SAND2010-5311P

Performance Tests of Physical Security Technologies
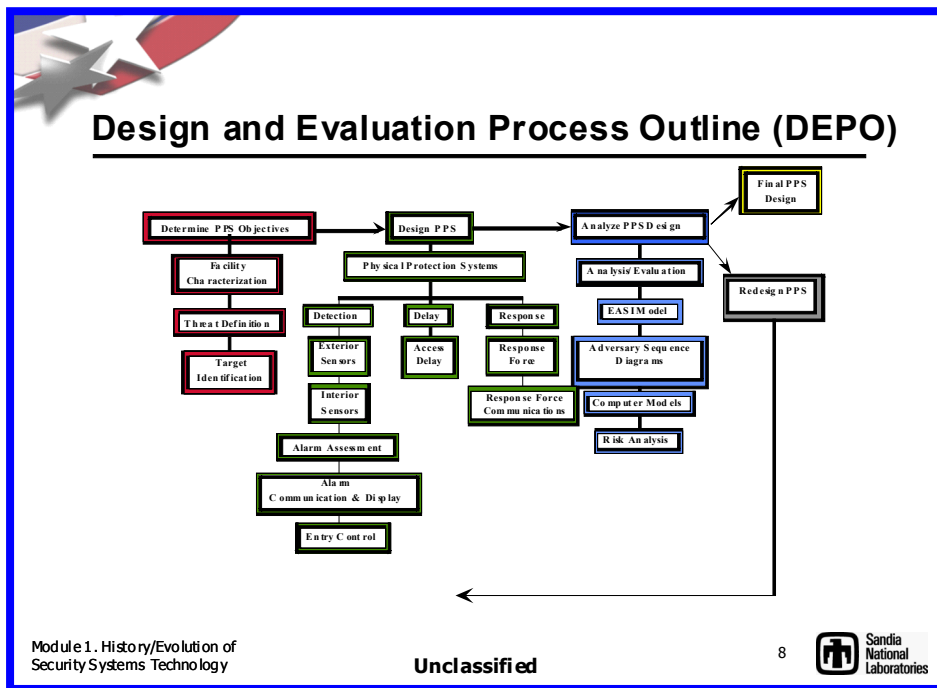# How to Test Outline

Principles

- Based on structure of our Design Process for Physical Security Systems
- Three functions of a Physical Security System
  - Detection
  - Delay
  - Response

Planning the Test

- **What** do you hope to accomplish
- Test objectives (Requirement Driven)
- Input from all stakeholders is ideal
  - Vulnerability Analysts
  - Site Test Group
  - CAS Operators (people that monitor the alarms)
  - Response Force
- Depends on Maturity Of Technology
  - Prior to Deployment
  - Just after Installation
  - Post Installation – annual, bi-Annual, and fter significant maintenance changes
- Scope
  - important to state/acknowledge what you are going to include
  - what you are not going to include
    - Sensors
    - Communications—wireless, verbal
    - Barriers
    - Alarm Monitoring
    - Response Force
  - Operability Tests
  - Performance Tests
  - Nuisance Alarm Rates

Design and Evaluation Process Outline (DEPO)

Module 1. History/Evolution of Security Systems Technology

Unclassified

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Sandia National Laboratories

ID assumptions

- Threat
  - No Knowledge
  - Partial Knowledge
  - Full Knowledge
- Safety
- Environmental Limitations
- Cost limitations
- Test Location – actual site vs. a test bed

Requirements

- Operational Requirements
- Performance requirements
- Policy Considerations

Planning the Test

- **How** you will meet you objectives/Design the Tests
- Non-Destructive vs. Destructive
- Performance Metrics (what are you going to measure)
  - Probability of Sensing (Ps—30/30 -- .9 at 95%-- from Binomial Tables – Cooke, 1964)
  - Probability of Assessment (Pa 4-6 pixels per sq ft – Johnson Criteria)
  - Probability of Communication (Pc)
  - Probability of Detection ($P_D = P_S * P_C * P_A$)
  - Delay Time (barriers—assuming given set of tools)
  - Barrier Penetration (K-12 – 15,000 pound at 50 mph)
  - LOD (Limit of Detection – nanograms -Explosive Trace Detection 95 out of 100 trials)
  - Nuisance Alarm Rate (1/hr, 1/day, for one sensor, for a system)
- Identify Variables – things that will influence performance
  - Type of intruder—crawler, walker, ATV, SUV
  - Speed
  - Knowledge of Intruder—Full, Partial, No Knowledge
  - Weather affects – rain, wind, snow, …
  - Foliage
  - Terrain
  - Distance from sensor (effective range or detection envelop)
  - Sensor settings – sensitivity, threshold crossings, filters, …
- Design of Experiment
  - Especially useful on new technologies
  - Identifies dominant factors/variables – screening tests
  - Can produce response surface as a function factors/variables, ex: $P_a = $ **a**(distance) + **b** (size) + **c**(light intensity) …
- Test Matrix
  - Summarizes tests planned and variables to be included in test
  - Look for gaps, over emphasis, under emphasis

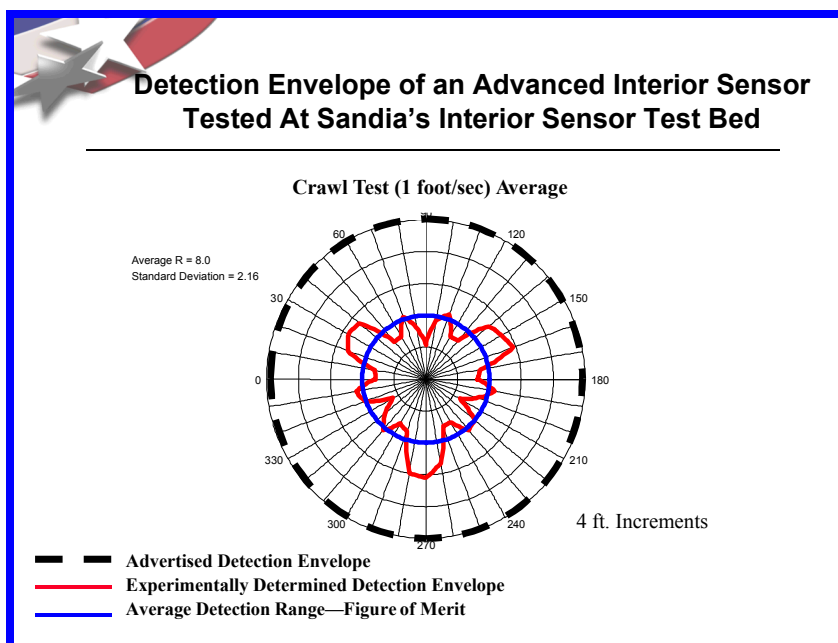### *Table 1. Summary of Radial Test Sets*

Radial Tests*	Unit #1		Unit #2		Total Number of Test Sets
	Small Stature	Large Stature	Small Stature	Large Stature	
0.5 ft/sec Slow Walk	10 sets	5 sets	4 sets	2 sets	21 sets
1.0 ft/sec Walk	10 sets	5 sets	4 sets	2 sets	21 sets
1.0 ft/sec Crawl	10 sets	5 sets	4 sets	2 sets	21 sets

* One set of radial tests consists of 1 test along each of the 36 radial transects, giving 36 data points.

Review of Test Plan

- Stakeholders
- Technical Subject Matter Experts
- Safety Office
- Execution of the Tests

Analysis of Test Results

Detection Envelope of an Advanced Interior Sensor Tested At Sandia's Interior Sensor Test Bed

Crawl Test (1 foot/sec) Average

Average R = 8.0
Standard Deviation = 2.16

4 ft. Increments

- - - **Advertised Detection Envelope**
——— **Experimentally Determined Detection Envelope**
——— **Average Detection Range—Figure of Merit**

Reporting the Results

- Objective
- Scope
- Necessary Limitations and Assumptions
- Configuration of test equipment
- Results
- Conclusions – did you meet your objectives

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In Summary:

Performance Testing Allows Designers, Site Security Managers, and Decision Makers to make "Informed Decisions"