SAND2012-7017C

10. Alarm Assessment

Fundamentals of Physical Protection Technologies and Systems

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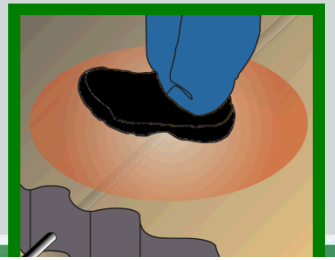
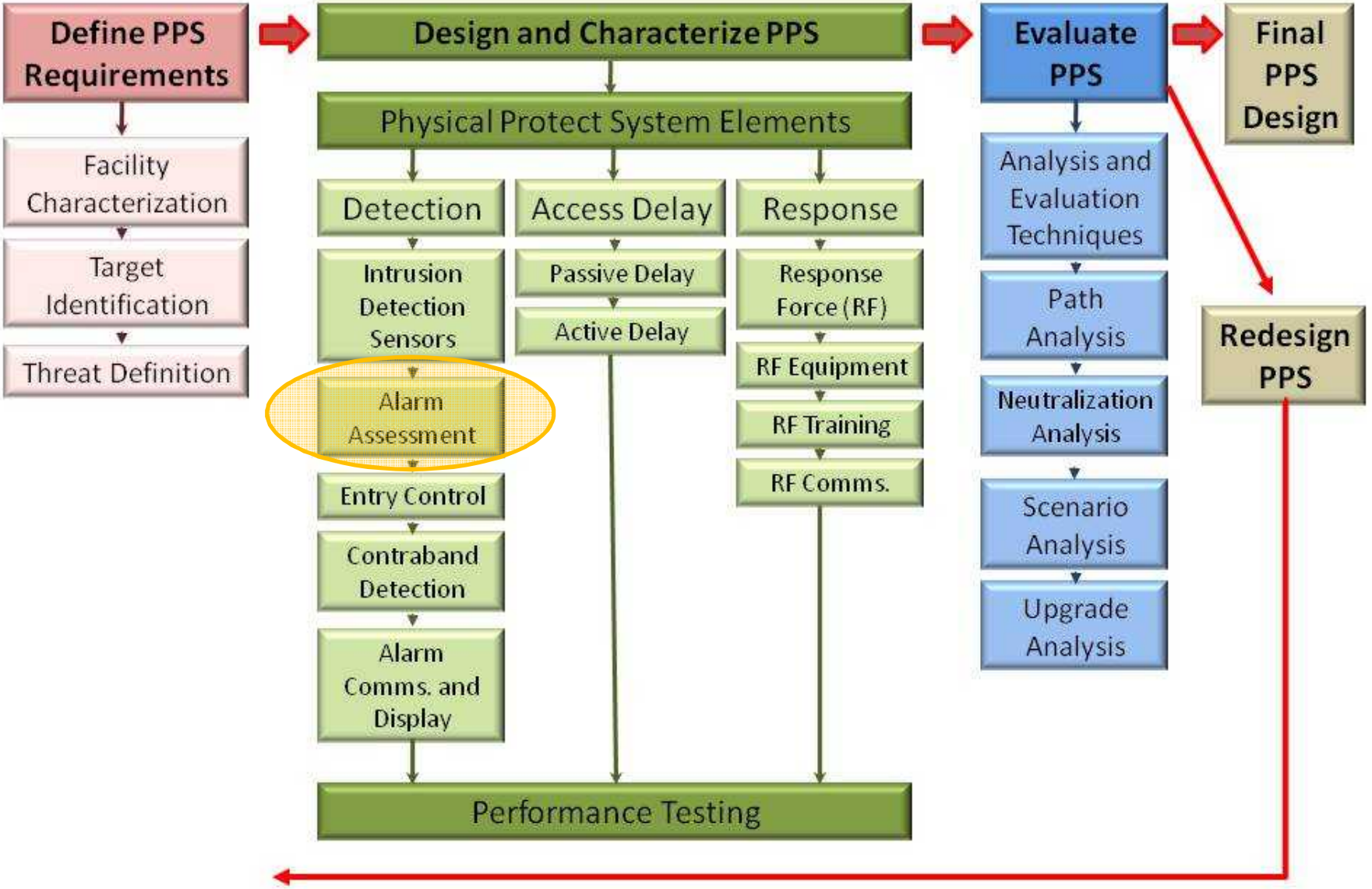
10. Alarm Assessment




Define PPS Requirements
Facility Characterization
Target Identification
Threat Definition
Design and Characterize PPS
Physical Protect System Elements
Detection
Intrusion Detection Sensors
Alarm Assessment
Entry Control
Contraband Detection
Alarm Comms. and Display
Access Delay
Passive Delay
Active Delay
Response
Response Force (RF)
RF Equipment
RF Training
RF Comms.
Performance Testing
Evaluate PPS
Analysis and Evaluation Techniques
Path Analysis
Neutralization Analysis
Scenario Analysis
Upgrade Analysis
Final PPS Design
Redesign PPS

Learning Objectives

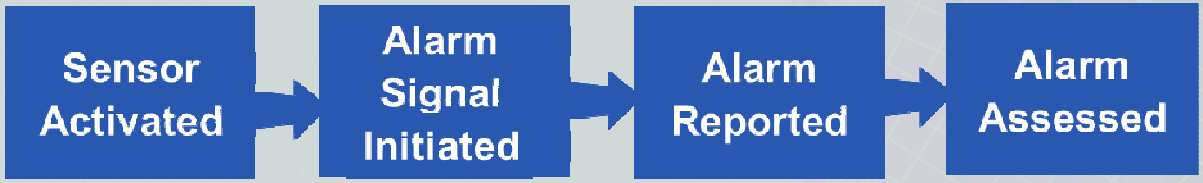
At the end of this module, you should be able to:

- **Discuss the purpose of alarm assessment**
- **List alarm assessment methods**
- **Identify response force assessment components**
- **Identify video assessment system components & requirements**
- **Discuss design considerations for video assessment**

What is Alarm Assessment

Alarm Assessment – Security operator determines the cause of an alarm

- Alarm Assessment completes the detection function
- Provides information if alarm is real or nuisance/false alarm
- Provides information for response force action
  - How many intruders
  - What equipment are intruders bringing in



Detection is not complete without Assessment

Assessment Methods

Response Force

Technology

Method 1: Response Force

- From local guard posts
- By roving patrols

Response Force Advantages and Disadvantages

Advantages

- Can provide on-site visual observation & detection capabilities
- Flexible deployment
- Can provide delay or immediate response

Disadvantages

- Significant time may have passed between an alarm and assessment
- Can only tolerate a very limited number of nuisance alarms
- Manpower costs
  - May be expensive in long term

Method 2: Technology

- Cameras & lighting must provide full coverage of sensored areas
- Assessment video displayed on monitors at a Central Alarm Station for operator assessment

Technology Advantages and Disadvantages

Advantages

- Alarm assessment can occur almost immediately
- Pre-event and post-event recording possible
  - Enhance assessment capabilities
  - Later audit and review
- Efficient use of people

Disadvantages

- Requires an infrastructure for effective video assessment
- Initial cost may be high
- Requires testing and maintenance

Assessment verses Surveillance

Assessment – Video display triggered by sensor alarm to determine if an intruder has penetrated a sensored area




Surveillance – Continuous video monitoring of an area that does NOT have sensors to cause an alarm



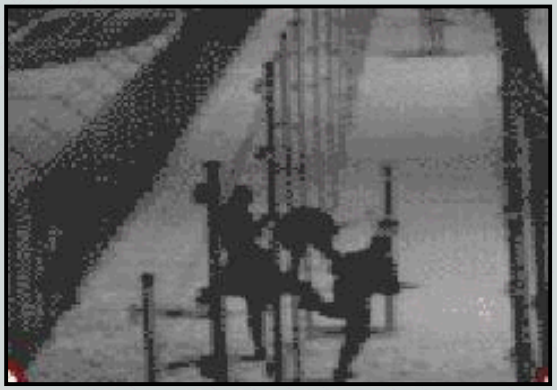
Assessment

- Electronic technology is fairly consistent
- Human alarm assessment is variable

Assessment video technologies can be a force multiplier

- One person can assess multiple areas
- Humans alerted to alarm events and video is automatically displayed

Proper use of video assessment technology helps humans make a quick and accurate assessment of an alarm event



Surveillance

- Low probability of detection
  - Used when time is not critical to an event
- Cameras usually visible to public and used as a deterrent
- With no sensors, loss of video leaves a single point failure in the detection of an intrusion event
- Effective for short periods of time and watching a single area
  - Useful for specific activities, such as observing deliveries or construction work
- Can track moving activities with pan-tilt-zoom cameras




Fixed and PTZ Cameras – Factors to Consider

Fixed Camera

- Always pointed at area of interest
  - Assessment – alarmed area
  - Surveillance – area to be protected
- Captures pre-alarm and post-alarm video
- Requires more cameras for complete coverage

PTZ Camera

- Requires fewer cameras for complete coverage
- Low probability camera will be pointed at alarm location
- Cannot provide video for two simultaneous alarms
- Used with extended range sensors to assess "beyond the fence" alarms

CAMERAS

Video Camera Types

- Color
- Black and white
- Day/night
- Infrared-enhanced black & white
- Intensified
- Thermal imager

Cameras of different technologies used together can provide a wide spectrum of solutions for specific applications — particularly at low light levels or for an obscure scene

Color versus Black & White Cameras

- Color enhances daylight scenes
- Color at night – gold-brown images with sodium vapor lamps
- Standard color camera resolution 18% less than black & white
- Day/night cameras
  - Color during day, switches to black and white mode at night
  - 18% resolution improvement at night

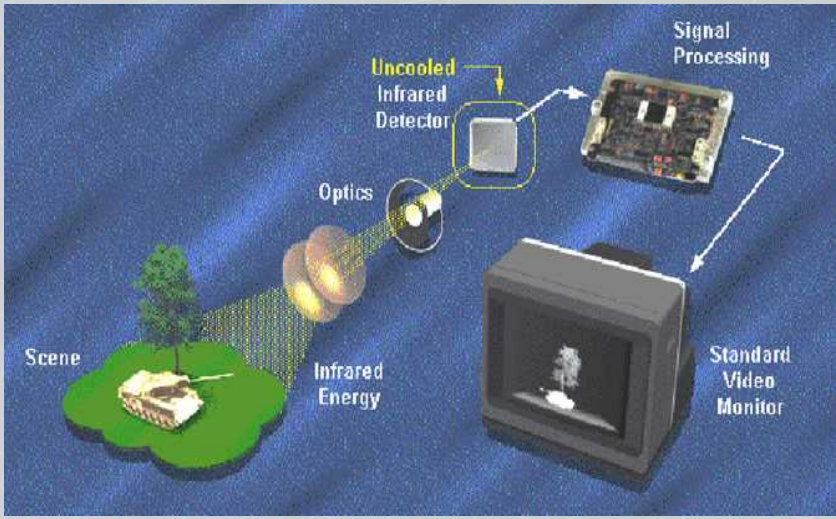
Color

Black and White

Color at Night

Thermal Camera

Responds to emitted thermal/infrared energy



Thermal Camera Properties:

Responds to temperature differences against a background temperature reference

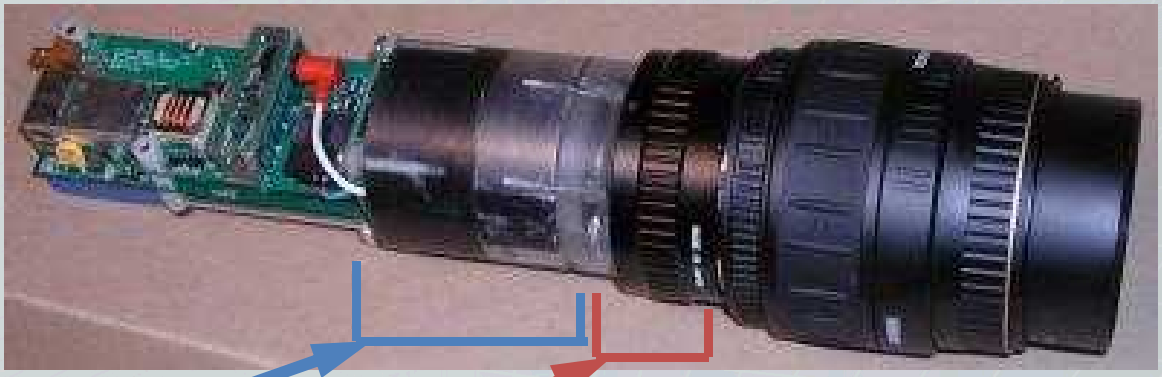
Passive device - requires no illumination to produce video image

Picture based on temperatures of objects in scene

Cameras are relatively expensive compared to visible light cameras

Thermal Camera Images

Intensified Low-light Camera



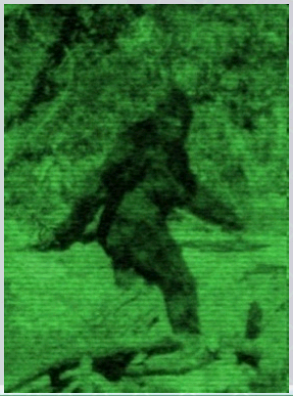
Camera Section

Intensifier Section

Intensified Low-light Camera (cont.)

Intensified Camera **- photon amplifier bombards luminescent (green) screen. Color camera focused on green screen to create video signal**

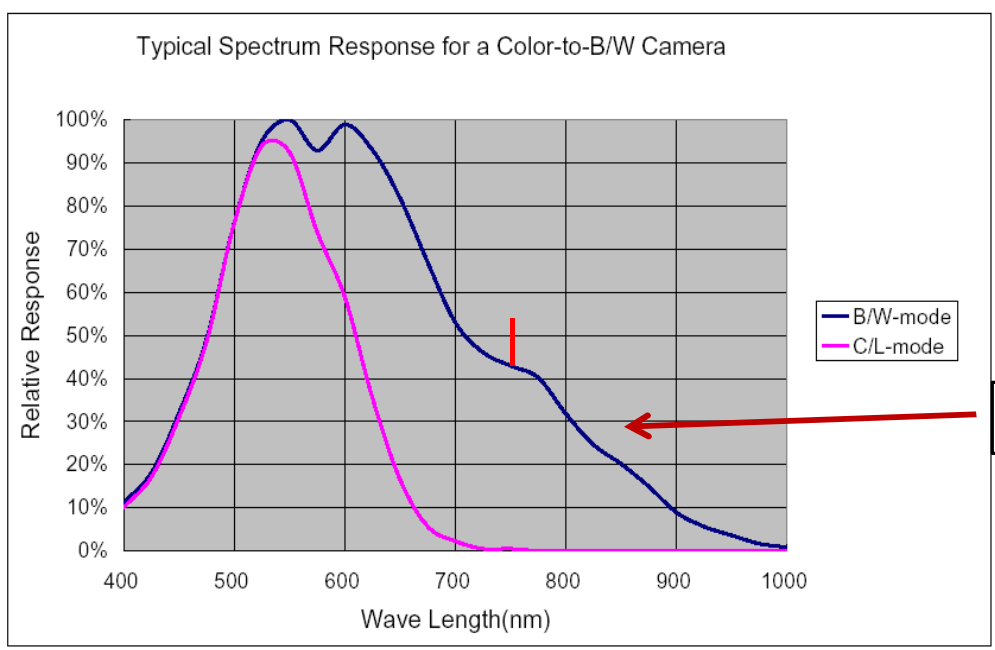
- **Responds to near IR illumination from stars, moon and artificial lighting**
- **Cameras are light receivers only - do not emit IR light**
- **More expensive than standard camera**
- **Maintenance - Intensifier has limited life**
- **Bright light sources in scene can distort images**



IR Sensitive Camera

IR Sensitive Camera **– Black & White camera with enhanced sensitivity to the near-infrared portion of the spectrum**

- **Allows use of covert infrared light sources to illuminate scene**
- **IR light sources however, can be seen with night vision goggles**



Comparison of Color and IR Sensitive Camera Images

LENSES

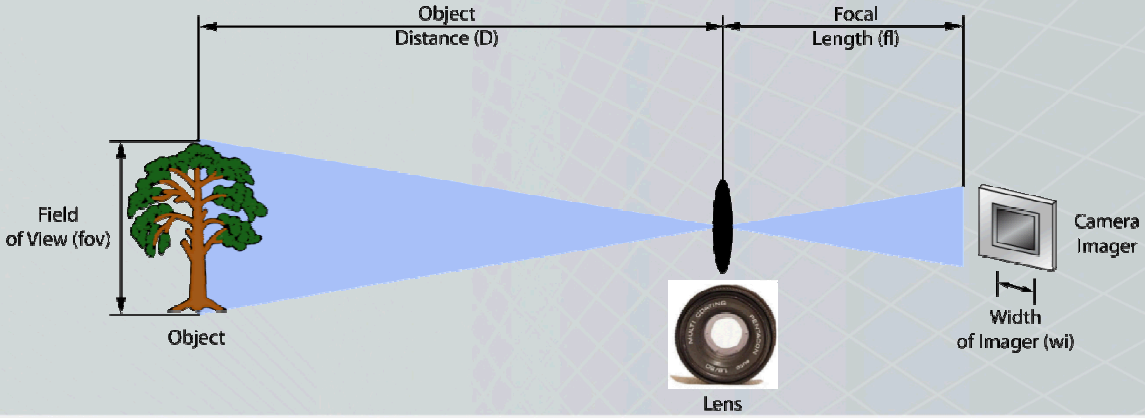
Primary Functions of a Camera Lens

Focuses reflected light from the scene on the camera imager

Determines size of scene image projected onto the camera imager at a specified distance behind the lens

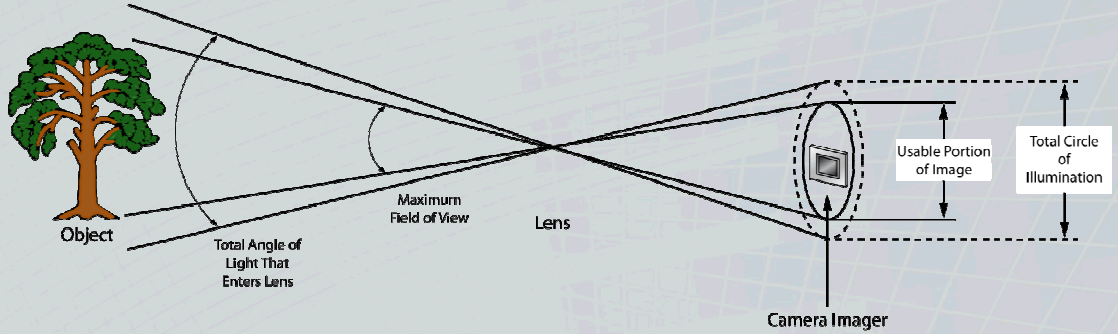
Lens selection factors include:

- Format
- Focal length
- Field of view
- Aperture
- Resolution

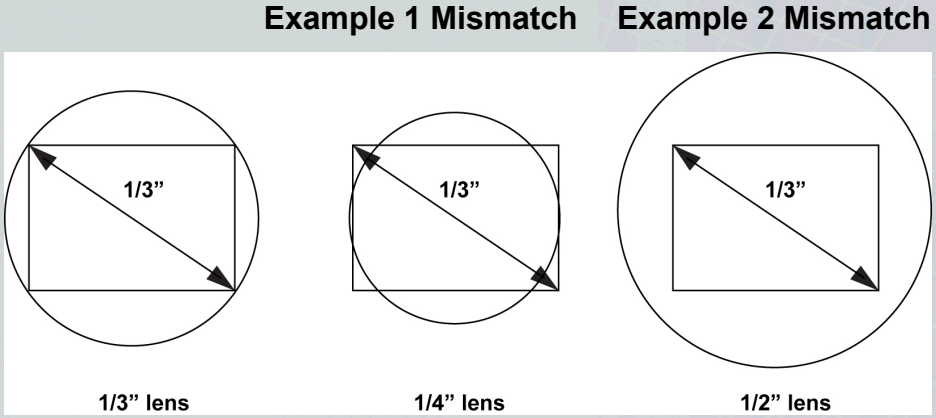


Lens Format

Lens Format – diameter of projected image circle at the distance behind the lens where imager is located



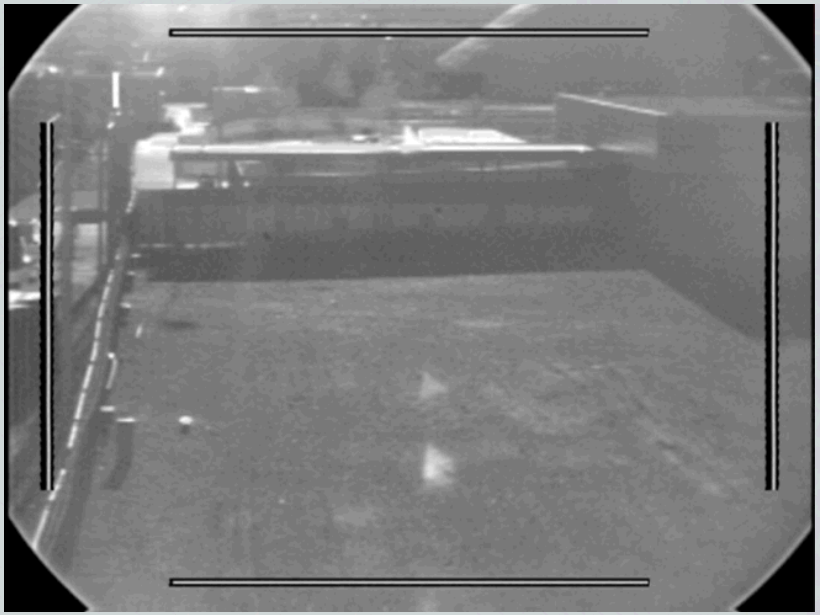
Examples of lens-camera imager format match & mismatch



Format Mismatch Example 1

Lens format smaller than imager format

- **Field of view is larger than specified for the lens**
- **Field of view does not cover entire imager**
- **Larger format mismatch causes larger black corners**



Format Mismatch Example 2

Lens format larger than imager format

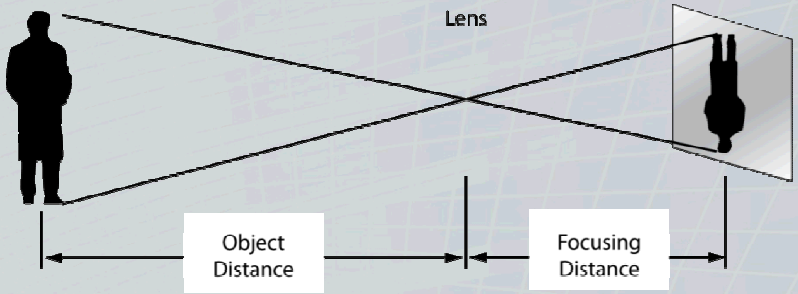
- **Field of view is smaller than specified for the lens**
- **Portion of field of view is focused outside the imager**
- **Larger format mismatch causes more near field not to be captured**

View with Matched Format

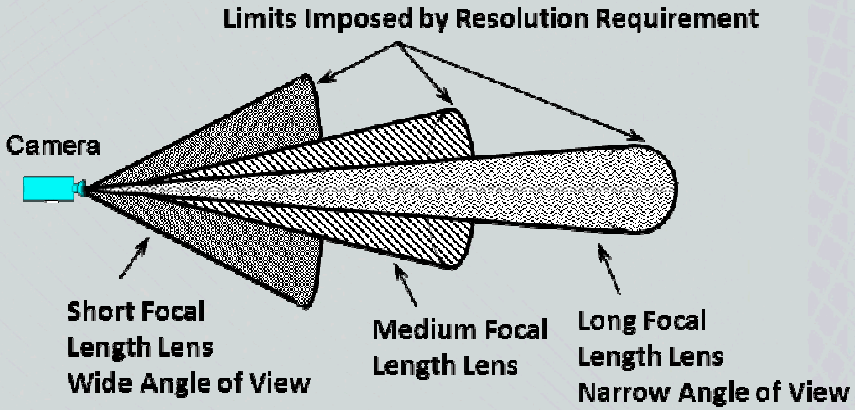
View with Mismatched Format

Focal Length

Focal Length – Distance from lens to imager when focused at infinity



Lens focal length determines field of view, and image magnification



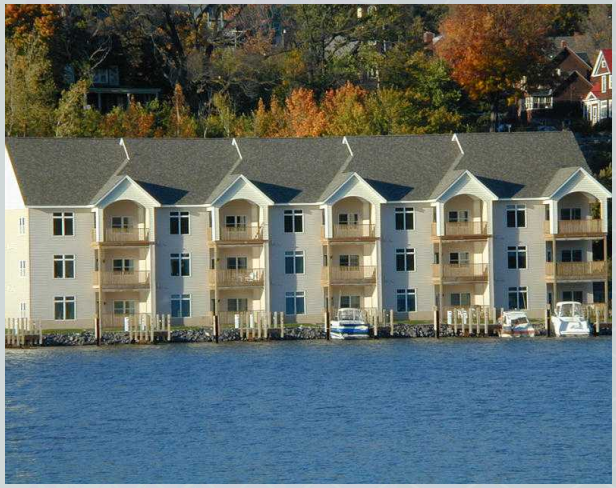
- Smaller numbers indicate a shorter distance and wider field of view (e.g., 4 mm, 6 mm)
- Larger numbers indicate longer distance and narrower field of view (e.g., 50 mm, 75 mm)

Examples of an Image at Four Different Focal Lengths

24mm

50mm

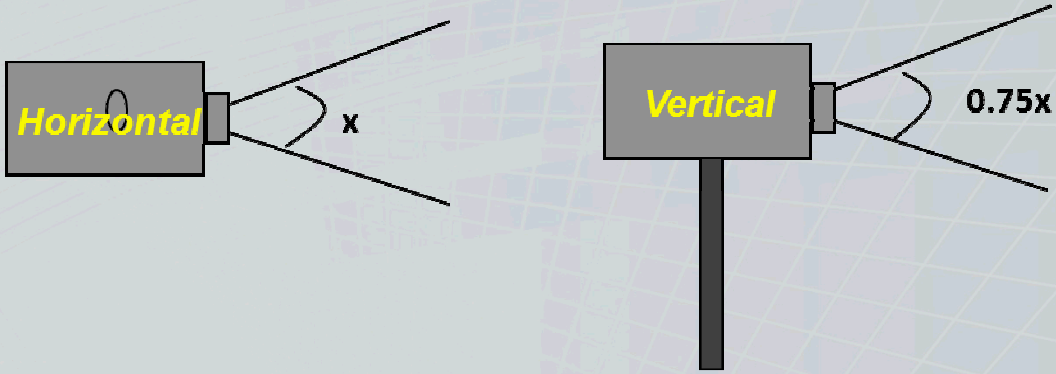
100mm



250mm

Field of View

Field of View – Horizontal and vertical distances visible in the camera image at a linear distance from the camera



Lens Aperture

Aperture – Adjustable opening that controls the amount of light entering the lens

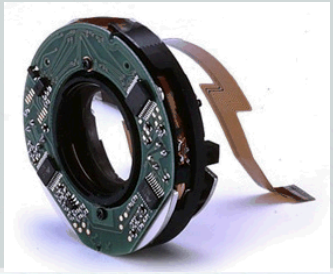
- Regulates amount of light that passes onto the imager
- Can be fixed or adjustable

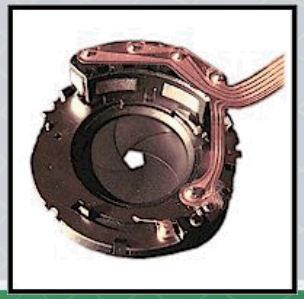


Manual Iris – Used where the amount of light is constant

Automatic Iris – Used where amount of light is not constant

- Controlled by signal from camera





Levels of Assessment Resolution

Detection	Classification	Identification
		
Determine Presence of Object	**Determine Nuisance or Real Alarms**	**Determine Identity of Object**
2-3 pixels/30 cm	6-9 pixels/30 cm	10-16 pixels/30cm

Important factors are *Contrast, Motion & Upright Human Figure*

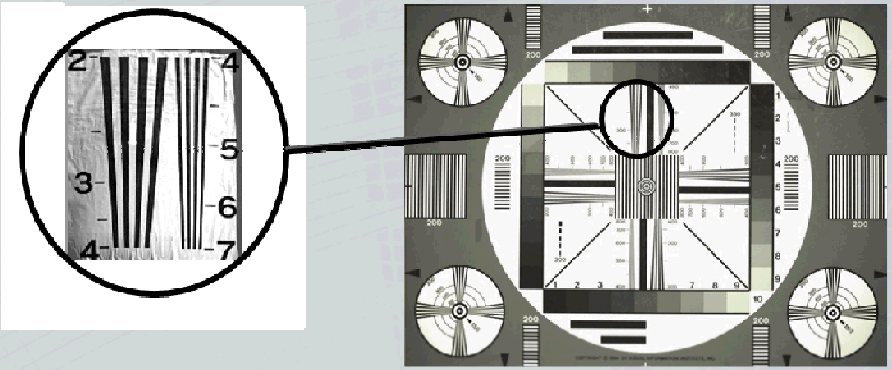
Assessment Resolution – *Detection*

Assessment Resolution – *Classification*

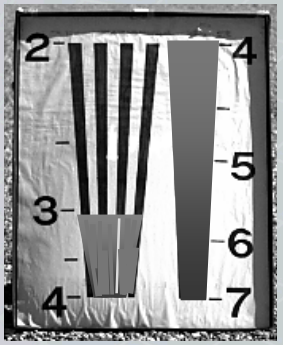
Assessment Resolution – *Identification*

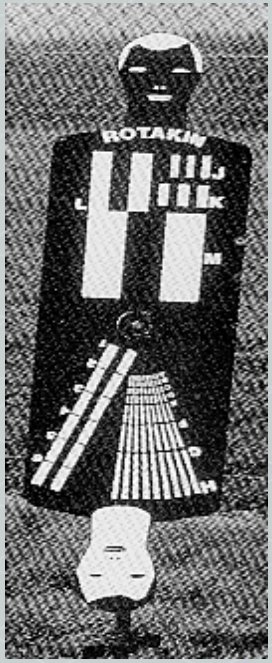
Camera Resolution Measurements

- Camera resolution is commonly measured using a resolution chart



- A laboratory chart, field chart and Rotakin field resolution chart are shown
- Resolution limitation is where distinct black and white lines are no longer distinguishable





Assessment Resolution (Cont.)

Classifying a target depends on camera resolution, lens focal length, size of object, object contrast to background, object stance and motion

Assessment Objective

- Distinguish between an animal and a person crawling with head facing camera
- Easier to determine if human is in standing position

Tests at Sandia showed that 8 pixels on 1 ft target at 100 ft far field viewing width is minimum to classify human shape

Far Field Resolution

760x480 Pixel Camera
Analog – displayed resolution is same as camera resolution

1376x1032 Pixel IP Camera
Digital – displayed resolution is less than camera resolution, but improved over analog due to more camera pixels and minimal compression techniques

Day and Night Exterior Camera View

Observe camera views for adequate image - daytime and nighttime

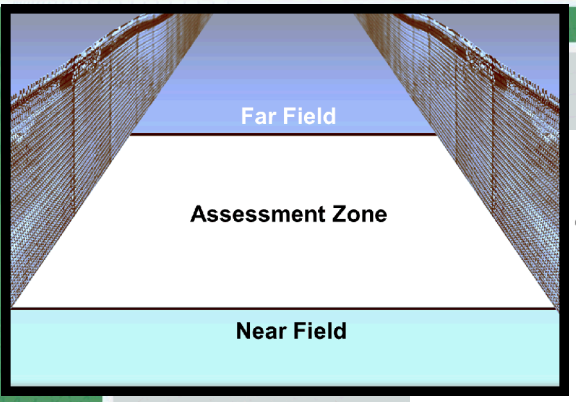
Day

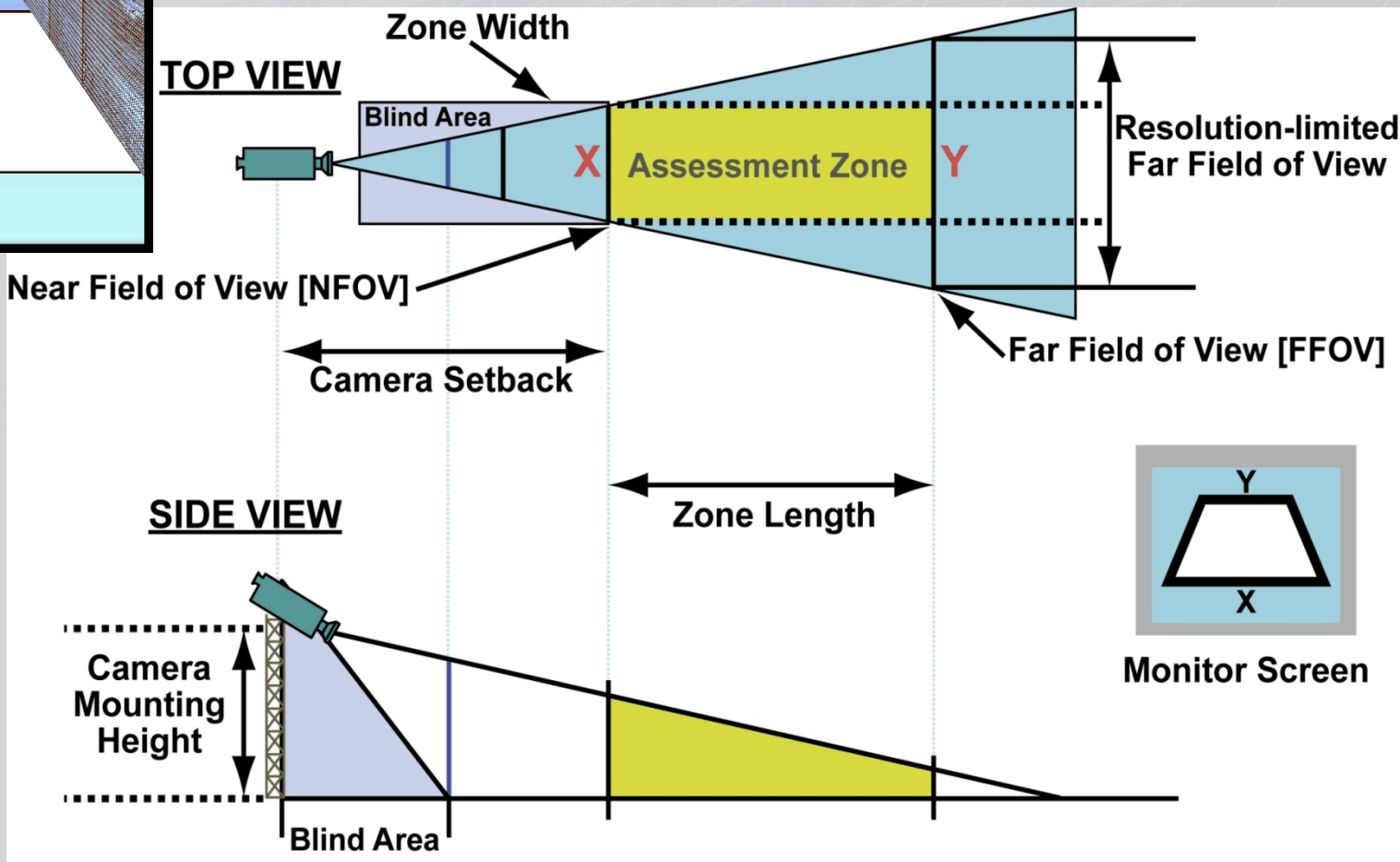
Night

Field of View and Resolution Testing

Using circle, triangle, and square to determine adequacy of far field of view resolution

Geometry of Assessment Zone



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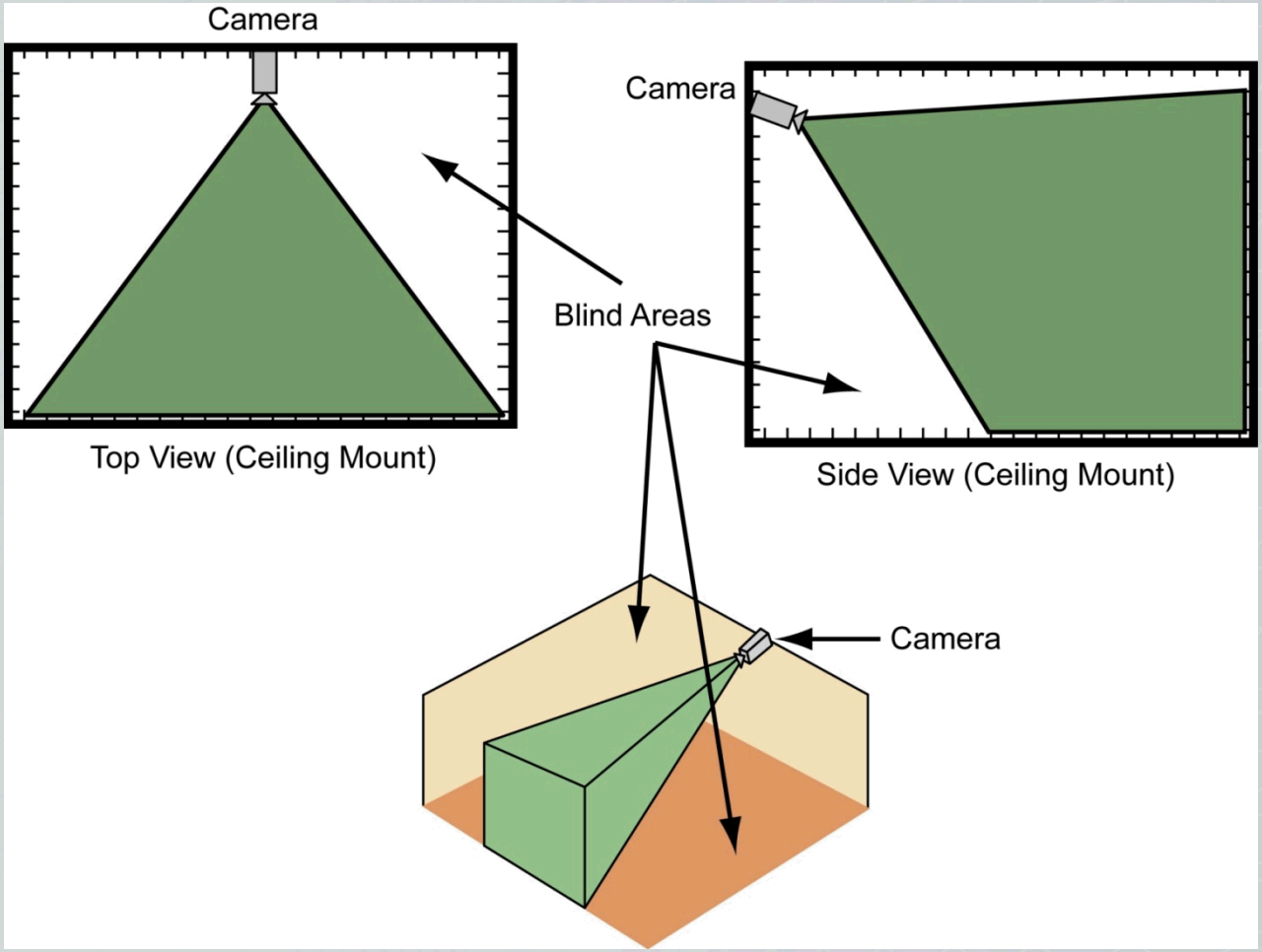
Geometry for Interior Assessment



LIGHTING

- Illuminates scene for night video assessment
- Allows camera to produce usable video
- Provide lighting for response personnel

Lighting Types

- Incandescent
- Tungsten
- Fluorescent
- Mercury vapor
- Metal halide
- High-pressure sodium
- Low-pressure sodium
- Near infrared

Mercury Vapor

High Pressure Sodium

Low Pressure Sodium

Lighting Requirements

- **Minimum lighting intensity**
  - 10 lux (1 foot-candle) minimum
- **Uniform illumination**
  - 6:1 light-to-dark ratio, maximum
  - 4:1 design goal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HOLD 13:00:10

Example 1: Uniform Lighting

Example 2: Non-Uniform Lighting

Entry Control Point

Video Monitor

- **Major types**
  - **Black and white**
  - **Color**
    - **CRT**
    - **Flat Screen (LCD, LED)**

Display resolution must be equal to or greater than camera resolution







Summary

- Alarm assessment
  - Completes the detection process
  - Identifies the cause of a sensor alarm
- Assessment may be performed using:
  - People - Response force/guards
  - Technology - Video alarm assessment
- Response force assessment includes sufficient
  - Trained personnel in appropriate locations
  - Lighting and effective communication to Central Alarm Station
- Video assessment includes:
  - Camera, lens, lighting and video control system
  - Complete coverage and display of sensored areas at all times

Video Assessment System Requirements

A good video assessment system will have:

- **Continuous operation 24 hours per day, 7 days per week**
- **Short time between sensor alarm & video display (seconds)**
- **Complete area coverage of intrusion detection zone**
  - **Camera views the entire area covered by sensor**
- **Sufficient resolution at the far field to classify a 1 foot target**
- **Field of view 10 feet high at far edge of detection zone**

Video Assessment System Requirements (cont.)

- Field of view at least 2 feet above tall exterior sensors
- Adequate nighttime illumination of the detection area

or

- Use of Thermal Cameras at night
- Minimal sensitivity to adverse weather and environmental conditions