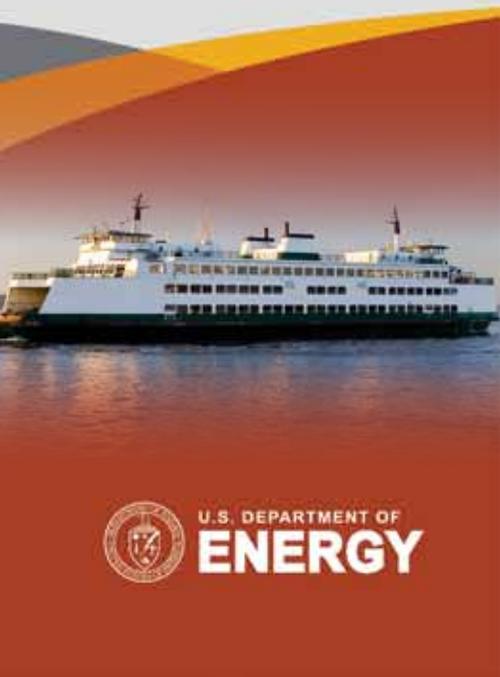




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Operations Research Scientists at PNNL use modeling and simulation to analyze real-world operational processes. The models form the basis for "what-if" scenario analysis and informed decision making.



Pacific Northwest National Laboratory

Operations Research

Operations Research (OR) is the discipline of applying advanced analytical methods to make better, more informed decisions to achieve desired outcomes. Mathematical modeling and simulation techniques are employed to analyze complex situations and conditions. Data collected and organized provides greater clarity and insight for making resource investment, operational, or other situational awareness-based decisions.

In national security and health domains, even minor adjustments in practices and decisions can reap substantial gains in effectiveness, safety, and productivity, as well as support improvements to system efficiencies. OR can also uncover practices and outcomes that need revision, and then serve as a guide to adjustments.

Operational Research experts at the Pacific Northwest National Laboratory (PNNL) have created a strong capability that leverages interdisciplinary teaming and collaborations across the U.S. Department of Energy (DOE) research complex and beyond, with OR capabilities being applied to operational challenges for federal and private industry clients.

Benefits of Analytical Technologies

Simulation – concepts and approaches can be modeled and tested without interrupting operations.

Optimization – systematically narrows performance choices to the very best among a large field of options.

Probability and statistics – risks are measured and data mined to characterize systems and make reliable forecasts.

Decision analysis – procedures, methods, and tools to represent and translate decisions into insight.

PNNL OR Activities

- ▶ **Resource allocation model** to minimize risk of terrorist threats to Washington State Ferries
- ▶ **Optimization model** to deploy radiation portal monitor equipment for Domestic Nuclear Detection Office (DNDO)
- ▶ **Simulation** of airport screening for pandemic influenza for the Department of Homeland Security (DHS) and Centers for Disease Control and Prevention (CDC)
- ▶ **Quick-look decision tools** to enable pandemic influenza planning for state/local governments
- ▶ **Simulation** of radiation screening of containers from cargo vessels at the Port of Tacoma in Washington state
- ▶ **Simulation and trade-off analysis** for analysis of detection platforms (boat vs. helicopter for DNDO)
- ▶ **Analysis of Alternatives** for best architecture and operations concept for small vessel radiation detection for DNDO
- ▶ **Simulation** for radiation screening of baggage and passengers at airports
- ▶ **Global infectious disease model** to analyze risk and impacts to the U.S. from smallpox outbreaks in foreign countries (CDC)
- ▶ **Biosurveillance event-detection** metrics to characterize and evaluate models and systems (DHS)
- ▶ **Modeling** the benefits of information flow to the Global Nuclear Detection Architecture



Specialty OR Laboratory

In 2010, PNNL established a new, state-of-the-art OR laboratory equipped with advanced computer systems, visual displays, and sophisticated interactive simulation, optimization, and decision analysis software packages. The lab provides a dedicated OR research environment that supports internal and external collaborations.

Diversity in Application

- ▶ Business, industrial and manufacturing processes
- ▶ Resource planning
- ▶ Technology development and deployment
- ▶ Emergency and crisis response
- ▶ Transportation systems
- ▶ Military readiness
- ▶ Medical services
- ▶ Port operations
- ▶ Risk Assessment

Clients, Partners and Collaborators

- ▶ Department of Homeland Security
- ▶ Centers for Disease Control
- ▶ United States Pacific Command
- ▶ Washington State Ferries and Washington State Patrol
- ▶ Universities and other academic institutions
- ▶ Other national laboratories
- ▶ U.S. NORTHCOM Surgeon General

Operations Research Approach

- ▶ **Understand needs** by focusing on client expectations, requirements, and desired outcomes
- ▶ **Develop models** to understand and analyze current processes
- ▶ **Use models** to test alternative processes and resources to determine best mix of both
- ▶ **Provide recommendations** to client for minimizing costs and maximizing efficiency



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DR. ROBERT T. BRIGANTIC is an Operations Research Scientist specializing in modeling and simulation, statistical pattern recognition, artificial intelligence, imagery analysis, design of experiments, and optimization. His research is focused on operational modeling and simulation of pandemic diseases and associated impact/effectiveness analyses; operational modeling and simulation of radiation/nuclear screening processes (e.g., passengers screening at airports and small vessels in maritime domain); and imagery analysis and automated target detection methods (e.g., feature extraction and automated conflation). Dr. Brigantic holds a Ph.D. in Operations Research from the Air Force Institute of Technology, an M.S. in Space Operations from the Air Force Institute of Technology, and a B.S. in Chemical Engineering from Oregon State University. He also serves as an adjunct professor of Operations Research with Washington State University and the Air Force Institute of Technology.



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DR. COURTNEY CORLEY is a Health Security and Informatics Research Scientist specializing in the development of computational explanatory and predictive models that integrate social, behavioral, and cultural factors with biomedical factors. This research demonstrates how decision-making regarding health responses to human, animal, plant, water and air biological events can be supported through leveraging predictive modeling techniques informed by system science. Research specialties include computational epidemiology and biology, data-intensive analytics, network science, and novel event-based biosurveillance models that leverage high-performance computing and social media analytics.

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MR. CASEY J. PERKINS is an Industrial Engineer specializing in process modeling and simulation, production and operations analysis, operations research, and supply chain analysis. Mr. Perkins has experience in performing production capability analyses, process improvement activities, resource planning, and forecasting.

Mr. Perkins graduated from the University of Washington with a B.S. in Industrial Engineering.

ABOUT PNNL

The Pacific Northwest National Laboratory is a Department of Energy Office of Science national laboratory. PNNL employs 4,700 staff, with an annual budget of \$1.1 billion, and has been managed by Ohio-based Battelle since the Lab's inception in 1965.

Scientists and researchers at the Pacific Northwest National Laboratory (PNNL) are advancing the frontiers of science and delivering solutions to America's most intractable solutions in energy, national security and the environment. These solutions cross cut both federal and private industry challenges.



Pacific Northwest
NATIONAL LABORATORY

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