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Author(s): White, Paul Scott

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National Laboratory Support to DHS Missions

Ensure Resilience to Disasters

Lawrence Livermore National Laboratory (LLNL) has developed the Improvised Nuclear Device City Planner Resource (iCPR) that will be used by FEMA Regional and Exercise Planners as well as State and local agencies to obtain quantitative Improvised Nuclear Device (IND) effects information. The iCPR is an interactive web-GIS based tool providing IND effects information for 60 major US cities that will be used to support FEMA's and other government agencies' IND planning process.

Pacific Northwest National Laboratory (PNNL) provided predictive flood modeling to emergency response operations during Hurricanes Harvey and Irma in 2017. These models employ the latest coupling to fast computing architecture for more timely modeling results. Models were operated over large geographical areas to improve accuracy in predicting how rainfall inundation would affect the flood boundary over time, so emergency responders had situational awareness of affected areas. These models were also used for drying time calculations, so recovery efforts could start as soon as possible. This work was supported by NPPD with near real-time data sharing to FEMA and others.

Los Alamos National Laboratory (LANL) has developed QUIC – Quick Urban and Industrial Complex – plume modeling system, to enable fast computation of chemical, biological, and radiological agent dispersion on building to neighborhood scales. DHS is using this tool to support sensor siting decisions in a range of scenarios. The tool is also being used extensively across the inter-agency.

Prevent Terrorism and Enhance Security

Following the United Kingdom liquid explosives threat identified in 2006, LLNL provided an initial characterization of the x-ray properties of liquid threats compared to non-threats within 2 weeks. Currently, the DHS S&T funded Livermore Explosives Detection Program (LEDP) supports the end-to-end characterization of explosives, from threat identification to explosives detection requirements. Ongoing efforts at LLNL are focused on characterizing the x-ray feature space for conventional explosives and HMEs, creating simulants for sensitive explosives, developing new algorithms to generate system-independent x-ray signatures, evaluating the diagnostic performance of next-generation explosives detection technologies and providing technical guidance to TSA for defining explosive detection standards. Advanced segmentation and reconstruction algorithms for x-ray data are implemented in Livermore Tomography Tools (LTT); these algorithms include direct and iterative reconstruction and artifact reduction techniques to improve x-ray image quality and extract better material characterization data. Adaptive automated threat recognition algorithms are also under development for checked and carry-on luggage to improve the probability of detection and reduce false alarms as the breadth of explosive threats increases.

PNNL developed the High Definition – Advanced Imaging Technology (HD-AIT) to provide higher resolution for detecting threats on persons at aviation security checkpoints. The prototype was used to image ~2000 people at the Transportation Security Lab in 2017. The resulting data set was curated by PNNL technical staff and is being used for an ongoing DHS prize competition to develop automated threat recognition (ATR) algorithms. The HD-AIT coupled to best in class ATR algorithms will enable a reduction in false positives and faster screening of passengers at TSA checkpoint operations.

PNNL completed deployment of Biofeeds to the National Bio-surveillance Integration Center (NBIC) in 2017. Biofeeds provides computing architecture and large-scale data analytics to NBIC analysts through a web portal developed on PNNL's Scalable Reasoning System (SRS). The system integrates scientific literature, public health alerts, geospatial information, and other data sources into a common analysis and situational awareness platform for the execution of NBIC's mission. Biofeeds deployment activities were funded by the Office of Health Affairs. SRS and advanced data analytics algorithms that were incorporated into Biofeeds were sponsored by the DHS Science and Technology Directorate.

National Laboratory Support to DHS Missions

Safeguard and Secure Cyberspace

Sandia National Laboratories (Sandia) is supporting DHS's development and evolution of National Cybersecurity Protection System (NCPS) capabilities, operationally known as EINSTEIN. Leveraging deep expertise in machine learning and big data analytics, Sandia is providing technical leadership in advancing EINSTEIN capabilities to include novel behavior-based threat discovery methods that can adapt to the evolving threat environment. In addition, Sandia has developed a suite of cyber countermeasures that are currently deployed as part of the EINSTEIN program.

LLNL's Network Mapping System (NeMS), commercialized through the DHS S&T Transition to Practice Program, provides network managers with a comprehensive view of their computer network environments and has been used to support the computer network security operations at several federal agencies. NeMS combines passive network monitoring with active network scanning to discover unauthorized devices on a network, understand network structure and identify which devices are communicating including which protocols are being used.

Secure and Manage Our Borders

LANL trains DHS components and state and local first responders to accurately analyze radiation data using spectroscopic tools and practices. The analysis includes identifying and distinguishing between special nuclear material and other suspicious but otherwise unidentified radioactive material. Multiple training sessions are held each year including at FEMA's Center for Domestic Preparedness.

PNNL's radiation detection expertise and capabilities were used to increase efficiency in radiological/nuclear scanning operations at US Ports of Entry (POEs). At Eagle Pass, Texas and Otay Mesa, CA new commercial (Leidos) spectroscopic sensors that are able to selectively distinguish between non-threatening and threatening radioactive materials were integrated and installed by PNNL into U.S. Customs and Border Protection (CBP) operations. Laboratory and field testing and validation were performed by PNNL prior to final deployment at the POEs to qualify the sensor's effectiveness and operational readiness. In coordination with the federal stakeholders and Leidos, optimization of the spectroscopic sensors for these deployments was successfully executed resulting in an order-of-magnitude reduction in CBP's operational burden at these deployment locations.

Sandia is supporting the development of an open and modular architecture for next-generation radiation portal monitors (RPMs) to assist U.S. Customs and Border Protection (CBP) with interdicting smuggled nuclear materials. Sandia serves as the Design and Development lead for the prototype Radiation Portal Monitor Open Systems Architecture (ROSA) and is partnering with PNNL which serves as the Validation & Verification and Integration lead. Sandia is also leading a similar architecture effort for the Transportation Security Administration focused on advanced passenger screening systems. These open and modular architecture designs are informing standards for acquisition and will enable DHS to realize decreased lifecycle costs, increase private sector competitiveness, and enable easier and earlier adoption of innovative technologies emerging from industry.