

Virtual Presence and Extended Defense Systems Enhance Security

Issue:

Today's security challenges require facilities to do more than deter adversaries or detect them as they penetrate the fence. Facility personnel want to be alerted about adversary activity as soon as possible, and as far away from the protected area boundary as possible. Traditional security systems employ fences, clear zones, sensors, and cameras to detect adversaries at the perimeter. However, because of the aggressive and broad types of threats we face, we need to provide reliable information to response personnel as early and as quickly as possible in the event of an attack.



VPED seismic data collection in heavily wooded location.

Solution:

Sandia National Laboratories has developed “beyond-the-perimeter” sensor and assessment defense systems called Virtual Presence and Extended Defense (VPED) systems. Already deployed in varying field environments, our VPED systems are tailored to meet specific challenges.

Each VPED system consists of sensor nodes (which support various types of sensors) and cluster nodes (which gather sensor data and provide video assessment capabilities). One of the most notable features of these systems is that sensors can be located almost anywhere, from a mountain ravine to along a paved road. Sensors communicate (via radio frequency links) to cluster nodes, which send data to a Command Center, or to standalone systems in the field. Security operators can alert responders immediately, allowing evaluation of the situation before adversaries reach the perimeter.

The VPED systems can be deployed with a stand-alone interface for responders operating without a command and control system. The VPED user interface is an easy to use web-browser-based system that can be deployed almost anywhere on a user's network. For users with a command and control system, the VPED is designed to work with other display systems through standard network interfaces such as XML.

As a leading national laboratory under the U.S. Department of Energy/National Nuclear Security Administration, Sandia has long been involved in safekeeping the nuclear stockpile to secure the nation. Because of this experience in security and defense systems, we seek opportunities to leverage our expertise—our people, facilities, and capabilities—to help other agencies facing similar problems in protecting critical national-security assets.



A VPED sensor node with an inconspicuous, ground mounted antenna gathers data from a variety of sensors and processes information for the cluster node.

Benefits:

VPED systems work with existing perimeter security systems to create detection zones where none previously existed.

They reach farther out than current systems, enhancing fixed-site security by enabling response forces to have earlier warning of adversary attacks. VPED systems provide detection and video assessment along potential avenues of approach (e.g., roads, trails, or ravines), and can let responders know of activity in observational positions and natural assembly areas.

VPED systems are flexible – they do not rely on any single sensor for detection. VPED systems are adaptable to the environment – whether it is a heavily wooded area or a sparse desert.

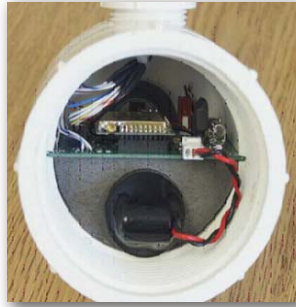
VPED systems are designed with the goal of minimizing nuisance alarms and employing quick and



reliable assessment techniques to manage the alarms that are encountered.

VPED systems share low power needs for both the sensors and cluster nodes, and alleviate the need for traditional power supplies. Sensor nodes are self-powered by internal batteries that can last up to seven years, which makes VPED systems ideal for placing in remote locations. In addition, cluster nodes are designed to be low power and can operate using alternative energy sources such as solar panels.

Optimal performance of VPED systems is achieved when sensor and assessment systems are tuned to maximize their performance in the local terrain. VPED tuning times are currently a few hours during initial system installation. After installation, VPED sensor, fusion, and cluster node parameters can be modified remotely, allowing operators to adjust sensitivity settings or algorithm settings without field maintenance.



Interior view showing D-sized battery and printed circuit board with radio and microprocessor.



Cluster nodes gather data from sensor nodes and use cameras to survey the area.

Anticipate and Prepare:

VPED systems are not designed to replace traditional Perimeter Intrusion Detection and Assessment Systems, but to augment them to provide better security system effectiveness for pedestrian and vehicle threats. VPED systems were designed for permanent installation, not as a tactical security system for quick field deployment at mobile sites.

A VPED system requires a security officer to consider their specific vulnerabilities and the threats they are facing. It requires the facility to anticipate probable attack scenarios, and determine which scenarios a VPED system will protect against. In doing so, a VPED system can be properly

integrated into the existing security system to truly prepare the facility for the threats being addressed.

Detect Attacks:

VPED systems use a variety of technologies to detect intruders:

- Intelligent sensor algorithms attempt to classify detections as persons, vehicles, or “other.”
- To avoid high nuisance alarm rates, sensor-fusion algorithms combine multiple sensor input to differentiate between human intruders and environmental factors.
- Operators can use captured images from area cameras to determine the cause of an alarm without dispatching patrols.



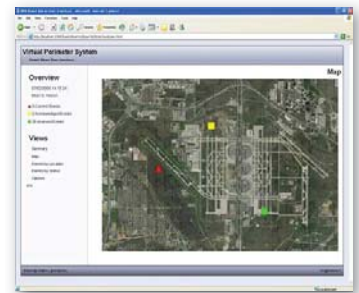
VPED camera installation at a road junction.

Response:

VPED systems allow facilities to detect adversaries through sensor placement and assessment capabilities beyond a site perimeter. Operators use video images to assess the cause of alarms and deploy response forces as needed. The reliable “beyond-the-fence” warning provides more time for response-force deployment.

Making a Difference:

The VPED systems work with existing perimeter security systems to give security officers more time to better detect and assess threats beyond their traditional perimeter. First prototyped in 2005, the VPED system is now a second-generation system that has been demonstrated in several real-world applications to validate system operation.



VPED stand alone user interface.

Learn more at: <http://www.sandia.gov/mission/homeland/index.html>

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