



Presents

PERIMETER PROTECTION

An Overview



The Perimeter -- A Timeless Concern



A Perimeter System Should

➤ *Deter*

➤ *Detect*

➤ *Delay*

Subsequent Activity

➤ *Alert*

➤ *Assess*

➤ *Respond*

System Components	Purpose	How?
Deter		
Detect		
Delay		
Alert		
Assess		
Respond		

Essential Criteria

- ✓ **Fit Situation**
- ✓ **Fall Within Budget**
- ✓ **Be Consistently Effective**

Perimeter System Terms

- PD = Probability of Detection
- FAR = False Alarm Rate
- NAR = Nuisance Alarm Rate
- VD = Vulnerability to Defeat

Probability of Detection(PD)

- Likelihood of detection within the detection pattern
- Typically specified as a % of intrusion attempts, ex. 95%
- BEWARE! PD is conditional

Conditions Affecting PD

- Intruder characteristics
 - travel speed
 - orientation (upright, crawling, rolling)
 - size/mass
- Adverse effects of weather
- Inherent constraints of technology
- Installation (settings,site,workmanship)

Nuisance Alarm Rate (NAR)

- Rate of invalid alarms caused by sources that are non-threat
- Usually stated as #/24 hrs or #/mo
- Typical causes include
 - animals, climate, personnel,
 - grounds and environment

False Alarm Rate (FAR)

- Rate of invalid alarms caused by unknown sources
- Usually stated as #/24 hrs or #/mo
- Typical causes include
 - faulty installation
 - damaged equipment
 - degradation of components

NAR v.s. FAR

What's the Difference Again ?

- NAR (nuisance alarm) is caused by the environment or other external factors, including people or animals
- FAR (false alarm) is erratic and is the result of failure within equipment or system

Vulnerability To Defeat (VD)

- Likelihood that the sensor can be defeated by bypass or by spoof is:
 - Specific to each sensor technology
 - Sophistication or knowledge of intruder
 - Availability and use of aids (such as ladders)
 - Inadequate security system design

Ultimate Goals Are

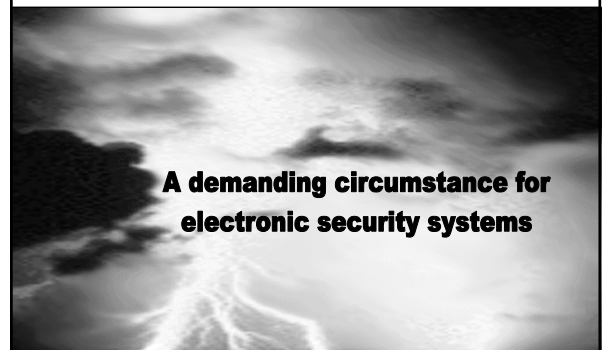
- High Degree of POD
- Very Limited VD
- Low NAR and FAR

The Tricky Part



- * A system must be sensitive enough for consistent detection
- * Smart enough to eliminate most nuisance alarms

The Great Outdoors



A demanding circumstance for electronic security systems

Essential Considerations

- Activity near the perimeter--human and wildlife
- Vegetation
- Weather
- All Wiring and Connection
- Grounding

Additional Key Factors

- Landscape & Topographical Features
- General Operating Environment
- Physical Barriers
- Reporting Method
- Integration with Other Equipment and Systems

What To Choose ?

NO SINGLE TECHNOLOGY WILL BE THE BEST FIT FOR ALL SITUATIONS!

Requires basic knowledge of various types of technologies and what performance to expect relative to the conditions of the site

Considerations

- ✓ Typical threat scenario
- ✓ Site/environmental constraints
- ✓ Intelligence of typical intruder for this type of site
- ✓ What will happen when alarm is received
- ✓ Expectations about system performance
- ✓ Budget limitations

Classification of Exterior Sensors

- OPERATION: Passive or Active
- INSTALLATION: Visible or Covert
- CONFIGURATION: Terrain Following or Line of Sight
- DETECTION ZONE: Linear or Volumetric
- APPLICATION: Free Standing
Fence Associated
Buried

TECHNOLOGIES

Linear Sensors

Fence Mounted Sensors




Fence Mounted Sensors

- Attached directly to the non-threat side of the fence (not “woven”)
- Do not require additional space
- Referred to as a “shaker system”


Fence Mounted Sensors

Detect



Two General Types

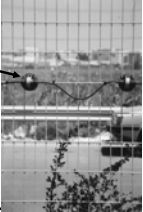
Linear Sensors



1. Strain sensitive (output voltage)
2. Fiber optic (spatial displacement of light)
3. TDR (time domain reflection)


Two General Types

Point Sensors



1. Electro-mechanical point sensors (signal output)
2. Mechanical sensors (switch opens/closes)

Does Wind Cause Alarms?



Wind blowing against the fence fabric does not cause alarms.

Noise generated due to poorly maintained items (loose fabric, signs, pole caps) or large vegetation hitting the fence is what causes alarms.

Fence Mounted Sensors

Advantages


- Terrain following on structure
- Tailor sensitivity
- Audio assessment on some types
- Provide maximum information from fence
- Easy to install
- Cut and climb detection

Fence Mounted Sensors

Limitations

- Fence Must Be Structurally Sound
- Fence Maintenance is On-Going
- Area Around Fence Must Be Maintained (prevent vegetation and debris from impacting fence)
- Does Not Detect Tunneling Under Fence

Strain Switch Detection






Commonly Called Taut Wire

Strain Switch Detection

- Array of horizontal wires connected to a detector post assembly and securely anchored at each end
- Mechanical action against one or several of the wires (climbing, cutting, spreading) generates the alarm.

Strain Switch Detection (Taut Wire)

- * “Stand Alone” provides both physical barrier and detection 
- * As overlay on existing fence 
- * Outrigger at top of fence or wall 

Strain Switch Detection (Taut Wire)

The Pro’s

- Low Nuisance Alarm Rate (NAR)
- High Probability of Detection (POD)
- Barrier and Sensor Combined
- Unaffected by Climate

Keeps On Working!



Strain Switch Detection (Taut Wire)

The Con's

- Requires substantial structure
- Labor intensive to install
- Zones cannot make direction changes (cannot turn corners)
- Must maintain appropriate individual wire tension
- Can tunnel under without detection

Capacitance Sensor



Capacitance Sensor

- Another version of multi-wire array
- Based on balanced capacitance
- Detection occurs by measuring change in electrical capacitance between the sense wires and ground
- Substantial interaction with wires or between them creates alarm
- Typically used as outrigger on fence or walls or building parapets or sides

Capacitance Sensor

- As with Taut Wire or Electrostatic Field, additional physical mounting structures are required
- Unlike Taut Wire or Electrostatic Field, can turn corners, including right angles

Volumetric Sensors

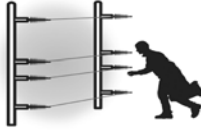
- ✓ Establish a detection pattern or field
- ✓ Typically used inside the perimeter boundary
- ✓ Used between fences (if space is adequate)
- ✓ Often used as secondary sensor ("double knock")
- ✓ Frequently used at entrances and spot areas

Electrostatic Field



Electrostatic Field

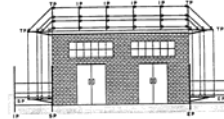
- Typically uses 2 transmit wires and 2 sense wires to create electrostatic field in the space around the wires



- Can be "stand alone" detector and barrier

Electrostatic Field

- Mounted on threat or approach side of boundary
- When fence mounted, wires are supported on outrigger approximately 20" off fence
- Can be used on roof line of building
- Also used to surround building



Electrostatic Field

Advantages

- Terrain Following
- Notices of Approach to Barrier
- Operates Independent of Fence Condition
- High, narrow field pattern = 10 ft. high and 3 ft. wide

Electrostatic Field

Disadvantages

- On-Going Maintenance: Wires and Insulators Require Cleaning and Re-Tensioning
- Sensitive to Vegetation and Animals
- Wind Blown Debris Can Cause Alarms

Buried Coax



Buried Coax

- Uses buried cable to create an array or detection field above ground



- Used where a covert sensor is desired
- Typically used inside a physical barrier

Buried Coax

Buried Sensor Advantages

- Not Visible
- Terrain Following
- No Mounting Structure
- Not Affected by Snow
- Not Affected by Ground Vibration

Buried Coax

Buried Sensor Disadvantages

- Difficult to repair
- Impacted by soil conditions
- Does not like running or standing water
- Maintenance--keeping it buried
- Requires "clear space" and no metal objects in field
- Cannot turn sharp corners

Bi-Static Sensors



Bi-Static Sensors

- Are "point to point" type sensors requiring a straight line of sight.
- Pattern of detection is established between a Transmitter and a Receiver

TYPES

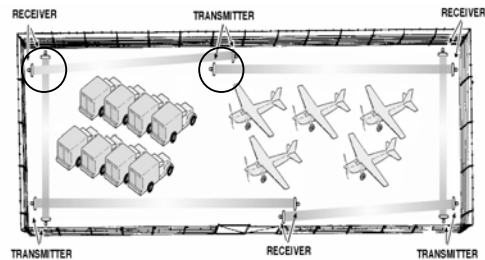
- Microwave
- Active infrared (photoelectric beams)
- Combined microwave/infrared

Bi-Static Sensors Points To Consider

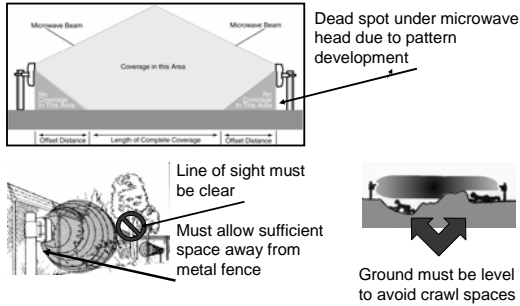
- Volumetric sensors require "real estate" regardless of what type of technology--this includes infrared
- Microwave hard to defeat and is the most impervious to elements; BUT is also the most unforgiving regarding ground conditions, eg.waving grass, puddles of water

Offset and Overlap

Must protect TR/RE and ensure no dead spots.
Accomplished by *offsetting* heads and *overlapping* them.



Installation Factors



More Points To Consider

- Active IR has more defined pattern, but can only achieve height by using multiple units
- Snow build-up, heavy fog can cause IR to alarm or “go to sleep” with a fade out device
- Units **MUST** be kept in alignment whether IR or microwave
- Neither can be installed too close to fence or other metallic objects due to reflection

Monostatic Sensors

Only one unit emits pattern



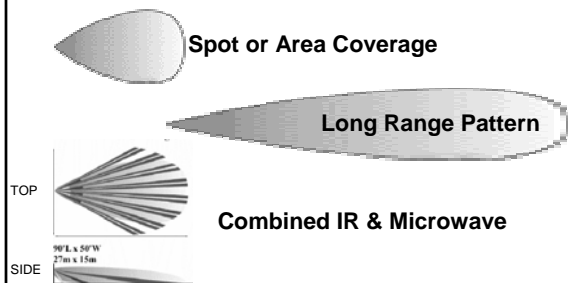
- Transmitter and Receiver in one housing
- Called a Transceiver

Monostatic Sensors

- Microwave, passive infrared (PIR) or combination of the two
- Microwave looking for shift in frequency due to moving target in pattern. More sensitive to forward/backward motion.
- PIR looking for ambient temperature variation between target & background. More sensitive to cross motion.

Monostatic Sensors

Large variety of detection patterns are available



Monostatic Sensors



- ✓ Typically used for strategic areas
- ✓ Protect specific asset or assets
- ✓ Used in conjunction with other outdoor sensors as “gap” fillers

- ✓ Should be used in a fenced or controlled area
- ✓ Should NOT be used in same configuration as bi-static sensors around perimeter
- ✓ Animals can cause a problem
- ✓ Must be careful pattern is not picking up large objects (vehicles) outside of protected area

Video Motion Detection



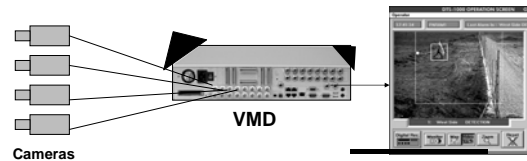
Video Motion Detection

- Becoming more widely used because of versatility and great improvements in recent years
- Can track direction of activity within field of view
- Alarms can be generated by non-motion items left in area
- Can isolate areas for detection
- Coverage of large area without physical structures

Video Motion Detection

- Microprocessor based image analysis from field of view of camera/s
- Wide range of unit capability from simplest pixelation change to highly complex algorithms defining parameters for areas
- Compensations made for global changes
- Price relative to sophistication

Video Motion Detection



Cameras perform multiple functions

- ✓ Surveillance
- ✓ Detection
- ✓ Assessment (other sensor alarms)

V M D Strengths

- Versatility in what can be detected--moving or non-moving people/objects
- Achieve multi use from CCTV system
- Can reconfigure "rules" for area/s of detection by programming
- Coverage can be for large or small areas--whatever is field of view of lens

And the Drawbacks

- Presents no physical barrier to intrusion
- Performance related to other equipment: camera and lens
- Weather conditions may reduce detection range
- Depending on equipment, moving items such as clouds, trees, camera itself moving can cause nuisance alarms

System Smarts



- **AT SENSOR LEVEL** --Adjustments for particular sensor/zone



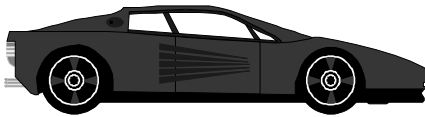
- **AT CONTROL LEVEL** --Smart processing to interpret sensor signals. Control designed to work with specific sensor type will be "smarter" than a general control.

Assessment Is Key

- Usually video
- Personnel
- Audio with some sensors

MAINTENANCE

- All systems and platforms (physical structures) require routine testing and maintenance



Even the sleekest car won't run if not maintained!

Thank You !

Thank you for your attention during this tutorial.

This presentation is intended to be a very general introduction to the highly specialized arena of exterior intrusion detection. It does not purport nor attempt to cover every possible type of technology or sensor available. Its goal is to point out factors which must be taken into consideration as well as discuss in broad terms the most prevalent types of technologies currently in use.



Airports



Refineries



Water



Chemical



Commercial



Corrections



Nuclear



Olympics

