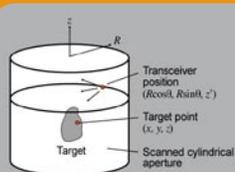


From Concepts to Solutions

PNNL researchers apply their expertise to problems across the full range of the technology development cycle. This evolves from basic research through proof of concept and prototype development to production and deployment of fully mature systems. This breadth helps PNNL staff understand and effectively deal with all of the challenges of bringing a technology from the idea stage to a working solution in the field. One such example below is PNNL's Millimeter Wave technology—a holographic imaging system.

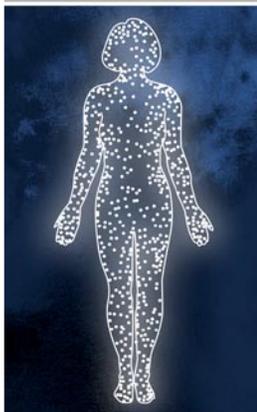
Research

This phase starts with an idea, defines a technical concept and conducts experiments and modeling to develop an understanding of the basic characteristics of the selected approach.



Development & Demonstration

This phase involves the development and integration of components into initial systems to demonstrate feasibility.



Testing & Evaluation

In this phase, activities are conducted to qualify technologies for application in a true operational environment.



Production & Deployment

In this final phase, system development is completed and the technology is commercialized for deployment in its final form.



Pacific Northwest National Laboratory

Pacific Northwest National Laboratory is a U.S. Department of Energy Office of Science research facility that delivers breakthroughs in the areas of environment, energy, health, fundamental science and national security. Battelle, based in Columbus, Ohio, has operated PNNL since 1965. PNNL is involved in research and development supporting mission objectives for the U.S. Department of Defense and the U.S. Department of Homeland Security.

PNNL is located in Richland, WA, and has an annual business volume of more than \$750 million and more than 4,100 employees. Additional web resources are at: <http://www.pnl.gov>.

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Pacific Northwest
NATIONAL LABORATORY

Explosives Countermeasures Capabilities



NATIONAL SECURITY



Multidisciplinary Approach for Integrated Solutions

There is no single solution to countering the wide range and continual evolution of explosive threats to our society. Threats involving explosives are proving difficult to mitigate because they can take a number of different forms and can be delivered to their targets in a variety of ways, and also because they evolve over time. Providing effective tactics to countering these threats requires an integrated, multidisciplinary approach that draws on a wide variety of applicable scientific and engineering disciplines and capabilities. This approach provides innovative and practical solutions that work in the real world.

Pacific Northwest National Laboratory (PNNL) scientists and engineers work closely with clients to develop an understanding of all aspects of their specific problems, and then draw from a broad range of disciplines and technologies to develop effective solutions. PNNL disciplines relevant to explosives countermeasures include the chemical, physical and computational sciences. Our experienced staff has the ability to address the full range of needs, from basic research all the way to the delivery of deployable solutions.



NATIONAL SECURITY

A Systematic Approach for Countering Explosives Threats

PNNL takes a systematic approach to countering explosives threats that recognize the range of activities needed to respond to different phases of an explosives attack. This holistic approach is necessary to provide effective and appropriate countermeasure approaches and systems that address all of the relevant elements of specific explosives threats to meet our clients' specific needs. We have identified six activity areas to illustrate our approach in this area. The information below highlights some of the key capabilities, technologies and approaches PNNL is employing in response to threats involving explosives.

PREVENT

DETER

DETECT

ASSESS

RESPOND

INVESTIGATE

Prevent and Deter

Prevention and deterrence require a clear understanding of the threats, the associated risks and the potential consequences of a successful attack. This information is necessary to develop focused solutions that reduce overall risk and decrease the probability of an attack. Important elements of this are predictive analysis and early warning. Both allow PNNL to apply countermeasures that can be applied prior to an actual attack. These are also important in developing approaches that will deter potential adversaries.



- ▶ Risk and Vulnerability Assessments
- ▶ Cognitive Informatics
- ▶ Visual Analytics
- ▶ Biomarkers and Pharmacokinetics
- ▶ Training and Exercises
- ▶ Predictive Behavior Modeling

Detect and Assess

Effective detection and assessment solutions are needed for screening people, luggage and shipping containers for potential threats. Applicable applications include checkpoints, standoff screening and remote detection.

Successfully detecting explosives threats requires a high probability of detection and a low rate of false alarms. Effective detection must be coupled with an accurate assessment of the variety of information available to assist security screeners and guide further action.

PNNL's Initiative for Explosives Detection is a multidisciplinary laboratory-wide effort. The major focus is the development of science-based detection and assessment solutions that can

be effectively deployed and used in a variety of real-world settings to meet existing and emerging challenges.

Respond and Investigate

In spite of our efforts to prevent, deter and detect attacks, the possibility of successful attacks remains. Thus, it is important to have the capabilities necessary to respond effectively, investigate the event, identify and prosecute individuals and help prevent another attack.

Helping first responders deal effectively with high volumes of complex information during response and recovery is essential. Other important capabilities include the need for rapid analysis of trace forensic evidence and statistical evaluation, coupled by event reconstruction to help

- ▶ Chemical, Physical and Nuclear Interrogation
- ▶ Intelligent Video
- ▶ Behavior Analysis
- ▶ Optical Sensing
- ▶ Human Factors
- ▶ Statistical Data Analysis
- ▶ Sensor Fusion
- ▶ High-throughput Information Extraction



- ▶ Emergency Response
- ▶ Chemical Forensics
- ▶ Statistical Evidence Analysis
- ▶ Event Reconstruction
- ▶ Critical Infrastructure Assessment

understand and develop better approaches to counter future threats.

It is also important to have the capability to assess the impacts of an event on critical infrastructure and to help guide restoration actions.