# Sandia National Laboratories

# VR·AR·MR
## Virtual, Augmented, and Mixed Reality Technologies

### APPLICATIONS FOR PHYSICAL SECURITY TRAINING, ANALYSIS, AND DESIGN

Conducting hands-on training on physical protection system analysis and design may occasionally be impractical—or even impossible—due to safety, security, or financial concerns. Such issues may be addressed through the application of virtual, augmented, and mixed reality technologies, which provide enhanced alternative experiences for trainees while mitigating the limitations of traditional approaches.

**Virtual Reality (VR)** fully immerses users into a computer-generated instance of an existing or hypothetical environment. VR projects the user into this digital world via a wearable headset and lets them determine what happens next via actions or gestures.

**Augmented Reality (AR)** uses the physical, real-world environment as a foundation on which to overlay information and other visual elements. AR enhances the user experience by further allowing users to create their own overlays and interact with virtual information and 3D models. AR sensors enable the tool to "read" and understand the existing environment—recognizing floors, walls, tables, and other surfaces (as well as people).

**Mixed Reality (MR)** Combines VR and AR to varying extents. MR immerses users into a virtual environment, but employs sensors to recognize the existing physical environment and integrate it into the experience.

## Benefits

Unique, flexible, and open experiences that provide opportunities for self-discovery, problem solving, and correcting mistakes.

Utilizes virtual existing or hypothetical facilities

Provides controlled environments and scenarios

Tools are safe, cost-effective, and non-intrusive

Users possess super abilities; they may fly, see through walls, walk through solid objects, endure extreme environments, and employ super-strength

Time constraints can range from high rigor to self-paced

Provides trackable experiences with a feedback loop

Enables visualization of complex designs and concepts

Provides access to tools and information that would be difficult or impossible in physical reality