset and resource utilization; it also provides 2D animation of vehicle movements.

Adapting ELIST to meet the needs of *emergency management and public health professionals* will help response planners develop an efficient, transparent, and flexible logistics system for transporting people, goods, and services during an emergency.



Sample ELIST closure graph



ELIST contains a complete data library on national-level transportation infrastructure used by DoD. This screen shot shows rail lines, pipelines, seaports, and international airports at the regional level.

ELIST answers questions like:

- Will personnel and supplies arrive on time?
- Is there enough infrastructure capability for their movement?
- Have enough assets been assigned to accomplish the undertaking?
- Are there any bottlenecks that could be alleviated?

**ELIST uses standardized data inputs, an interactive mapping system, and customized local data to perform a vehicle-level discrete event simulation to determine if a logistics plan is feasible, and if not, why not. All infrastructure and asset resources can be displayed in either graphic or table formats.*

PAT – Activity Center Model for Micro-level Planning and Analysis

Like ELIST, PAT can be tailored by the analyst to emulate scenario- and site-specific functions,* reflecting the tasks and procedures to be performed at facilities – from large-scale depot operations to activities taking place at a small location like a vaccination center. The analyst can specify combinations of unique facilities (i.e., those that conduct dissimilar functions) and multiple facilities that conduct similar operations, such as Federal Emergency Management Agency (FEMA) logistics centers, transshipment facilities (for drugs, water, and other supplies), and temporary or existing healthcare facilities (e.g., gymnasiums, hospitals, and clinics).

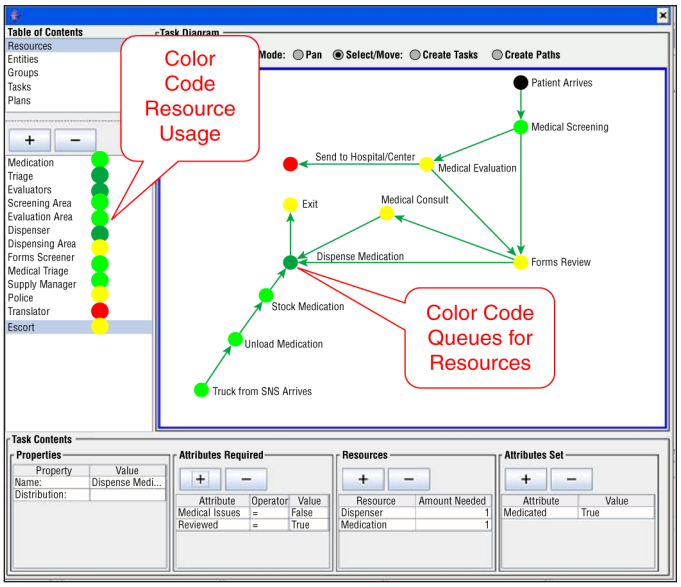
Caregivers administer shots at a vaccination center during a mass inoculation training exercise

PAT Design Process

- Analysts can define triggering conditions:
  - Diagram the initial process flows and use the output to create the tasks and decision points in a plan
  - Tailor the activity times for each task
  - Execute the tasks selected and analyze alternative configurations
- Once the initial model is tested, analysts can:
  - Change the timing distributions of processes
  - Change the type/number of available resources
  - Add/delete/modify agents required to perform the processes
  - Run alternative/contingency plans (scenarios)
  - Work with experts to develop new scenarios

**PAT can support the planning of FEMA training exercises or crisis responses by modeling the complex behaviors of individual actions, decision logic, and social interactions. The analyst can define what entities are needed to support planning and execution (e.g., healthcare facilities, supply depots, personnel vehicles, medical staff, etc.) and the processes that are performed at the site.*

Pre-positioned supplies at a FEMA logistics center



Scenarios can be run dynamically or batched to produce output. Data are gathered and histories generated for each agent used in the simulation. Color coding is used to effortlessly identify queuing data and resource usage.

LPAT – Building on the Strength of Proven Software

LPAT permits the analyst to use the ELIST or PAT components *independently* or *in concert* with one another as the scenario dictates. When used individually, ELIST and PAT are powerful tools for analyzing the multi-scale impact of supply chain operations. By integrating these two models into a supply chain system (Logistics and Process Analysis Tool), the *emergency management or public health professional* gains the ability to test, analyze, and understand how the interaction between individual parts of the supply chain influence each other. When used in scenario planning and training exercises, LPAT will permit users to determine the likely consequences of transportation and process decisions *before* commitments are made.

LPAT makes it possible to track supplies, such as SNS (Strategic National Stockpile) movements, from storage to transport (shown loaded on an aircraft) to delivery to distribution

Benefits for Emergency Management and Public Healthcare Professionals

- Answer real-world questions about actual situations
  - What is the effect on dissemination of prophylaxis during a Strategic National Stockpile deployment if nursing staff is reduced by 25 percent?
  - How does capacity affect deployment to dispensing and vaccination centers?
- Test and evaluate logistics issues before an incident and evaluate response alternatives after an event
- Use as a planning tool to prepare for an incident of local, state, or national significance
- Master connections among strategic, tactical, and operational levels of deployment
  - Determine routing/re-routing needs
  - Isolate potential infrastructure congestion or limitations
  - Pinpoint fuel requirements
  - Identify the need for additional or reconfigured assets
- Assess hazard impacts, such as damage to housing, hospitals, and utilities, and analyze the assets required for response/recovery, such as trucks, power generators, staff, and supplies

An EMT and a doctor push a "patient" into a temporary emergency room during an exercise

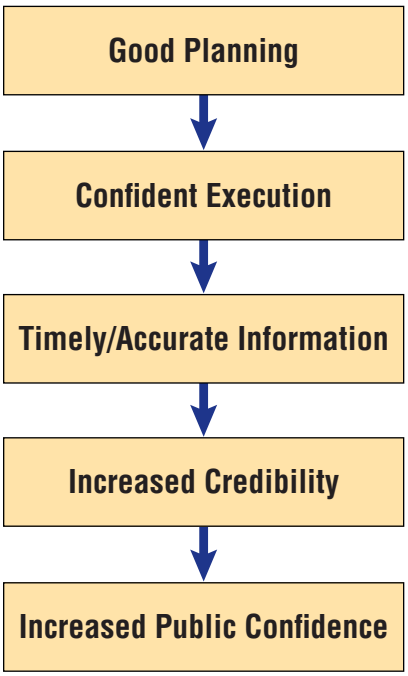
Disaster Management Assistance Team member retrieves medicine from inventory

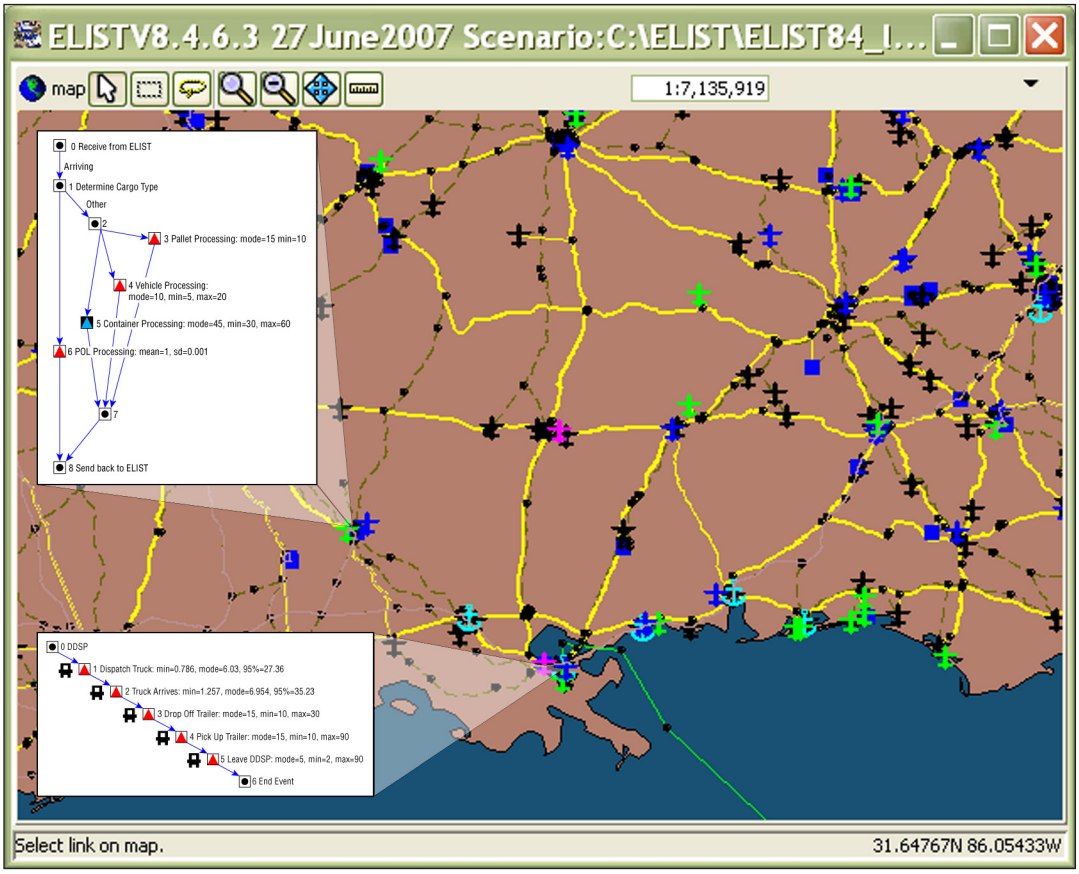
Alternative LPAT Applications

LPAT's combination of transportation and processing analysis can function as a useful platform within and across many domains:

- Evacuation
  - Identify unique transportation requirements for the special-needs population
  - Recognize existing transportation alternatives for people leaving cities where there is limited or no gasoline
- Multi-mode Transportation Analyses
  - Ascertain additional assets required for shipment
  - Determine the impacts of infrastructure and material-handling investments
- Emergency Management and Public Health Deployment
  - Predict arrival time of personnel
  - Assess performance of various resupply and distribution schemes
- Epidemiologic Modeling
  - Simulate multi-agent infectious diseases
  - Support multiple disease modeling techniques (e.g., agent-based, system dynamics)

Logistics Planning Continuum





Transportation infrastructure with process nodes included. LPAT adds detail to ELIST. The sample screen shot shows how transportation infrastructure would interact with distribution facilities given location. The combination of transportation and processing analysis can be applied to many domains.

Argonne National Laboratory Experience and Track Record

Argonne National Laboratory is one of the U.S. Department of Energy's premier research and development centers. Today, the laboratory has 21 research divisions, including the Decision and Information Sciences Division (DIS), which includes the Emergency Preparedness Group.

DIS develops state-of-the-art decision tools, models, and information systems. Systems-based emergency services planning, training, and exercises are the foundation of Argonne's emergency management activities. DIS employs 330 professionals, including 242 scientists and engineers, holding more than 160 doctorate or other advanced degrees. With an annual budget of more than $55 million, DIS supports more than 200 research programs for governmental and non-governmental organizations.

DIS aggressively recruits qualified and innovative professional personnel and project managers for our program management teams. These teams can address the unique needs of both technology and service-driven companies and organizations like FEMA. As a results-oriented organization, DIS is small enough to be fast and flexible, but with a pool of multidisciplinary resources to ensure quick location of information to meet the needs of our clients. DIS prides itself in developing products, services, and technology that are useful, usable, and used.

Why LPAT and Argonne National Laboratory?

- LPAT will assist *emergency management and public health professionals* in defining gaps in response and recovery needs:
  - What do I have?
  - What will I need?
  - Where can I get it?
  - How will I move it?
  - How fast can I get there?
  - What alternatives do I have?
- LPAT will facilitate the ability of *emergency management and public health professionals* to manage equipment, supplies, and personnel to support effective disaster response-and-recovery operations.
- With advanced planning, training, and exercises supported by Argonne National Laboratory, LPAT can assist public affairs officials in providing timely and accurate disaster recovery information.
- Argonne National Laboratory has 30 years of experience in supporting national, regional, state, and local emergency management activities with systems-based emergency planning, training, and exercising. We will support you, your needs, and the software.
- The combination of Argonne National Laboratory's dedicated personnel, experience, resources, and reputation equal a partner that federal, state, and local emergency management won't outgrow.

Argonne National Laboratory – Fostering solutions built to LAST…

Listen — Argonne **listens** to clients to understand their working environment and needs

Assess — Argonne **assesses** what they've heard to identify potential technology solutions to client requirements

Solve — Argonne **solves** the problem by combining ideas and technology know-how to meet the specified challenge

Transfer — Argonne **transfers** the solution by delivering a useful product, exceptional training, and long-term support

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