

VIDEO IMAGE DETECTION

Presentation for



U.S. DEPARTMENT OF
ENERGY

Fire Protection Conference



Mac Mottley, CEO

Agenda

- DOE Fire Protection Implementation Guidelines
- What is Video Image Detection (VID)?
- Testing and Certification
- The Challenge
- Current Protection
- System Architecture
- Installations

DOE Fire Protection Implementation Guide

DOE O 420.1B establishes facility and programmatic safety requirements for a comprehensive fire protection program for DOE sites, facilities, and emergency service organizations to minimize:

- The potential for a fire or related event
- Fires that can cause an unacceptable onsite or offsite release of hazardous or radiological material that could impact the health and safety of employees, the public, or the environment
- Unacceptable interruption of vital DOE programs as a result of fire and related hazards
- Property loss from fire exceeding limits established by DOE
- Fire damage to critical process controls and safety systems structures and components (as documented by appropriate safety analysis)

DOE Fire Protection Implementation Guide

Implementation of alternate or innovative fire safety configurations and practices that will meet the requirements of DOE O 420.1B and achieve a level of fire protection and emergency response determined to be equal to that attained by conformance with this guide is allowed according to Sections 4c and 5b(5) of DOE O 420.1B

Highly Protected Risk

Highly Protected Risk (HPR) is a rating given to property that qualifies for insurance coverage by the Factory Mutual System, the Industrial Risk Insurers, and other industrial insurance companies that limit their insurance underwriting to the best-protected class of industrial risk.

Highly Protected Risk

The requirement of the applicable building code and NFPA codes and standards are considered minimum levels of protection and do not necessarily meet the HPR status. DOE facilities are expected to meet or exceed the applicable building code and NFPA codes and standards. DOE facilities may also need to meet criteria in DOE-STD-1066-99 to minimize:

- Unacceptable onsite or offsite release of radiological or hazardous materials
- Interruption of Vital programs
- Property Damage

Fire Hazards Analysis

- All Hazard Category 1,2 and 3 nuclear facilities
- High-Hazard Facilities
- Significant New Facilities
- Performed under the direction of a qualified fire protection engineer
- Should evaluate the consequences of a single, worst case automatic fire protection system malfunction; i.e., a detection system that also activates a pre-action type sprinkler system, but fails to transmit alarm to site emergency response force
- Analysis may include reliance on actual fire testing or historical data on fire events both inside and outside the DOE
- FHAs for high bay locations should consider the effects of smoke/hot gas stratification that may occur at some intermediate point below the roof or ceiling as well as the potential for delayed sprinkler response

Baseline Needs Assessments

- The BNA should be based on conformance with applicable NFPA standards, as well as supplementary requirements and guidance developed by DOE
- A critical factor in any such analysis is the minimum response time necessary to begin active intervention activities
- Annual fire protection assessments should be made of facilities valued in excess of \$100 million, facilities considered to be high hazard, or those which vital programs are involved as defined by DOE.

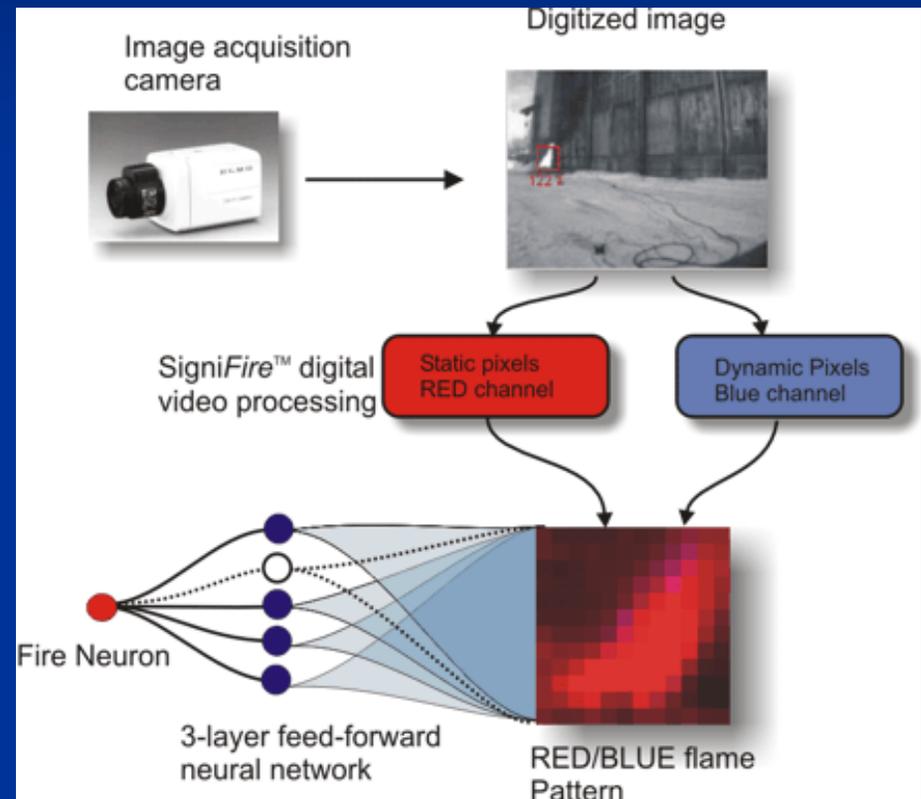
DOE / axonX Relationship



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What is Video Smoke and Fire Detection?

- Uses visible spectrum spatially resolved video images from stationary cameras
- Analyze each frame pixel by pixel
- Uses analytic process designed to identify characteristics of flames and/or smoke
- Outputs alarms and video to user interface



Detection Algorithms

- Video Analytics
 - Artificial Intelligence
 - Neural Networks
- Alarms
 - Flames (combustion in open air)
 - Reflected Fire light
 - Smoke
 - motion detection
- Trouble
 - Image change
 - Loss of camera
 - Poor image (dirty, low light, out of focus)
- Supervisory
 - System crash
 - Loss of power

Flame Detection



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Reflected Fire Light Filter



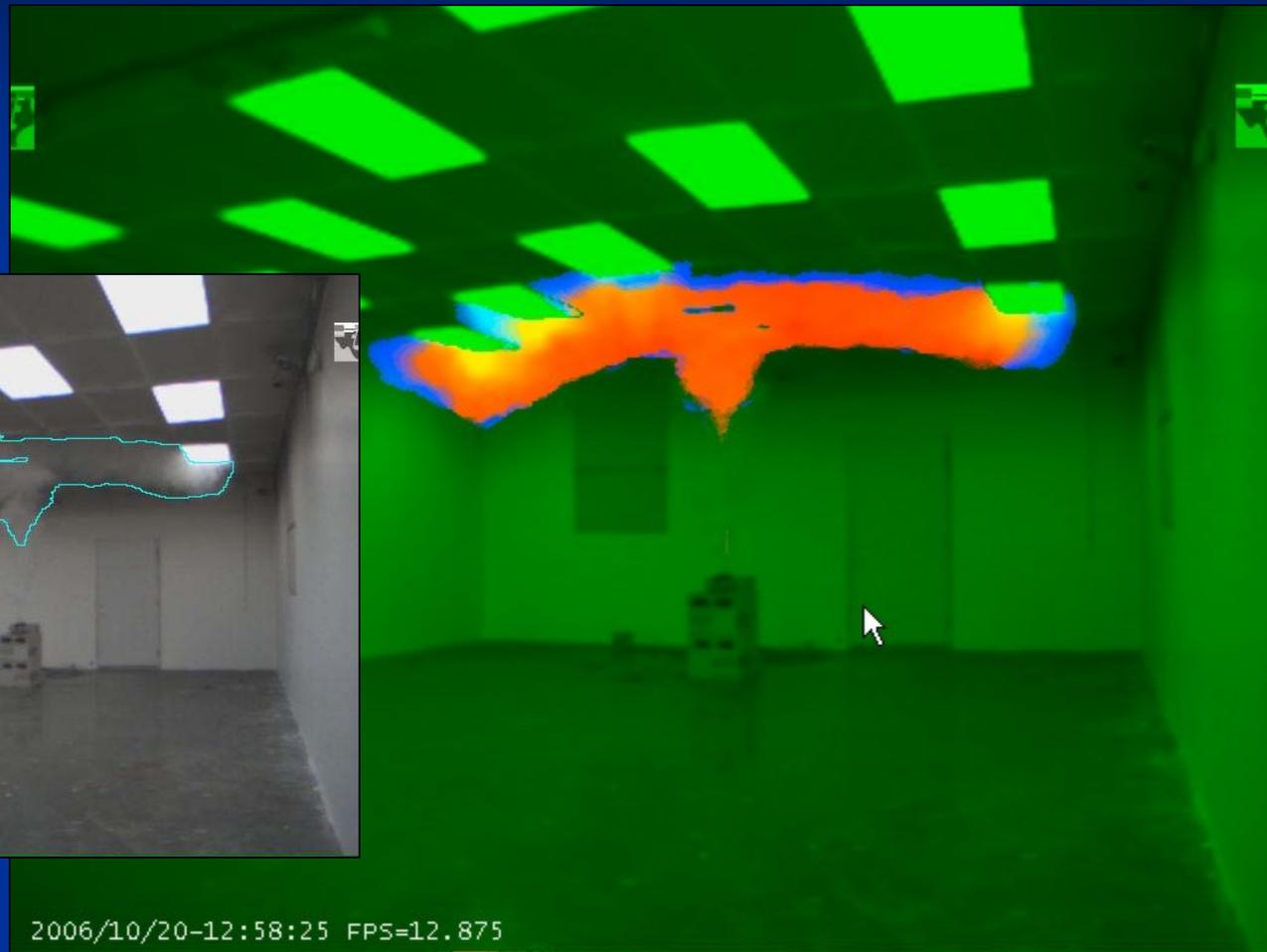
Correlation DSP filter takes out all residual light, leaving only light that is originated from flames.

RFL Implementation



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Excitation/Aging Filter



Smoke Detection



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Motion Detection

- Motion detection is byproduct of analysis
- Generally not as sophisticated as security analytics
- Can be tied to image location and schedule



IP Network Camera

Detection Capability

- Flame*** 1 ft² pan fire at 100 ft
 - Smoke*** 4 minute smoke emitter at 100 ft
 - Motion** Configurable zones within field of view
- *Factory Mutual Approved*

Camera Features

Hardware Texas Instruments TMS320DM642 DSP
Micron CMOS Sensor 1.3 Megapixel
10/100baseT Ethernet, RJ45 twisted pair

Analytics Flame, Smoke, Motion and Reflected Fire Light detection algorithms

Video Output MJPEG digital output 15fps, Customizable compression
Analog out BNC connection (NTSC/PAL) 15fps color

Alarm Output Transfer video & alarms over the network
Connection to standard fire alarm panels, (3) individually programmable dry contact output relays

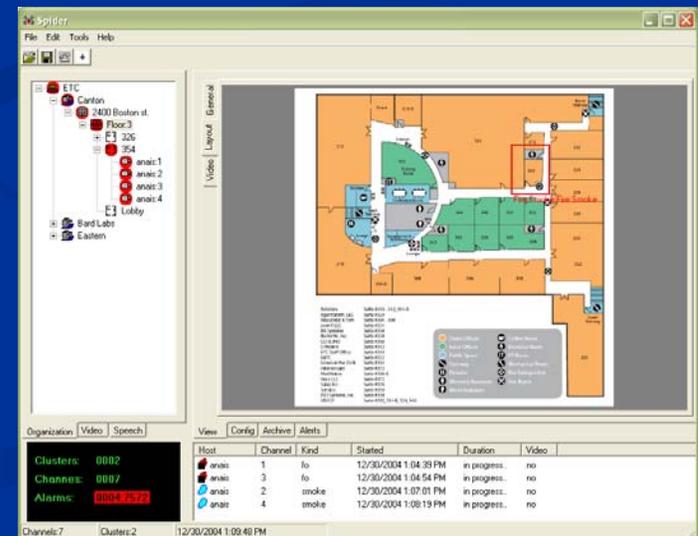
Power Req. Power over Ethernet (POE) or standard 12-24 VDC power supply
Power consumption <6 Watts



Spyder Guard™

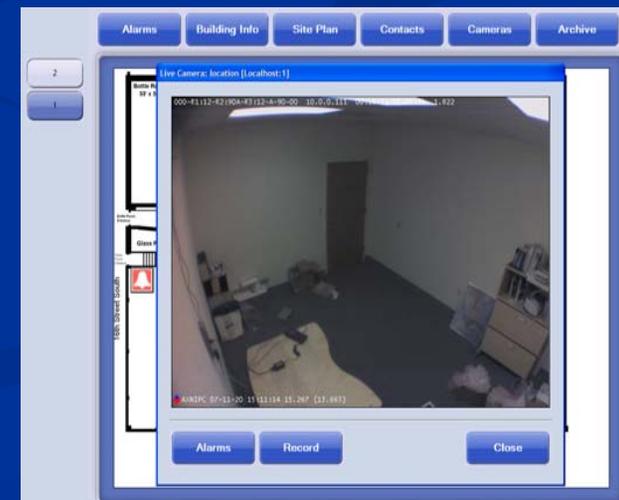
- Simple but robust monitoring software application
- Functions on a standard PC workstation
- Provides video surveillance, fire safety monitoring, and allows configuration of an unlimited number of FSM-8 units
- The software is not centered around the cameras, but rather around the assets under protection
- View the condition that caused the alarm
- Receive an audible voice warning
- Locate the event on building and site plans
- Coordinate response efforts

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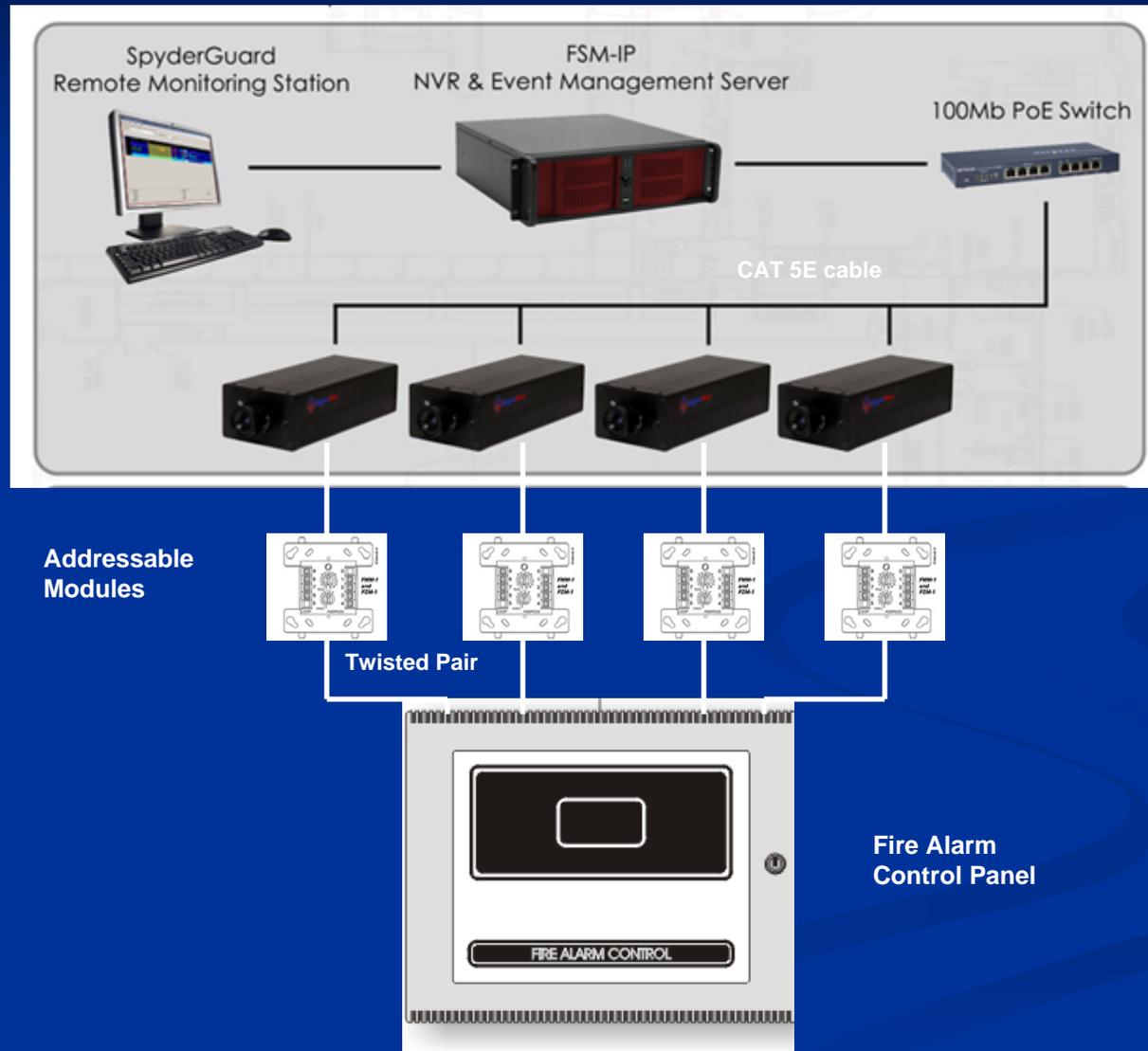


Security Touchscreen

- Functions on a standard PC workstation
- Allows video surveillance, fire safety monitoring
- View the condition that caused the alarm
- Receive an audible warning
- Locate the event on building and site plans
- Coordinate response efforts

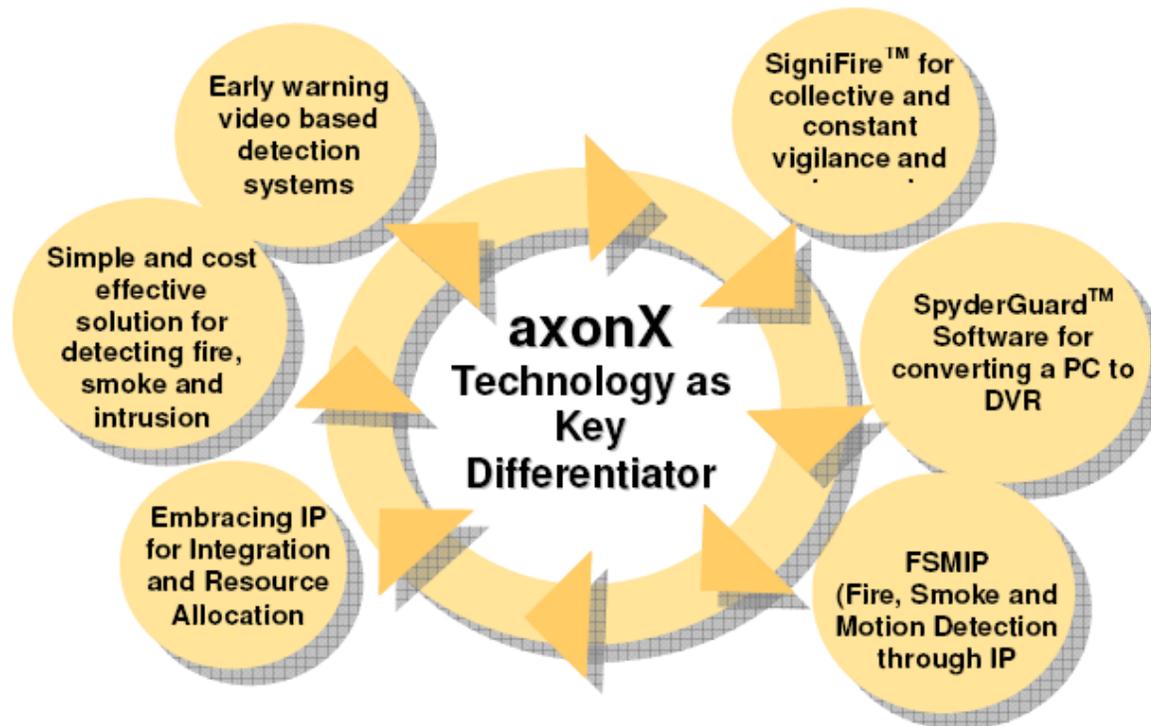


System Architecture



2007 North American Fire & Smoke Detection Devices Technology Leadership Award

AxonX LLC: Technology Leader in Vision Based Detection Systems



Source: Frost & Sullivan

IRG: 19
Manager: Jorge Moreno, Analyst: G.G.Hariharan

www.frost.com
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Factory Mutual Approved

- Only System approved as a Smoke and Fire detector
- Modified - UL / ANSI 268
- Modified - FM 3260
- Environmental testing
 - Humidity
 - Vibration
 - Durability and Stability
 - Temperature

Challenge

- Conventional detection methods are not suitable for many of the environments requiring protection
- The nature of these detectors makes the severity of a nuisance alarm greater due to limited situational awareness
- Codes mandate that fire equipment be installed for life safety and to prevent conflagration

TOPICAL FIRE RESEARCH SERIES



Non-Residential Structure Fires in 2000

June 2004

Volume 3, Issue 10

Findings

- In 2000, 126,000 non-residential structure fires resulted in 90 fatalities, 2,200 injuries, and \$2.8 billion in property loss.
- On average, non-residential structure fires were less injurious and deadly than structure fires generally, but the monetary property loss was higher.
- The highest percentage of non-residential structure fires occurred in storage structures, which included parking garages.
- The leading cause of non-residential fires was incendiary/suspicious (arson) fires.
- No smoke alarm was present in 72% of non-residential structure fires.

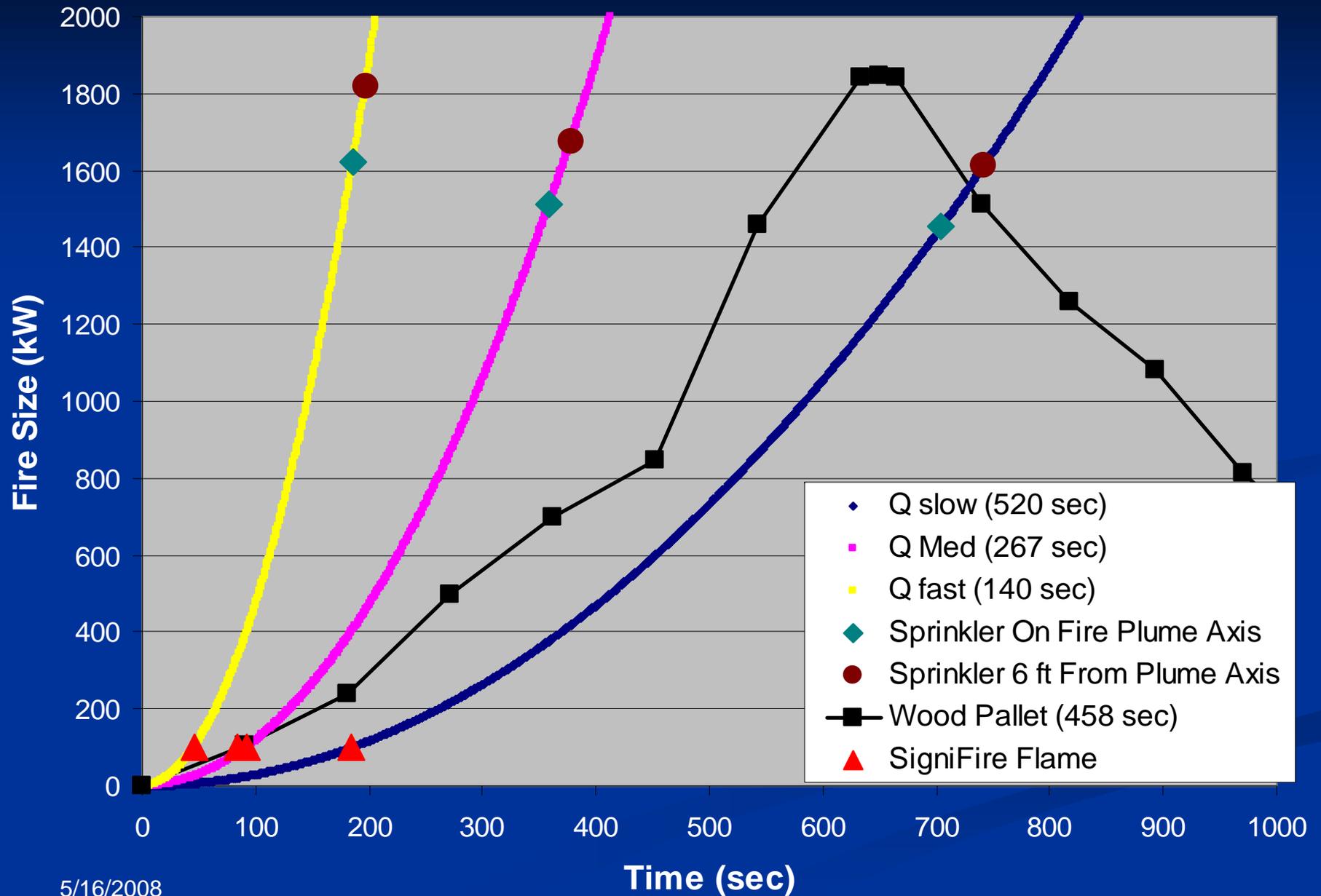
Conventional detectors

- Ionization
- Photo-electric
- Air aspiration
- Heat Detectors
- Beam detectors
- Linear heat detectors
- Delayed Detection
 - Transport times
 - Sensitivity levels
- Nuisance Alarms
 - Lack of situational awareness
 - Severity of Nuisance event
- Source Bias
 - Small or large smoke particles
- Architecture and Implementation
 - Piping, wiring, coverage
- Application Specific

Current Scenario



Fire Growth vs Sprinkler Activation



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NIST Wood Pallet Fire Data



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Sprinklers

“Full scale fire tests by Bennets et al. (1987) and Lougheed et al. (2000,2001) have shown that successfully sprinklered fires can continue to burn and produce enormous amounts of dense buoyant smoke after sprinkler activation.”

Dr. James Milke, Principles of Smoke Management

**Automatic Extinguishing System Operationality
When Fire Was Large Enough to Activate System, by Property Use
2002-2004 Non-Confined Structure Fires**

A. All Sprinklers

Property Use	Percent where systems failed to operate	Based on number of fires*
Public assembly (Eating or drinking establishment)	7% (8%)	800 (500)
Educational	11%	300
Health care**	8%	500
Residential (Apartment) (Hotel or motel)	4% (3%) (4%)	3,600 (2,500) (500)
Store or office	6%	1,600
Manufacturing	7%	2,300
Storage (Warehouse excluding cold storage)	20% (19%)	500 (300)
All structures***	7%	10,100

Distribution Center



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Distribution Center



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Pratt & Whitney

A United Technologies Company



PW2000

“The recent addition of the axonX SigniFire smoke and fire network cameras have helped provide an early warning detection system of the plants most critical running processes. The SigniFire network camera and SpyderGuard software combination is the most innovative and effective solution to early warning fire detection in the industry”.

Bruce Nedau

Manager Protective Services

Pratt & Whitney

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“We decided to install this state of the art protection system to provide an additional safety net for our business and associates. We are very pleased with the simplicity of system and the capabilities that it provides.”

Jim Morris
General Manager
Marriott Textile Services
Edison, NJ

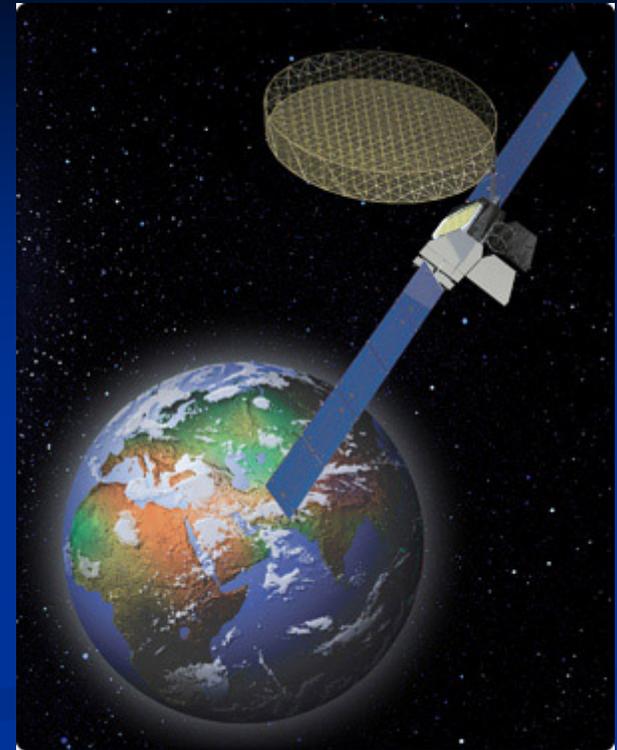


Abel (Site Fire Marshall)

Per discussion at last week's meeting, Boeing Enterprise Fire Protection will support usage of this product at your facility. I discussed the subject at this morning's staff meeting and Rich Stine agrees. He was pleased to learn the product is FM approved. The last time Rich saw a demonstration, FM had not yet approved it's use.

Larry Rodman

Boeing Regional Fire Protection Engineer

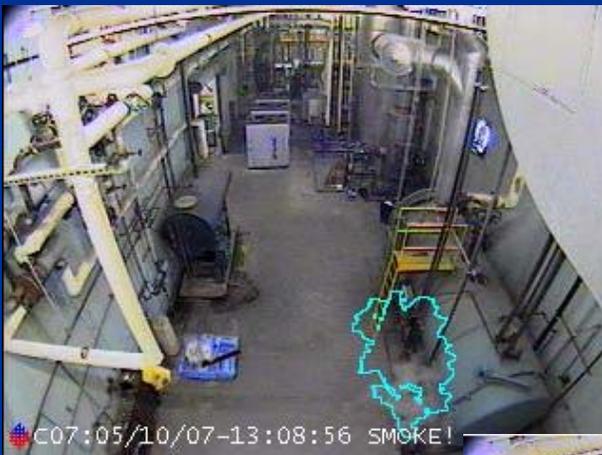


Mitigating Nuisance Alarms

- Sensitivities
- Blocking or Detection Zones
- Delays
- Cross Zoning
- Schedules
- Commissioning Period

Marriott

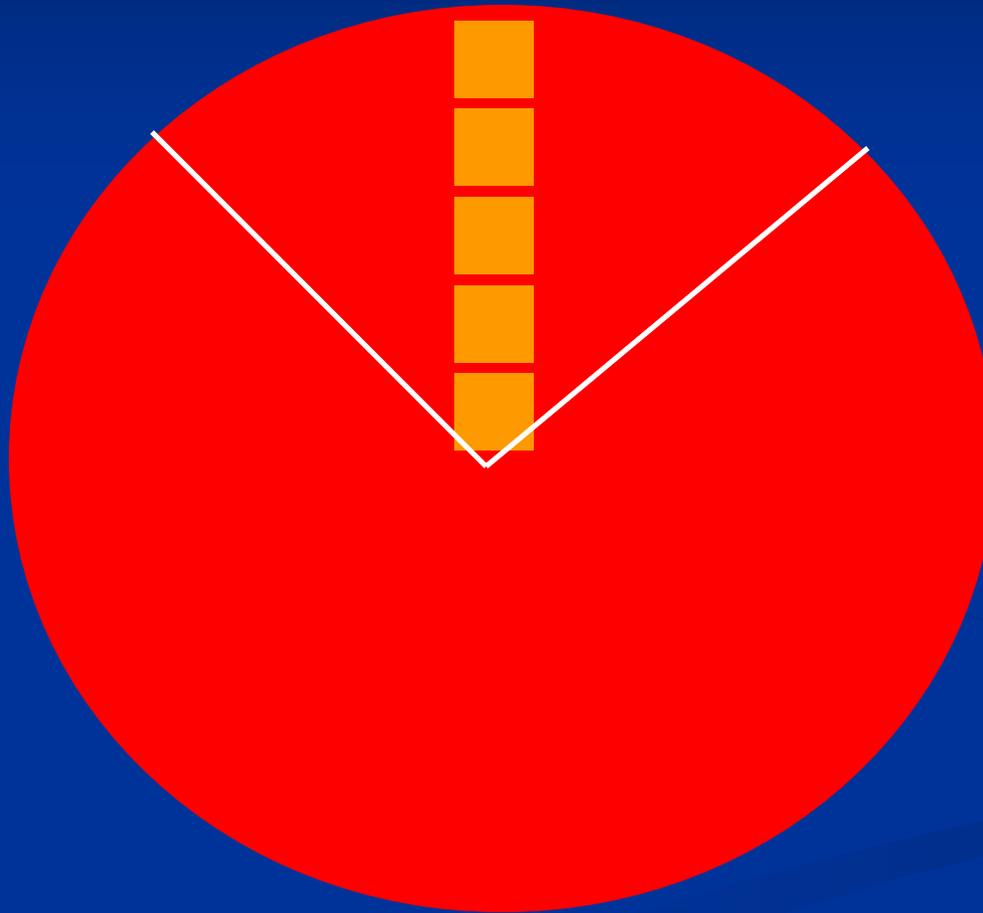
- 8 Camera System attached to horn and strobe
- Monitored onsite and with remote access



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Coverage Comparison

150 ft radius



30 ft on center
900 sq ft
\$300 per detector
\$.33/sq.ft



150 ft range
17,600 sq ft
\$3,000 per detector
\$.17/sq.ft

Advantages

- Volume Detection
- Large coverage area
- Situational awareness
- Continuous video recording
- Standards and Listing
- Fast detection
- Cost
- Nuisance rejection
- Post event reconstruction
- NFPA 72 & FM

Provides a solution to fire and smoke detection

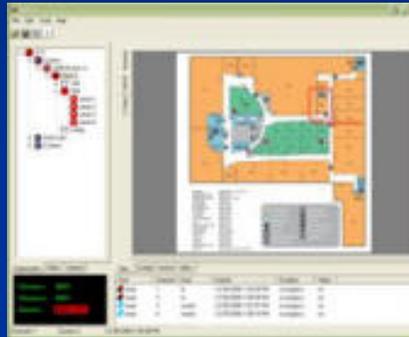
Video detection Scenario



Fast Detection



Visual ID



911

Improved response time and situational awareness



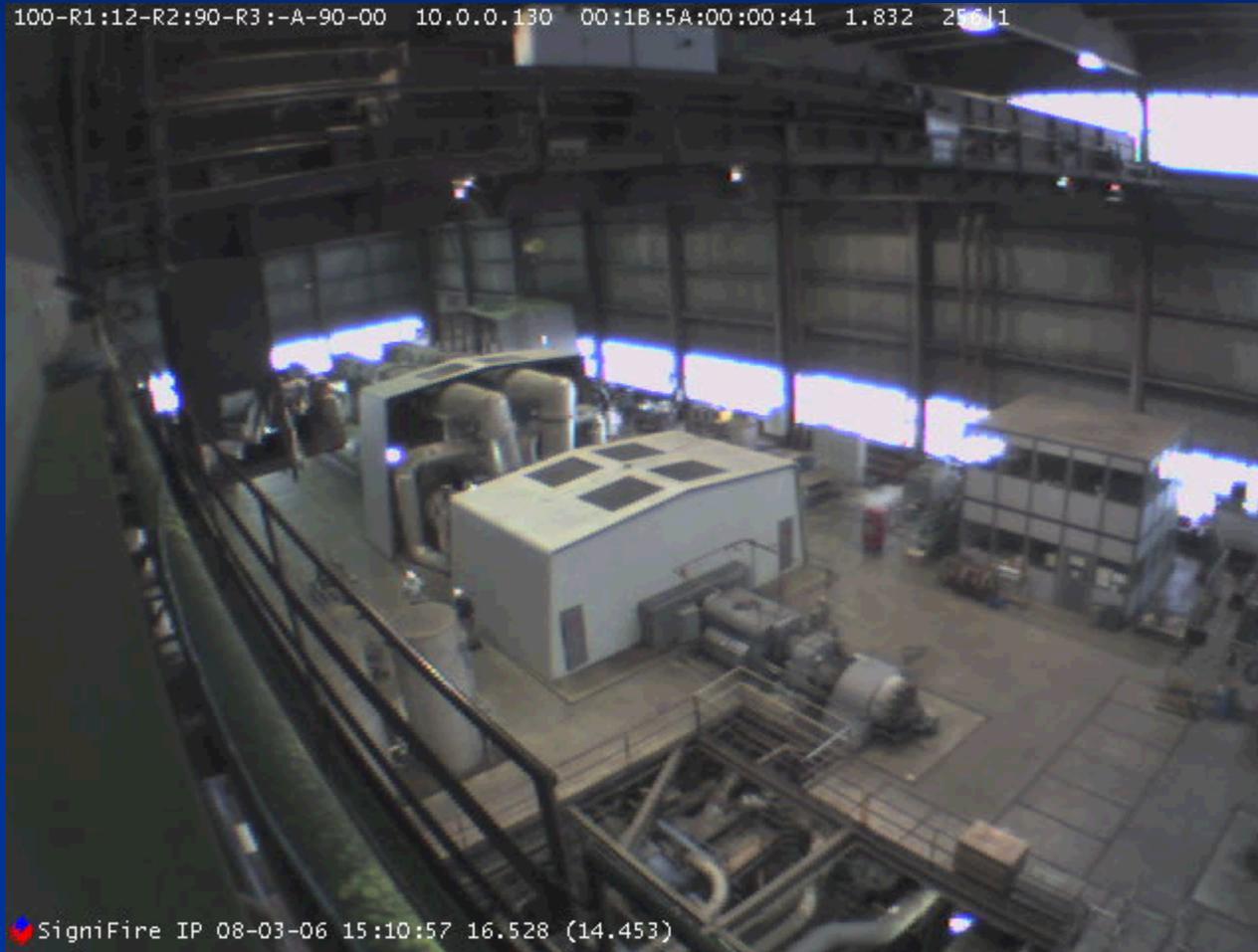
IP



Dry-contact



Dominion Energy PRB Coal fire test



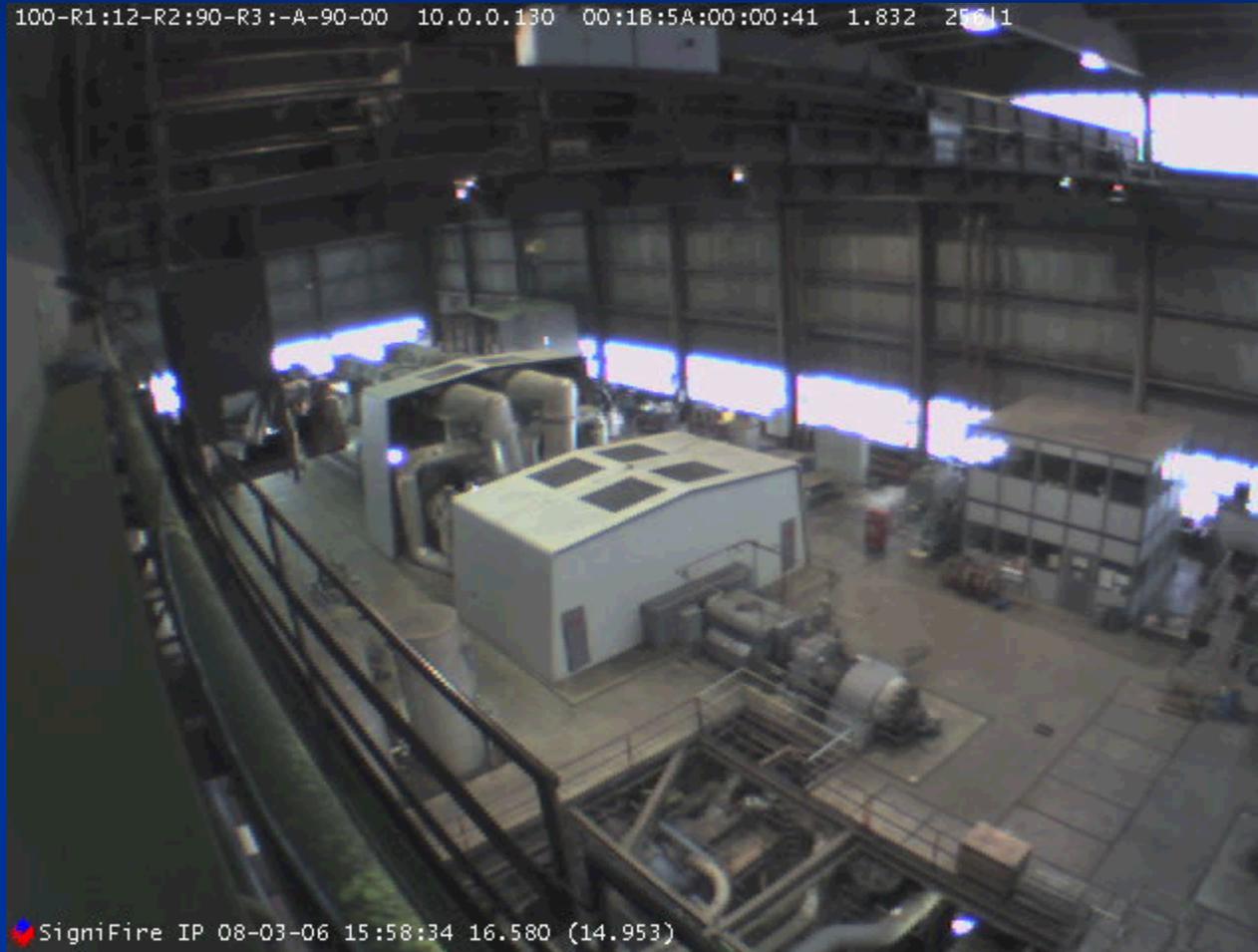
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Smoke Detection



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Dominion Energy PRB Coal Smoke Test



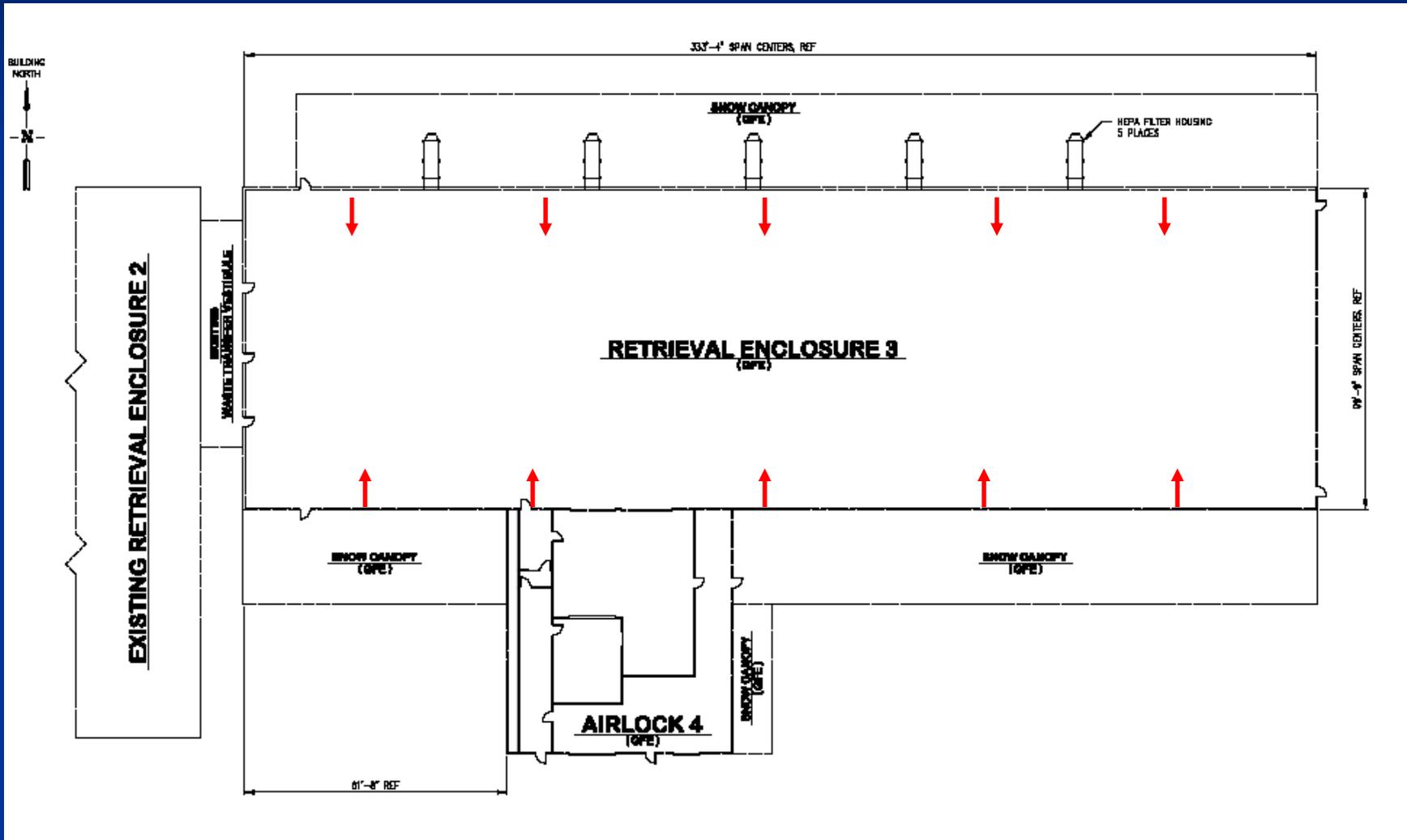
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DOE Idaho National Lab



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SIFSS

Shipboard Intelligent Fire Suppression Systems

Demonstration of an 'aimed'
closed-loop video based
detection/suppression system
for use on RN platforms

Developed for MESH IPT under contract from BAE
Systems by the Fire Protection Association



BAE SYSTEMS



Questions and Contact Information

- Questions, Comments, Words of Wisdom
- Contact Information

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