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A Systems Approach to Border Security

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Role of Technology in Border Monitoring

- Detect and prevent illegal border crossings
  - Terrorists
  - Smugglers
  - Illegal immigrants
- Detect threats to fixed sites
  - Military outposts and bases
  - Other infrastructure
- Early detection of military attack
- Reduce risk of accidental conflict
- Potential to enhance bilateral or regional confidence

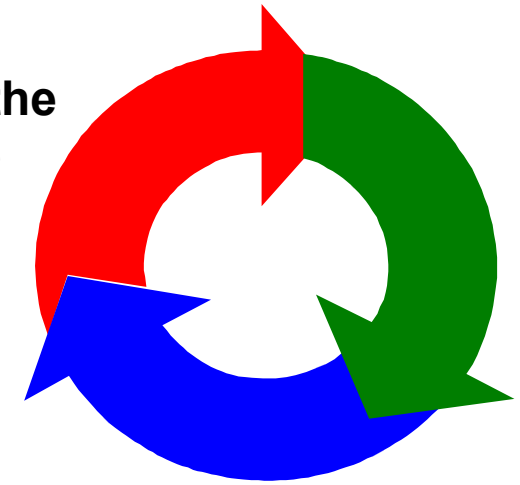
Border Monitoring Approach

- Border monitoring is one element of border security that includes: detection, tracking and/or delay, and response
- Monitoring techniques
  - patrols
  - observation posts
  - ground-based sensors
  - aerial/satellite remote sensing
- Monitoring strategy
  - assess threats and set operational objectives
  - undertake systems approach to meet objectives
  - focus on militarily significant activities and high-risk areas
  - balance cost with benefit
  - coordinate with existing security and national technical means systems
  - blend technical and non-technical types of monitoring
  - monitoring in depth

Focus is on the process of developing a border security system

Establish the Objectives

- What's important?
- What to protect against?
- How well are you currently protected?



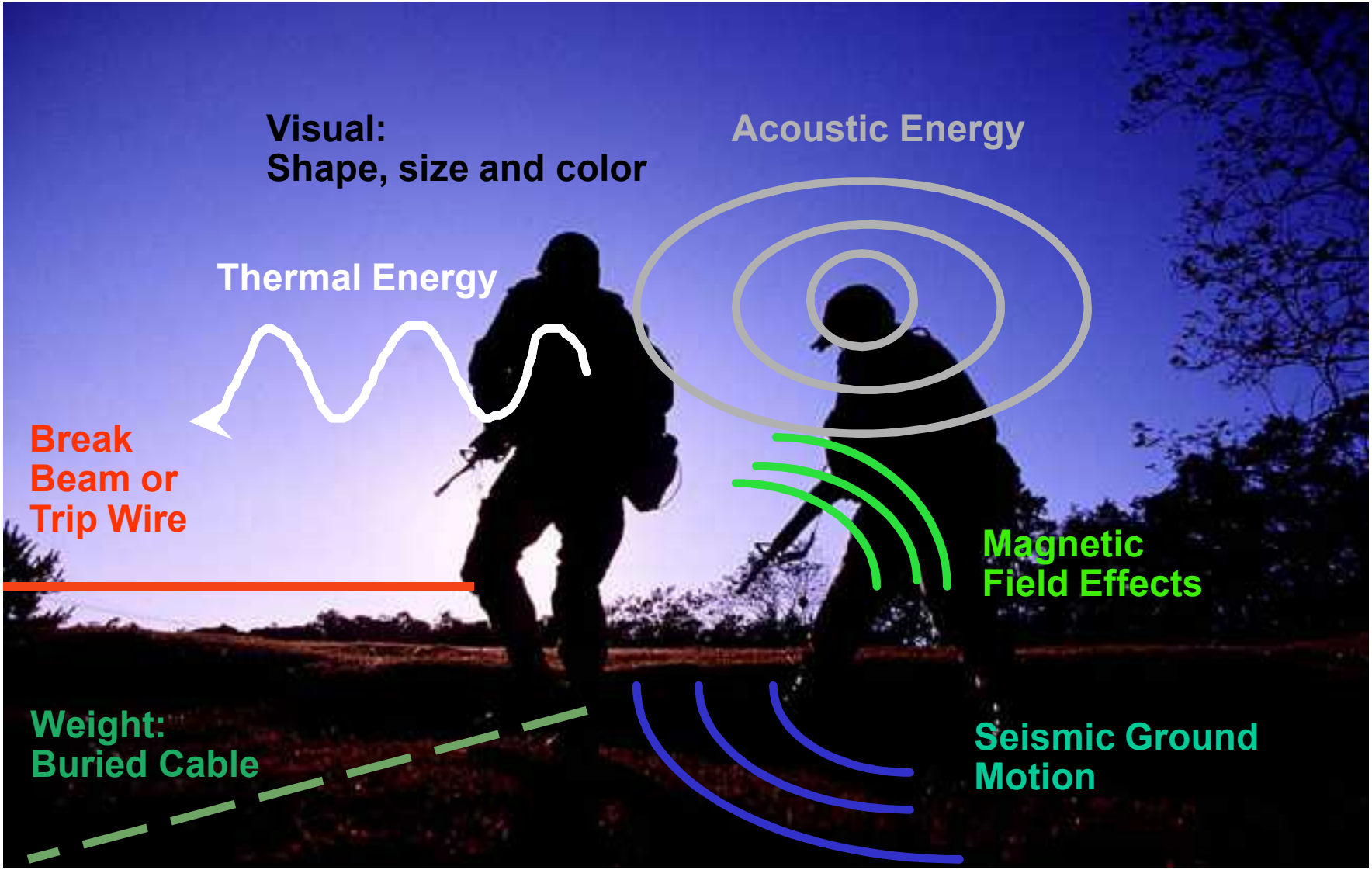
Design the System

- Detection
- Delay
- Response

Assess and Refine the Design

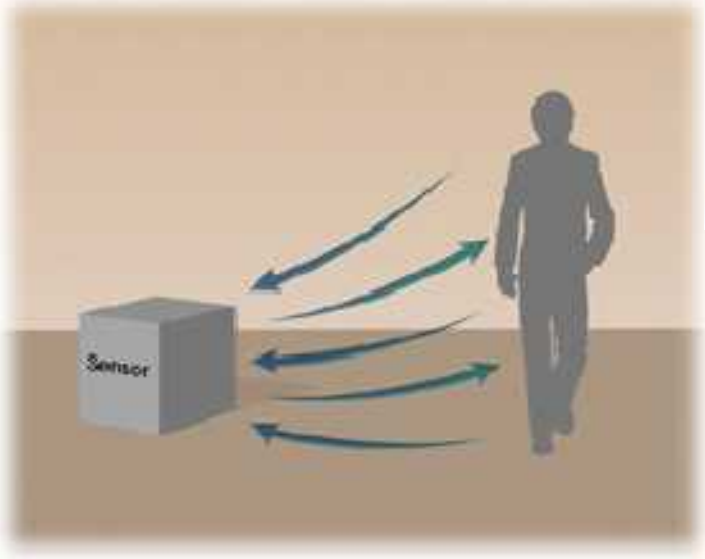
- Elements in an assessment:
  - Performance Testing and Analysis
  - Vulnerability Analysis
  - Cost-Benefit Analysis
  - Modeling and Simulation

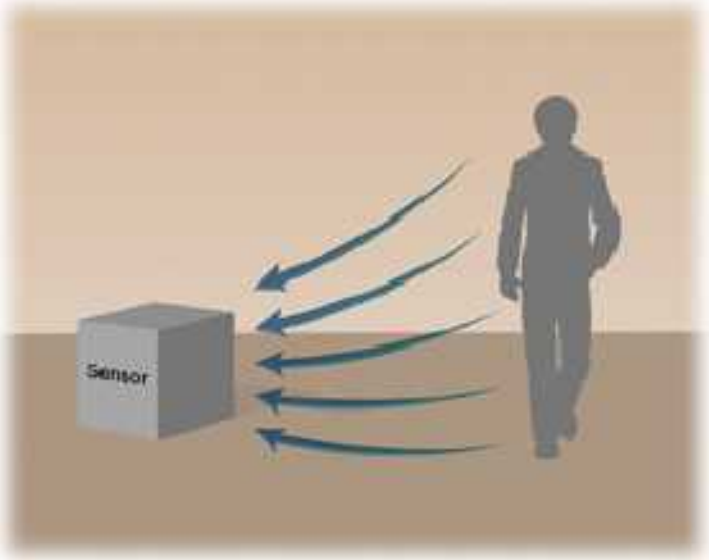
Example Sensor Measurements



Active and Passive Sensors

Active sensors emit energy and measure reflected response





Passive sensors respond to energy emitted by external sources

Ground-Based Technologies for Border Monitoring

Passive Sensors

seismic, magnetic, infrared, acoustic, buried strain cables, fence sensors, optical systems

Active Sensors

infrared break beams, ground radar, microwave

Many Sensors can also be Deployed on Remote Sensing Platforms

- Candidate Sensors
  - Optical cameras
  - Infrared imagers
  - Radar

Manned Aircraft

Unmanned Aerial Vehicles (UAV)

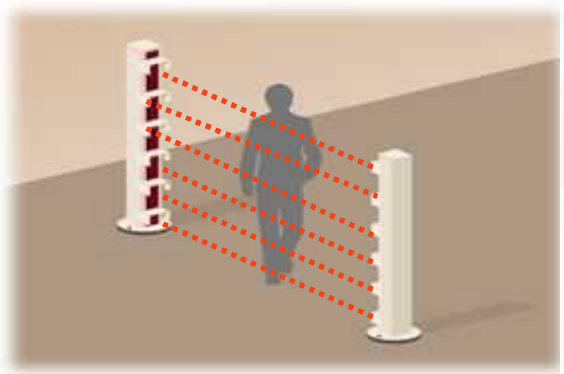
Tethered Balloons

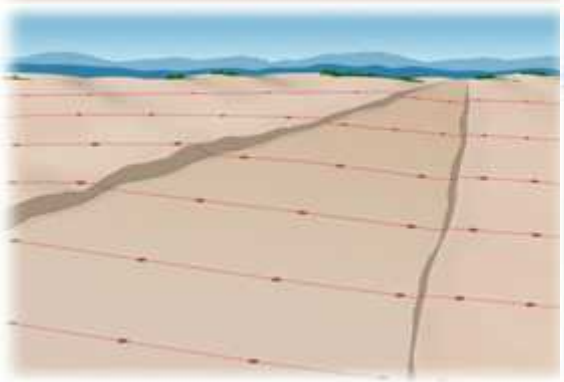
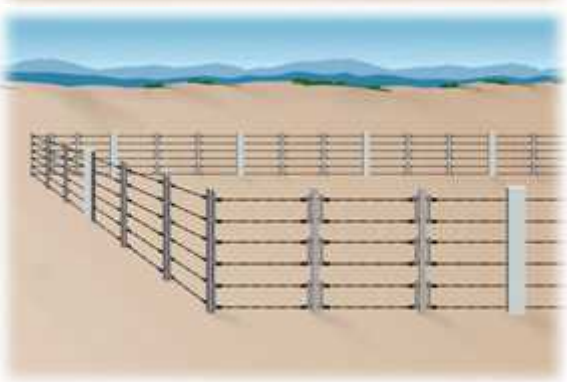
Other Sensor Concepts

- Volumetric vs. Line
- Line-of sight vs. terrain following
- Covert vs. Visible

Appropriate monitoring technologies will vary with mission and terrain

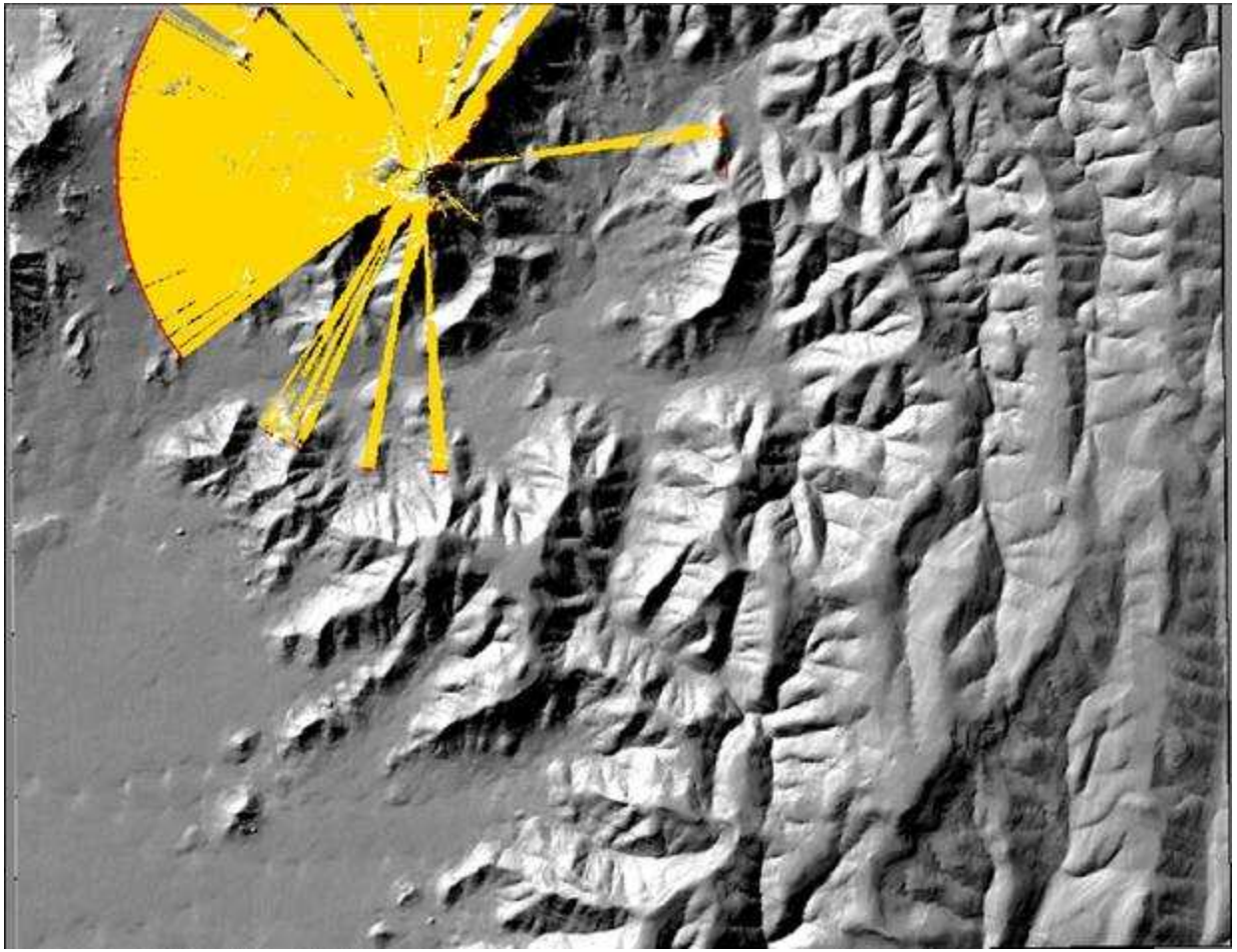




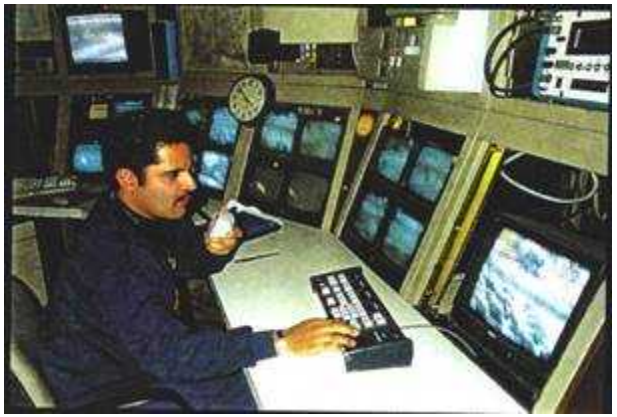
Example of line of sight calculated by software for a hilltop location

Yellow areas indicate locations where view is blocked by terrain



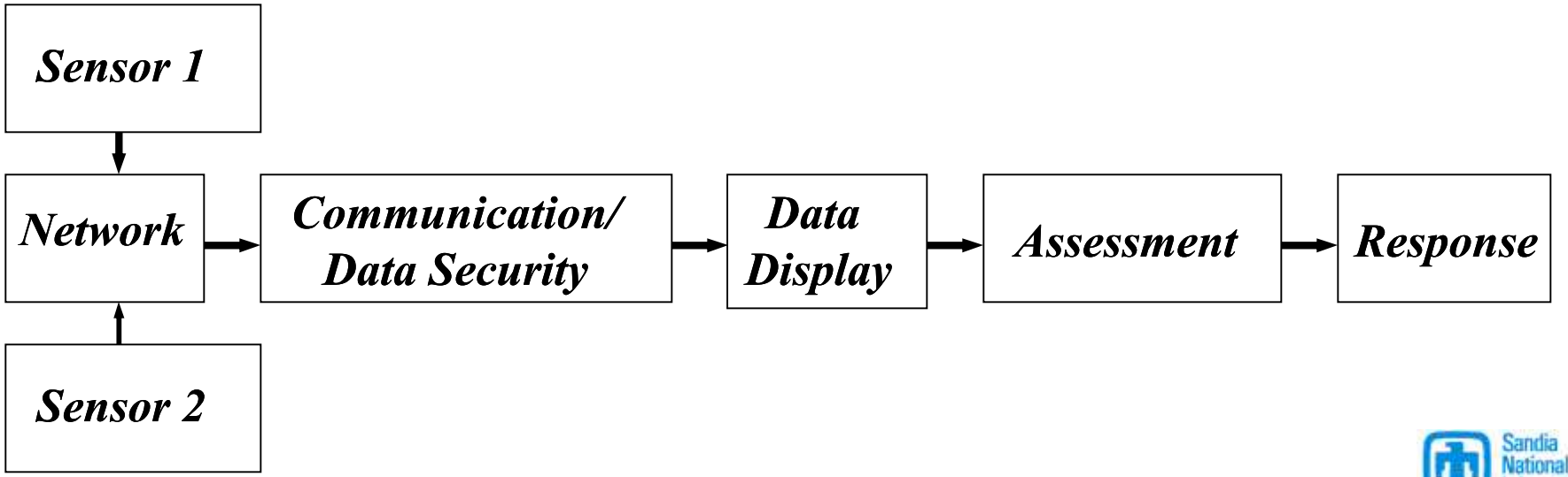
Elements of Border Security System

Sensor Deployment

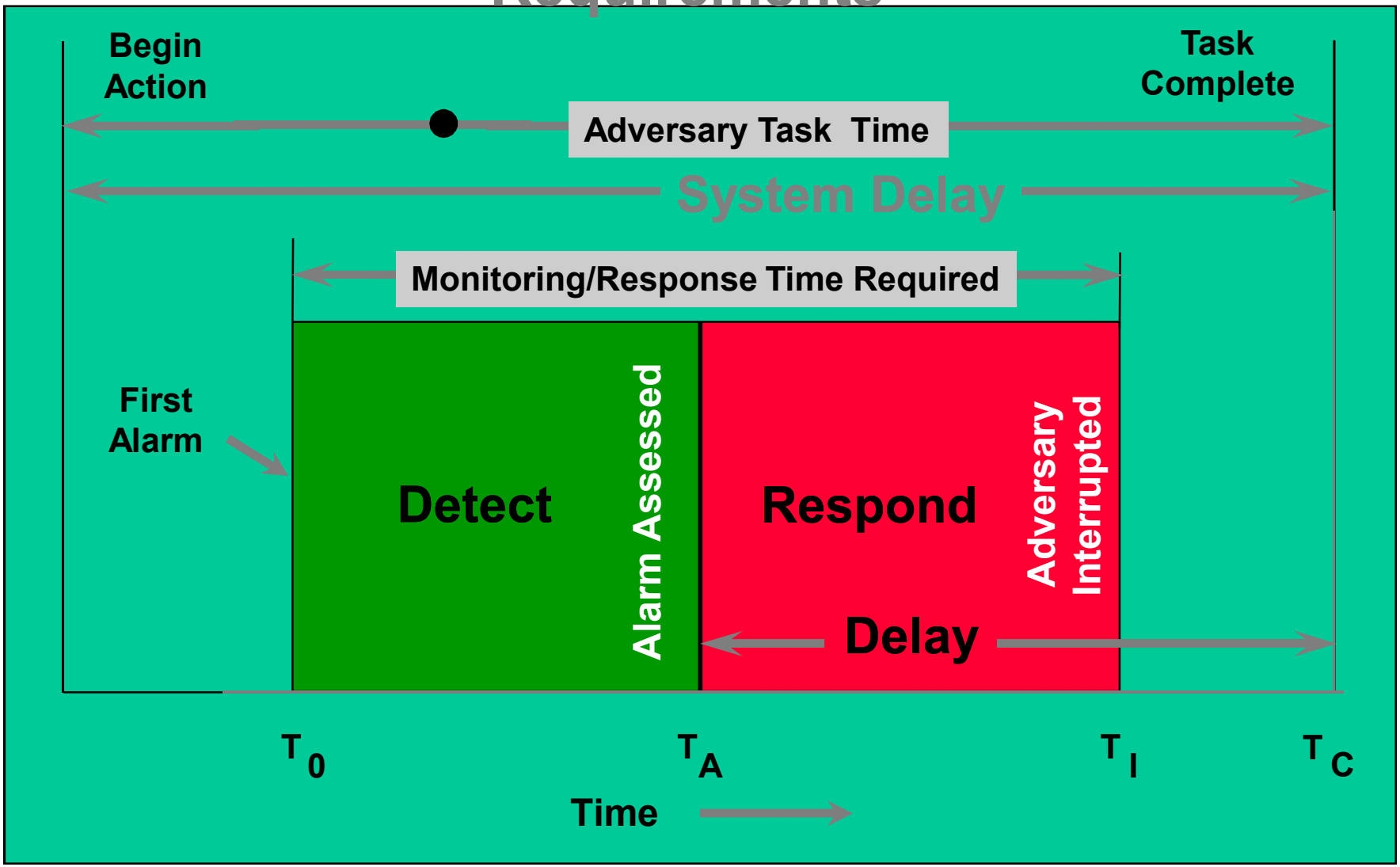


Monitoring Center

Response Force



Adversary Task Time vs. Monitoring/Response System Time Requirements



A Variety of Border Monitoring Applications and Configurations Exist

- Official crossing points/ports of entry
- Open Border
  - Flat
  - Mountainous
  - Maritime
- Observation Posts
  - Fixed
  - Mobile

Monitoring for official ports of entry: Improve detection of contraband

- Apply screening techniques for drivers and vehicles
  - Ask questions based on terrorist profiles to identify suspicious drivers
  - Weight scales to detect suspicious loads
  - All trucks larger than a certain size are directed to an inspection facility
- Establish an inspection facility near border
  - Dedicated facility
  - X-ray screening of selected vehicles and packages
  - Tools to open packages
  - Hand-held chemical detection equipment

X-ray showing car in a truck

Weigh in-motion Scale

Conceptual Diagram of an Inspection Area

Gate

Inspection Building

X-Ray

Inspection Building

X-Ray

Gate

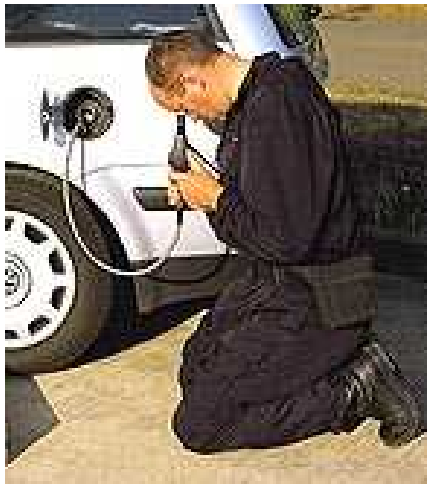
Inspection Area

Hand-Held Inspection Tools

Detectors for gaseous emissions from explosives and drugs

Sample collection from people or containers for explosive and drug residue

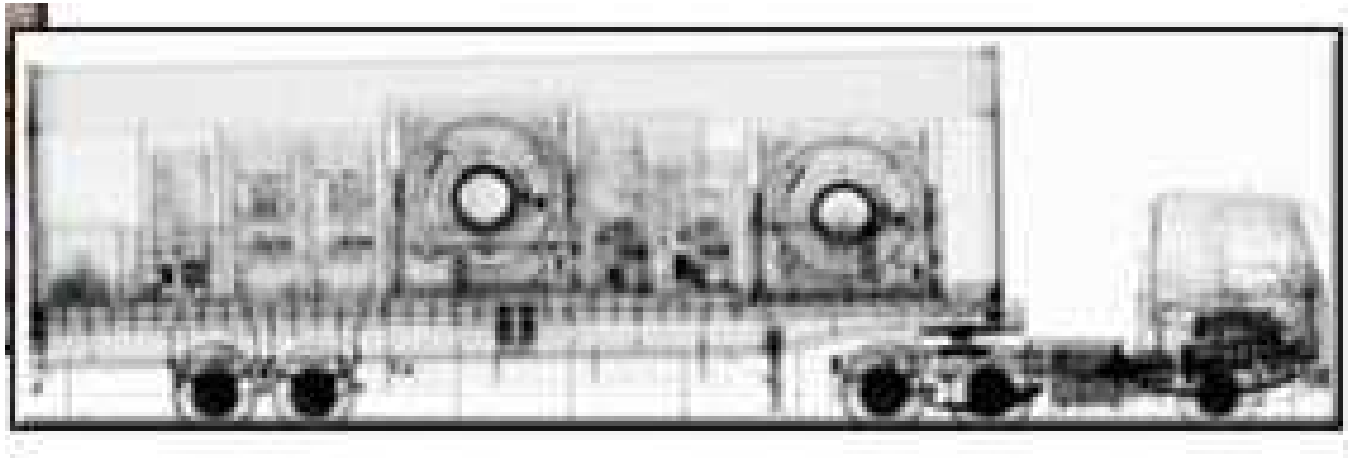
Narcotics identification



Fiber-optic tool to look inside enclosed spaces

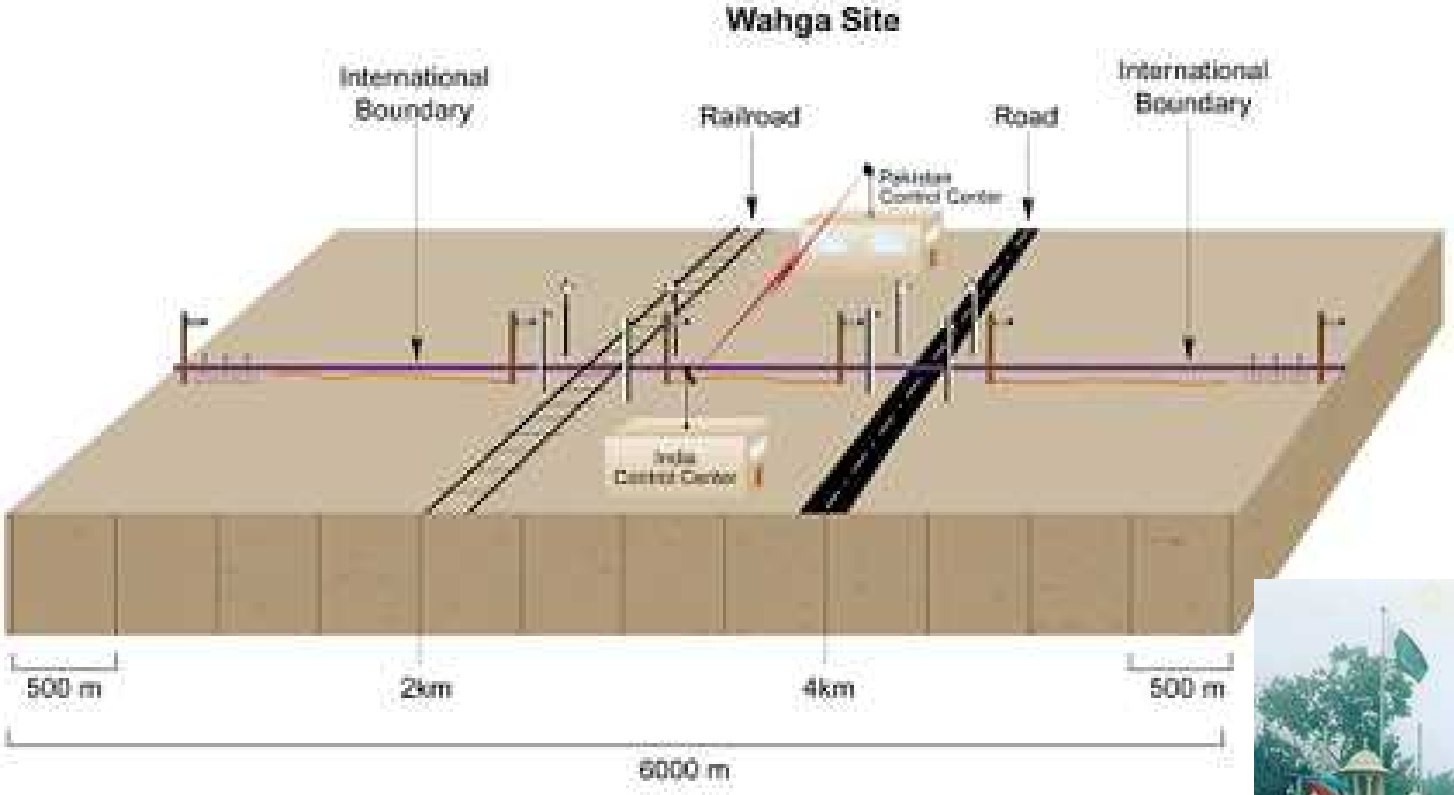
Metal detector for personnel or small package inspections

X-Ray Inspection of Vehicles – Fixed or Mobile Systems



Note: radioactive source requires security protection

Other Monitoring Systems Deployed for Cooperative Crossing Point Border Monitoring-- Proposed South Asia Example



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Monitoring plan for official ports of entry: Deter and detect bypass of border

- Establish fixed or mobile checkpoints on routes away from border
- Portable chemical and x-ray assessment equipment

Examples from US-Mexico Border

Mobile

Portable Lighting and generator

“Sky Watch” mobile observation post

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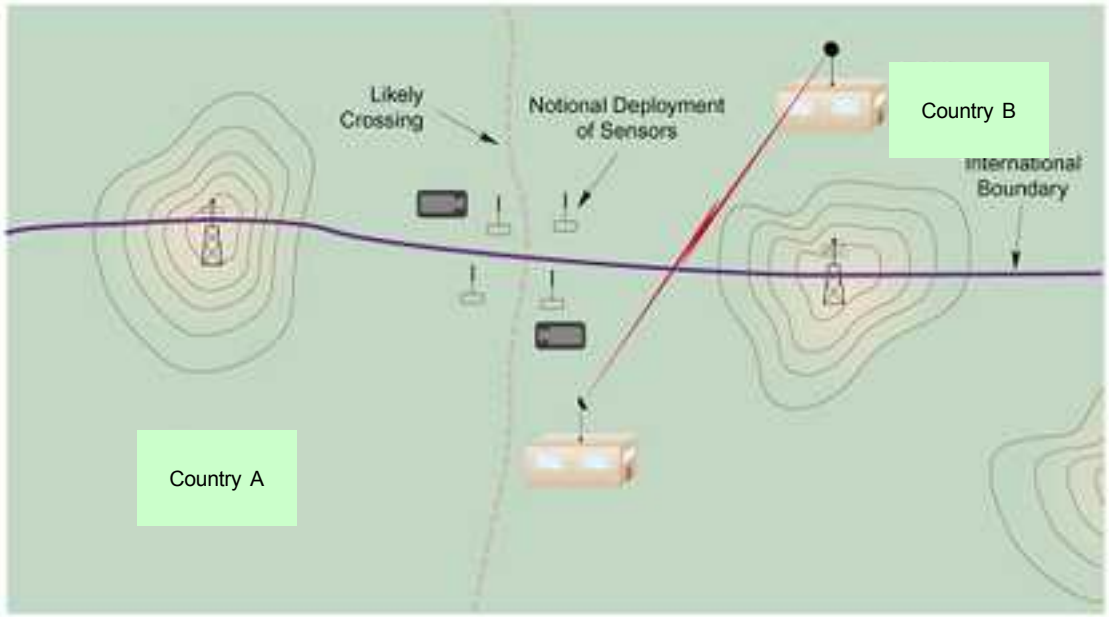
Flat Open Border Monitoring

- Characteristics
  - Long distances
  - Good line of sight
  - Low population density/infrastructure
- Technology Options
  - Selective use of unattended ground sensors
  - Video systems
  - Buried Fiber-Optic Cables
  - Ground-based Radar

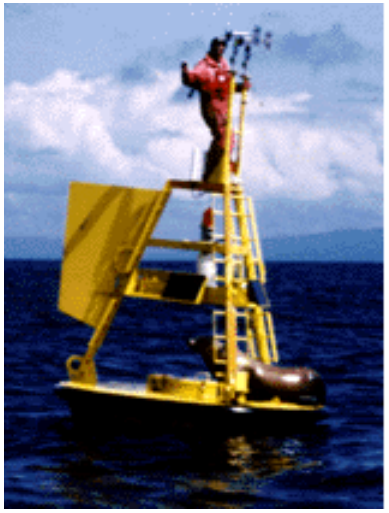
Example Mountain Region Border Monitoring

thermal image



Maritime Monitoring

- Port Security
- Vessel Tracking
- Boundary Marking



Border Monitoring Application: Observation Posts (OPs)

- Goals
  - Detect illicit crossings
  - Enable response forces to interdict intruders
- Monitoring Objectives
  - Improve force protection measures
  - Increase probability of detecting intruders
    - particularly during poor weather and at night
    - coordinate response force actions
  - Enhance ability to conduct reconnaissance

Monitoring plan for observation posts: Improve force protection

- The OP may become a target of criminal/terrorist attack
- Deploy sensor network in local area to detect intrusions
  - Install on paths or use to define a perimeter
  - Seismic and Infra-red break-beam sensors
  - Sensors report to OP
  - Assume sensors outside of an OP will be destroyed or stolen if visible
- System maintains efficiency of OP and protects morale

Multiple vendors produce sensor systems

Monitoring plan for observation posts: Increase probability of detecting infiltration

- Deploy a hand-held night vision devices
- Deploy unattended ground sensors along paths and roads in the OP's area of responsibility
  - Seismic, magnetic, infrared
    - Exact combination of sensors depends on specific site
    - Terrain may require radio repeaters
    - Assume sensors outside of an OP will be destroyed or stolen if visible
  - Sensors alert observer to identify an intrusion if within OP's field of view or initiate reconnaissance in areas outside of field of view

Night Vision System

Portable thermal imager

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Increase probability of detection of infiltration: Use mobile observation posts

- Move mobile monitoring station to areas of concern based on:
  - Increasing levels of infiltration activity
  - Reports of pending infiltration
- Need unit to provide perimeter security

US Border Patrol "Sky Watch" mobile observation post

Day / night cameras with high intensity spot light

Monitoring plan for observation posts: Increase probability of detecting infiltration

- Install portable ground scanning radar units at OPs with long fields of view
- Install tower inside OP with video and thermal imagers.
  - Zoom capability in imagers
  - OP provides security
  - Install armor plates to deflect bullets
  - Install portable diesel generator for power
  - Potentially mount on truck or trailer for mobility

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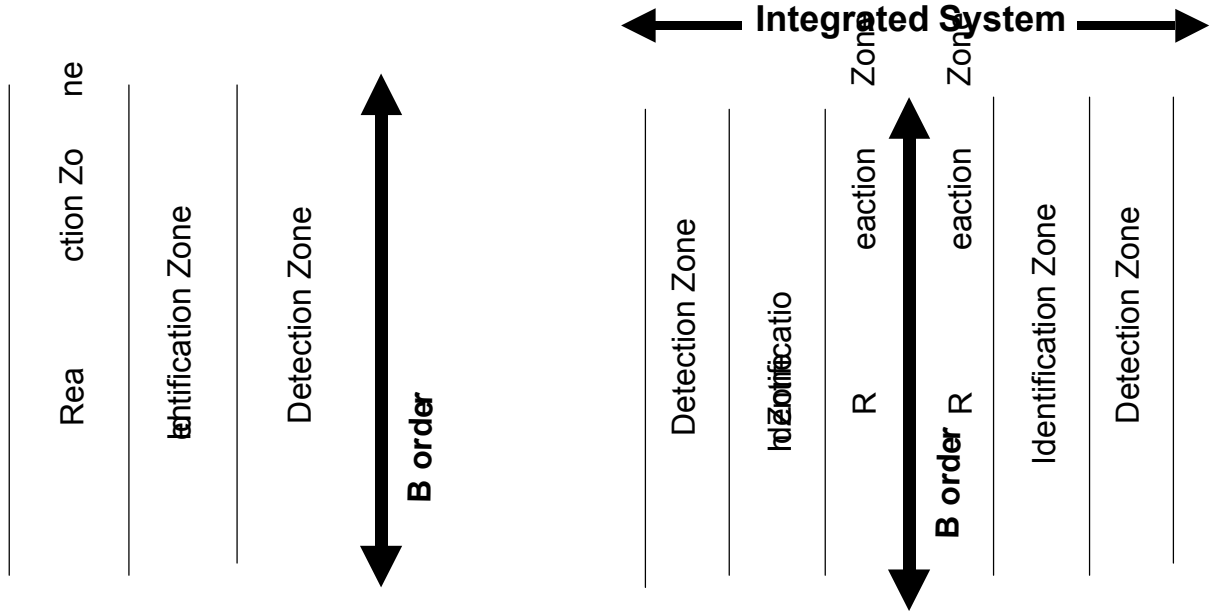
Cooperation could improve the effectiveness of border monitoring and security



A. Unilateral Monitoring Model

B. Cooperative Monitoring Model

- Trans-border cooperative approach to monitoring
- A cooperative strategy reverses the usual order of detection, identification, and reaction

Value of a Systems Approach to Design

- Without a systems approach:
  - Objectives of a system are not clearly defined.
  - Solutions may solve the wrong problem.
  - Solutions may provide little or no reduction in risk.
  - Cost effective solutions may be overlooked.
  - Resource allocations or resource requests are difficult to make and justify.

Summary

- A systems approach to design is necessary to meet border security objectives
- Understanding the threat, objectives, and operational constraints are key starting points in a systems design process
- Monitoring technologies enhance the ability to detect cross-border movements
- A balance of human and technological solutions are needed
- Multiple sensor types are available for different applications, terrain and climate
- Using a combination of sensors to measure different signatures increases system effectiveness