Increasing Security Measures for Nuclear Power Plants and their Security Officers

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Physical Security Pathway

If individuals or groups attack a nuclear power plant, their first targets may be the plant's security officers. Their officers safety, efficiency, and effectiveness could be improved by providing them with equipment to remotely detect intruders, and remotely operate their firearms.

Since 2019, LWRS researchers have been evaluating a Remotely Operated Weapon System (ROWS) that uses thermal imaging and optical cameras to identify intruders. ROWS allows a person in a control room, that is outside the line of fire, to aim a rifle at the target, and pull the trigger. The system would let a single security officer switch from one vantage point to another, almost instantly, by control from within a protected room.

Security officers make all the decisions. ROWS does not rely on artificial intelligence. Placing security officers in a secure location allows them to effectively respond in the event of an attack, while reducing the negative impact that their adrenaline can have when they are under fire.

Figure 3. A remotely operated "Single Sentry-II" installation, replacing a guard post. ROWS Configuration.

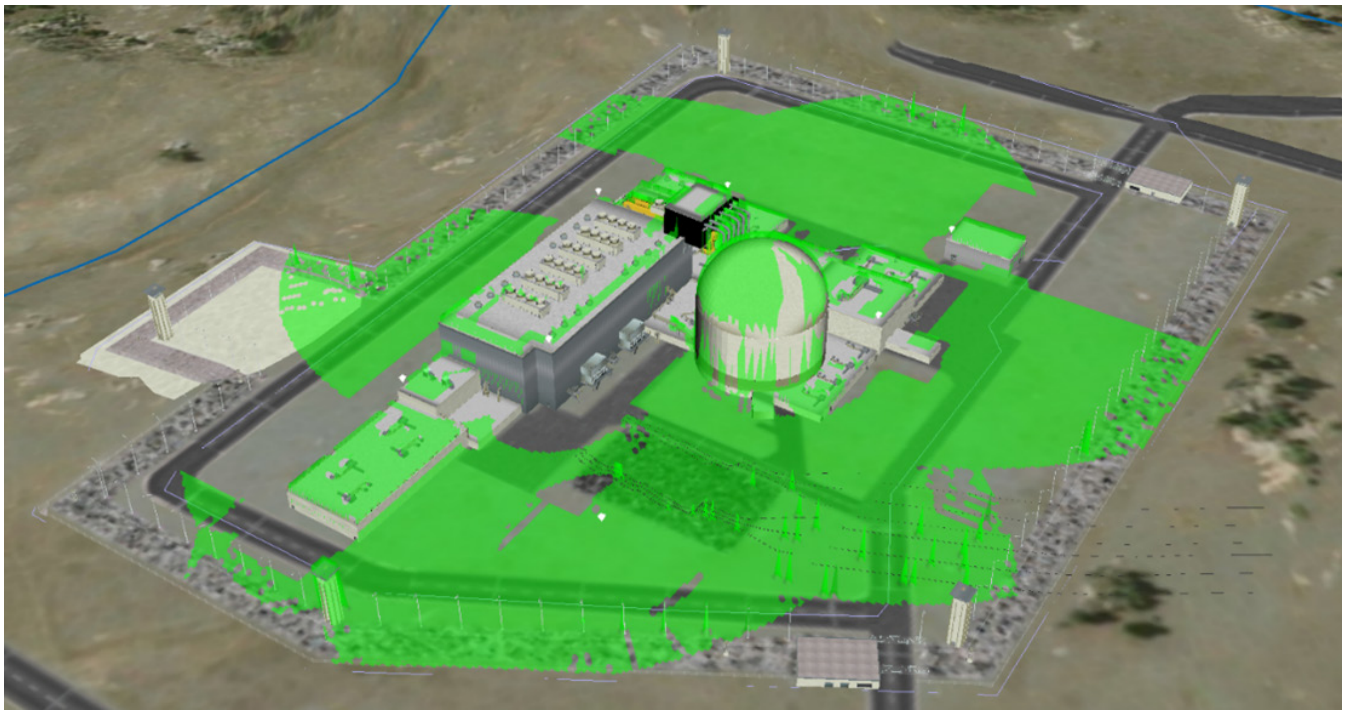

Figure 4. A computer-generated model of a hypothetical nuclear plant. Dante ViewShed schematic double coverage view of a notional nuclear power plant. Areas in green are covered by overlapping fields of fire from two or more remotely operated weapons.

Currently, security officers are stationed in bullet resistant enclosures (i.e., steel boxes), sitting on towers outside the plant, or in "hardened fighting positions," usually inside the plant. These have several shooting ports facing different directions from which the officers can fire.

A security officer can only be at one location at a time. A security officer stationed in a control room with access to multiple remote-controlled positions, i.e. ROWS, can promptly and effectively be at the scene almost instantly. If two officers are in the control room, they could quickly begin operating weapons with overlapping fields of fire.

ROWS has been tested in many applications and it has proven effective in these applications, and its applicability to nuclear power plants is clear, see Figure 3.

Researchers have modeled the performance of ROWS against the "design basis threat," the characteristics that the Nuclear Regulatory Commission presumes an attacking force will have. The details of the design basis threat are safeguarded, but the ROWS based security force generally has a higher success rate against the adversary force over a traditional security team.

By the end of next year, researchers will determine where to put ROWS equipment, inside and outside a plant, and develop the simulator's scenarios to train defenders, and verify the system's effectiveness.

The current research is being conducted at two commercial nuclear power plants. Tabletops and high-fidelity modeling and simulation are the main basis of the research. The tabletop exercises are being conducted with Sandia's Scribe3D tool, where security personnel can make decisions with the tool that allows them to explore states and decisions over an attack with a human-in-the-loop. The high-fidelity modeling and simulation is being conducted with Sandia's Dante tool suite, where over two decades of high-fidelity physics, behavior engine, path planning, and many other libraries are melded together to evaluate several thousand iterations of different scenarios of adversary and security force tactics in a Monte Carlo batch analysis, see Figure 4.

Security officers at nuclear power plants conduct routine "force-on-force" exercises, in which attackers and defenders are given what resembles laser tag equipment, while human observers monitor and evaluate the exercises. Researchers plan to use ROWS in such an exercise in 2025. In 2026, the program would include a full-scale deployment execution plan of ROWS at an operational reactor site.