Pacific Northwest
NATIONAL LABORATORY

Photo courtesy of Getty Images

A new millimeter-wave (mm-wave) imaging technology that addresses today's aviation passenger screening needs has been developed by Pacific Northwest National Laboratory (PNNL) and is ready for commercialization.

WHOLE-BODY, FOOTWEAR SCREENING TECHNOLOGIES

New systems can improve threat detection and the passenger experience

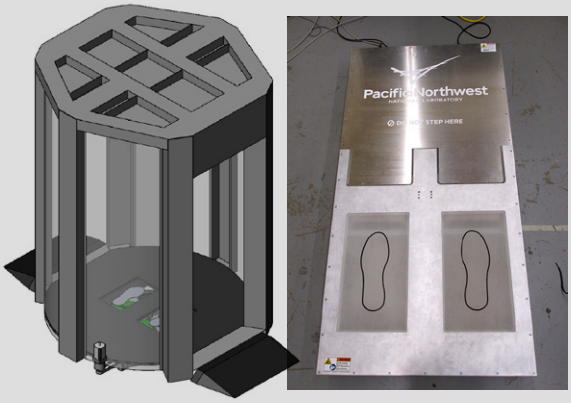
The next-generation security screening checkpoint is a high-resolution, mm-wave Advanced Imaging Technology (AIT) system capable of quickly detecting aviation threats concealed underneath clothing and inside footwear via an integrated footwear scanner.

The growing number of air travelers highlights the need for higher throughput screening systems that can keep pace with the stream of commerce. Evolving threats test the limits of current checkpoint systems, while shoe divestiture introduces a significant impediment to efficient and rapid screening. The aviation security market needs new technologies that can address these complex challenges.

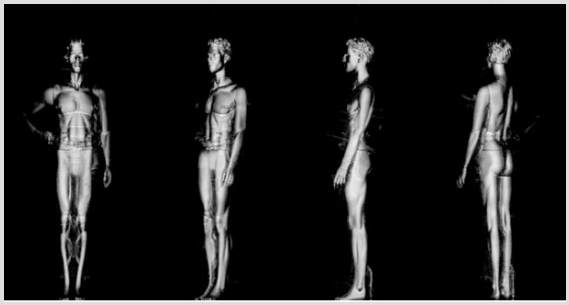
The Department of Homeland Security funded PNNL to develop the High-Definition (HD) AIT cylindrical body scanner and the mm-wave footwear scanner. These technologies are designed to be configured as an integrated system to provide a high-throughput, divestiture-free, whole-body screening capability. Engineering prototypes have been completed and manufacturing-ready reference designs are currently in development for the whole-body and footwear scanners.

TECHNOLOGY FEATURES

- **Innovative:** Integrated whole-body and footwear screening solution
- **High-throughput:** Eliminate time-consuming footwear divestiture and reduce need for secondary screening
- **Secure and reliable:** Improved resolution and coverage means enhanced detection and significantly fewer false alarms
- **Low-cost design:** Highly integrated mm-wave modules
- **Compact:** Form factor compatible with existing checkpoints
- **Safe:** Very low power, non-ionizing radiation
- **Private:** Compatible with Automated Threat Recognition algorithms and avatar displays



This conceptual drawing is of the HD-AIT system integrated with the footwear scanner. Inset photo: the engineering prototype of PNNL's mm-wave footwear scanner.



Example mannequin image from an HD-AIT prototype system.

Example mm-wave image of person-worn footwear.

NEXT-GENERATON CHECKPOINTS

A pioneer in the field, PNNL has extensive experience developing mm-wave screening systems for aviation applications. A first-generation cylindrical body scanner was commercialized and widely deployed in airports around the world. The mm-wave technology developed by PNNL generates three-dimensional, fully focused images using frequencies that pass through common dielectric barriers.

The checkpoint technologies have significantly advanced the state of the art by providing a much higher resolution HD-AIT body scanner to improve detection, while dramatically reducing false alarms and associated secondary screenings compared to existing systems. The new system design also improves antenna beam coverage and significantly reduces imaging artifacts.

PNNL has leveraged these advancements to detect anomalies in person-worn footwear using an upward-facing array. A combined checkpoint system would simultaneously screen the body and footwear in seconds. Higher throughput is achieved by eliminating the need for footwear divestment and minimizing false alarms. A common frequency band is shared between the body and footwear screening subsystems, which can reduce component costs.

Combined with machine learning techniques, advanced imaging algorithms can further improve the system's performance over time, while preserving privacy. The system has been designed to support implementation of additional computational capabilities or those developed by third-party software developers.

INDUSTRY APPLICATIONS

The mm-wave checkpoint solution is ideal for detecting concealed metal threats, such as firearms and knives, as well as non-metal items, such as explosives, liquids, illicit drugs, or cash.

While primarily developed for airport security, courthouses, federal buildings, embassies, prisons, and military installations could also benefit from the system.

AVAILABLE FOR LICENSING

PNNL is actively seeking a licensee. Design-for-manufacturing prototypes are in development to enable rapid deployment of an integrated checkpoint configuration. Interested parties are encouraged to contact us to collaborate on this exciting new market opportunity.

LET'S CONNECT

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