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Update on Advanced Reactor Security Activities

Presenter: Douglas M. Osborn, PhD

Contributors: Sandia National Laboratories, Los Alamos National Laboratory, Idaho National Laboratory, and Oak Ridge National Laboratory

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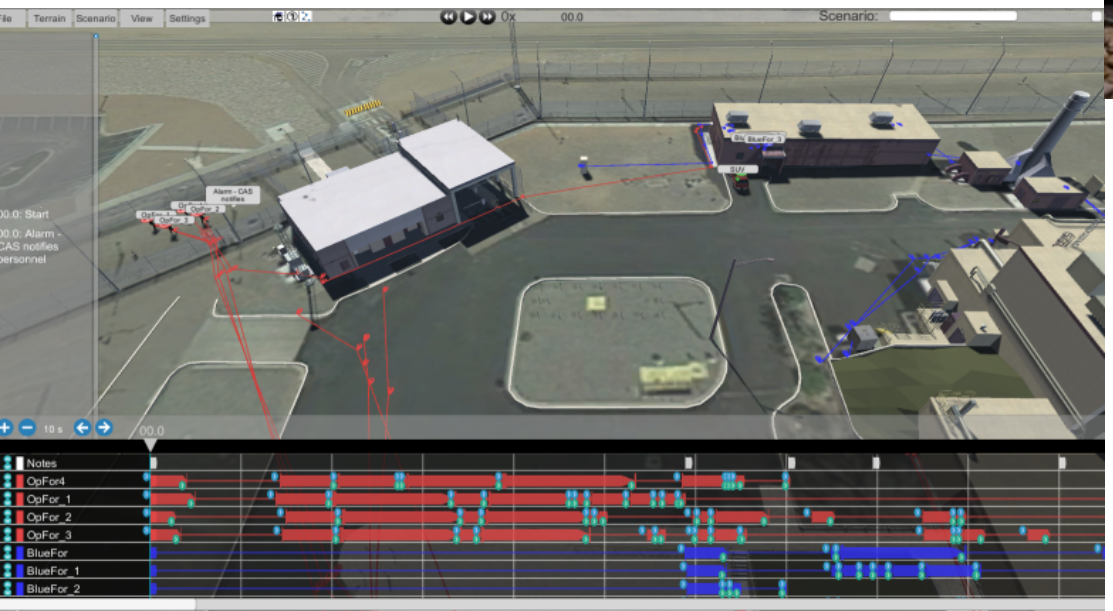
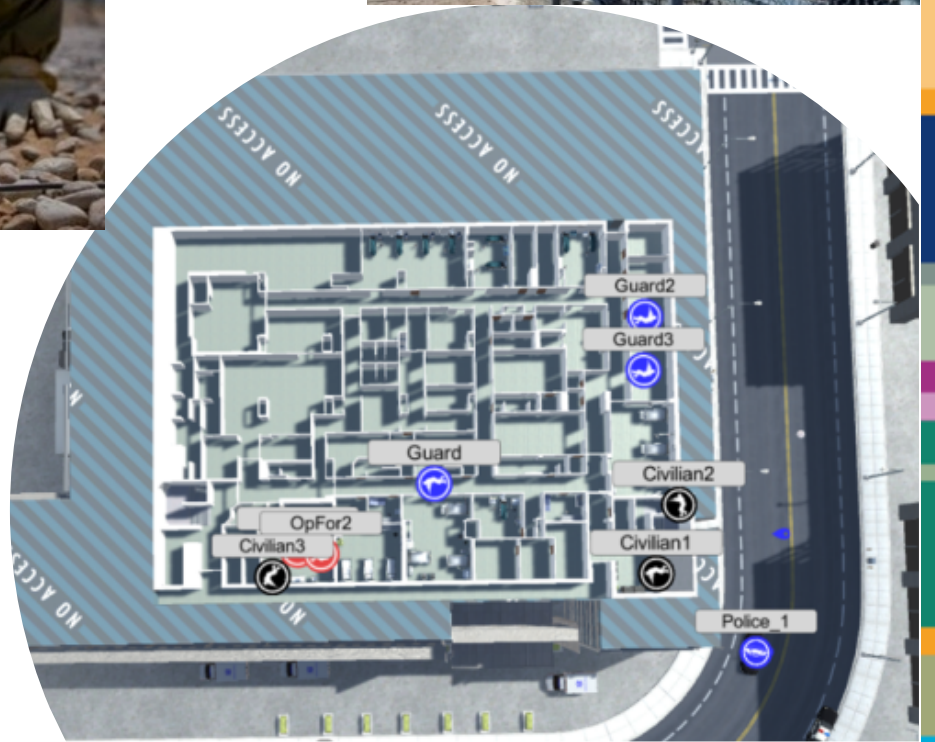
Overview Discussion

- Advanced Reactor Target Set Identification
- Security Economics Tool
- SMR / Advanced Reactor Testing and Training (SMARTT) Platform
- Online Security Training





Future Reactor Builds & Target Set Identification – Motivation

- Static Level 1 PRA does not do sufficient job capturing *passive safety* or FLEX equipment
  - Passive safety ≠ Passive Security
  - Integrated Cyber-Physical Assessments
  - FLEX equipment can include onsite portable backup equipment
  - Duration of threat vs. time to core damage
- Investigation into new methods:
  - Dynamic event/fault tree analysis
  - System Theoretic Process Analysis (STPA)
  - Consider the integration of *timing* from reactor system response and security analyses
- Leverage System Theoretic Process Analysis (STPA) to inform target set identification
  - Current method uses Leve l1 PRA for vital area identification and ultimately target set identification for direct and indirect sabotage *only*
  - Theft is not considered in current target set identification
  - Cyber is not considered in current target set identification

Target Set Identification – Overall Project Goal and Objectives

The overall goal of this work is to create an approach which U.S.-based advanced reactor vendors can identify and evaluate theft/sabotage target sets and vulnerabilities for a given protection strategy.

Objectives:

- This effort will help identify gaps in modeling physical protection strategies by linking advanced reactor system response modeling with vulnerability assessment (VA) modeling and applying current security design methodologies.
- Consideration will be given to advancements in detection, assessment, delay, lethal/non-lethal denial and application of off-site response forces to assist U.S.-based vendors in decreasing overall security costs.
- This work will allow for a first order estimate to determine if off-site response force is adequate for protection strategies of advanced reactors and if such a concept could ever be applied.

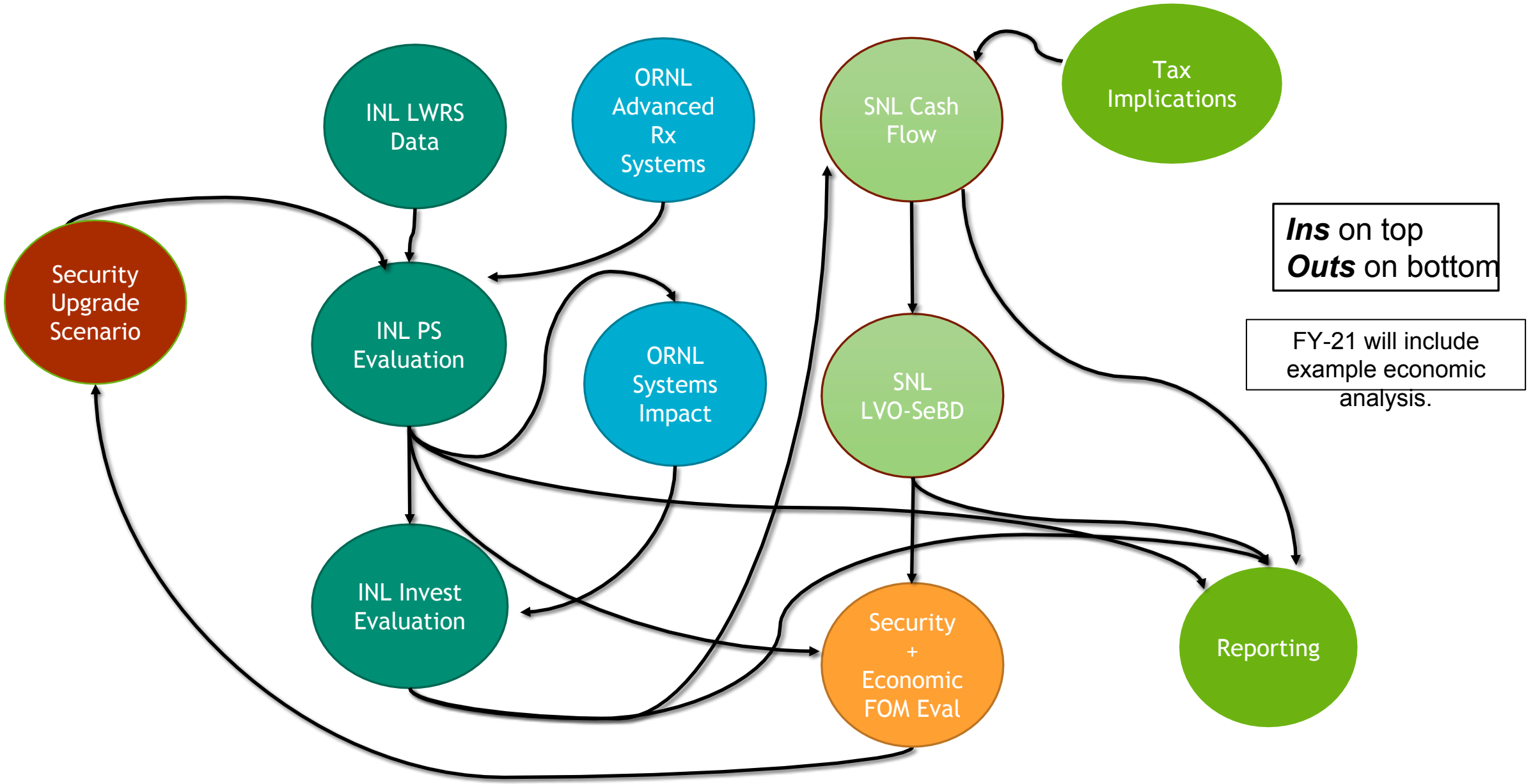
Security Economic Tool – Overall Project Goal and Objectives

National Nuclear Security Administration

Goal: Develop a capability and tool that vendors and utilities can use to perform an economic analysis for design features which have the purpose of reducing O&M costs related to nuclear security

- The tool will be generic enough to be used on multiple AR/SMR designs and will be flexible enough to consider labor cost differences in different countries
  - Value of capital will be incorporated into all calculations
- Example;
  - There may be a benefit to designing a barrier system for an SMR that will be deployed in the U.S., due to the high cost of security personnel
  - This same SMR deployed in another part of the world may not show a cost benefit if labor costs in that region are much less than the U.S.
- This is a multi-year effort;
  - Activities started in FY-20 and expected to be completed in FY-22.
  - Industry input will be sought in FY-21 to ascertain interest in this work
  - FY-22 effort will depend on level of industry interest

Economic Technical Elements – DOE Lab Roles and Connections



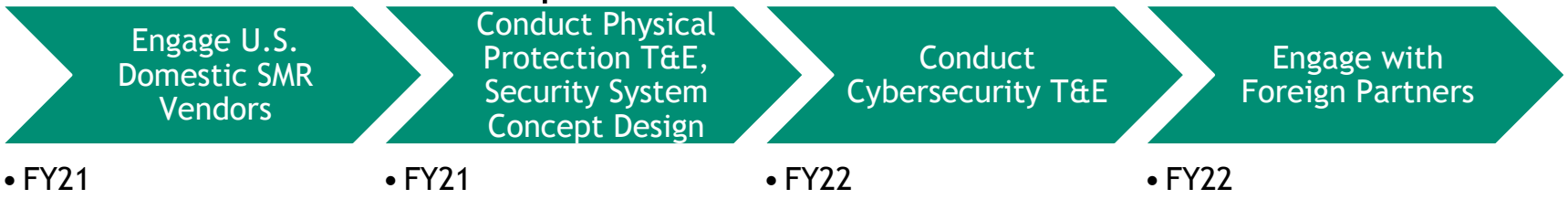
Overall Goals of SMARTT Platform

Summary: Small Modular Reactor & Advanced Reactor Testing and Training (SMARTT) Platform will provide the USG ability to **engage** domestic and international partners on integration of cyber & physical security system concepts and technologies for nuclear infrastructure of the future.

- Provide **testing platform** for advanced security technologies to improve security systems applied to SMRs and advanced reactor facilities.
  - Small facility footprint
  - Technical basis for limited or *no* onsite security personnel
  - Early detection and assessment (prior to facility fence line)
  - Active/Passive delay systems
  - Active & Final denial systems
- Provide **training platform** on various SMR/AR security concepts for U.S. industry:
  - Advancements and proof-of-concepts of security-by-design (SeBD) in Target set and Vital Area identification with considerations of physical & cyber security
  - Novel concepts and approaches for Access controls for SMR/AR facilities with consideration of remote operations and monitoring
  - Novel concepts and approaches for Access delay and Active Denial for SMR/AR facilities with consideration of remote operations and monitoring

SMARTT Platform Benefits

- Raise Technology Readiness Level of security system technologies for Small Modular and Advanced Reactors
- Platform for technical exchanges on topics relating to the protection of nuclear facilities with small footprint
  - Physical Protection;
  - Cybersecurity;
  - Sabotage Mitigation;
  - Insider Threat Mitigation; etc.
- Expand real-time demonstrations and hands-on training exercises with partners
  - Place personnel in a “feels like” real-world environment to advance technical training, testing, and evaluation of security systems
  - When you can see it, feel it, and sometimes smell it, attracts Fruition and Ideas of Others
- Integration of SMARTT with other aspects of ISF

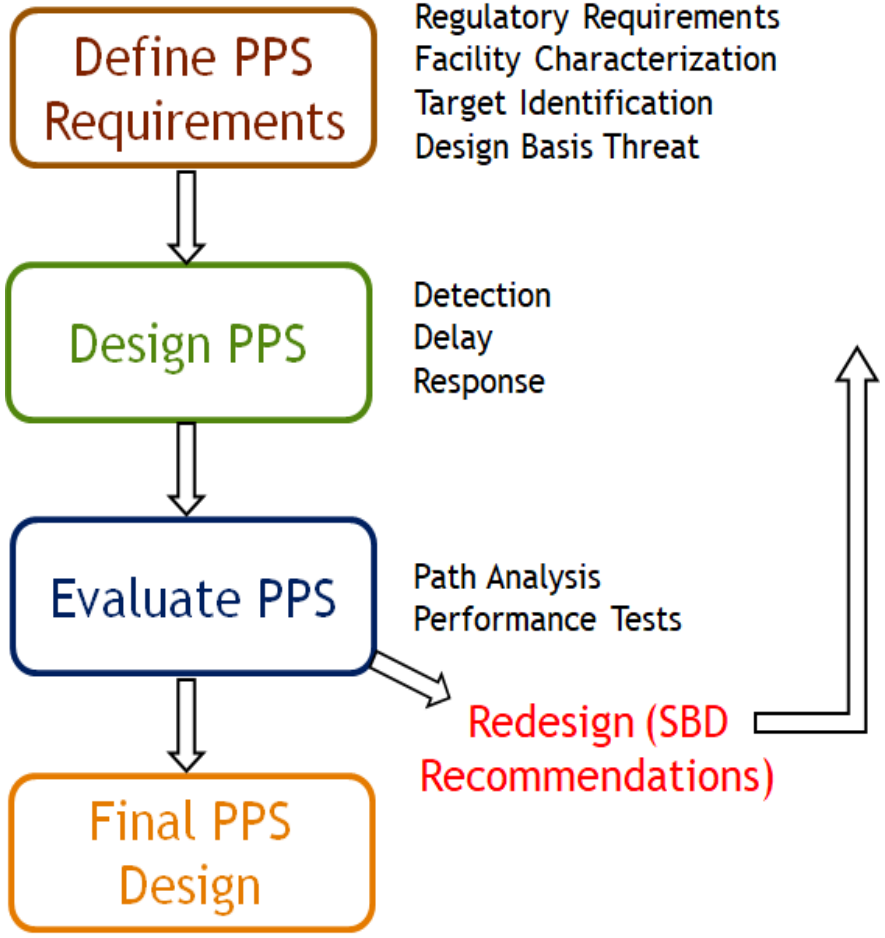


Design Evaluation Process Outline (DEPO) Methodology

Define physical protection system (PPS) requirements - Study the existing facility and its plans to learn all of the operations, conditions, and important physical features that affect the PPS. Then conduct a detailed study of the range of adversaries that the physical protection system must successfully counter. Finally, identify the most important areas or materials that must be protected from the adversary.

Design a PPS - Either identify the existing physical protection elements for potential upgrading or design a new protection system using elements of detection, delay, and response that are effective against the capabilities of the potential adversary.

Evaluate the PPS design - Given the information about the facility, threat, targets, and physical protection system, use accepted analysis techniques to obtain a measure of the protection system's effectiveness. Redesign and reanalysis may be required if the measure of effectiveness is not satisfactory.



Online Security Training – Design Evolution Process Outline

National Nuclear Security Administration

The Design Evaluation Process Outline (DEPO) is a systems engineering method that has been applied to nuclear security since the 1970's. DEPO is a performance-based methodology to design and evaluate physical protection systems (PPS) against the threat of unauthorized removal of nuclear materials or radiological sabotage.

- Traditional DEPO training is a 5-day in-person training course with field exercises
- The classroom lecture materials were converted into a 16 module (~14 hour) online training course

https://nstc.sandia.gov/training/smr-depo-course

MODULE	TITLE
1	Intro to the DEPO Process
2	Overview of Physical Protection Principles
3	Regulatory Requirements and Risk Management
4	Target and Vital Area Identification
5	Threat Definition
6	Facility Characterization
7	Intro to Design of PPS
8	Intrusion Detection Systems

MODULE	TITLE
9	Alarm Assessment Systems
10	Delay System Design
11	Access Control
12	Prohibited Items
13	Alarm Communications & Display and Response
14	Computer Security
15	Performance Testing
16	Intro to Evaluation of PPS

Questions