Emerging Trends in Port Security Technologies

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American Association of Port Authorities

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Presentation Outline

- Overview of PNNL
- Wide area surveillance
- Maritime imaging systems
- Detection of nuclear materials
- Rapid infrastructure assessment

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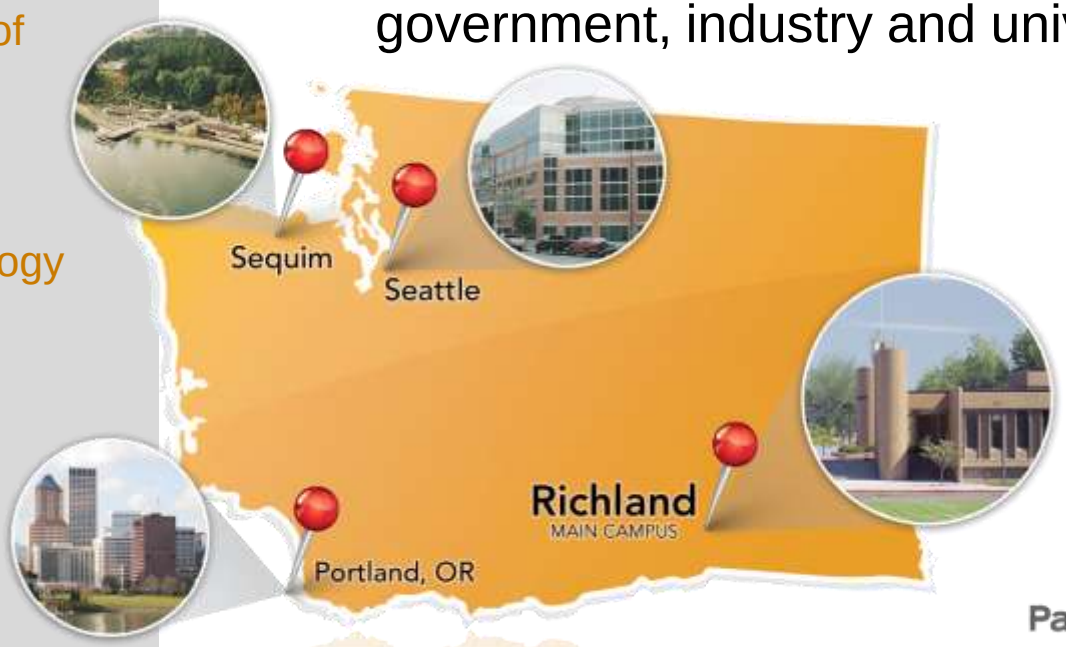

Washington, D.C.

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PNNL is focused on four mission outcomes

Strengthen U.S. Scientific Foundations for Innovation

Increase U.S. Energy Capacity and Reduce Dependence on Imported Oil

Prevent and Counter Acts of Terrorism and the Proliferation of Weapons of Mass Destruction

Reduce Environmental Effects of Human Activity and Create Sustainable Systems

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Wide Area Surveillance Challenges

Homeland Security

Requested Capabilities

- Capabilities include:
  - Persistent, high resolution view of the entire coverage area – “God’s Eye” view
  - Multiple interactive viewer work stations performing different functions without affecting the persistent view and/or bogging down the system
  - Virtual Pan Tilt Zoom (PTZ) with the ability to “drill down” into the scene without losing clarity
  - Exclusion areas and virtual fences with automated violation notification
  - Vehicle identification and tracking (and back-tracking)
  - Vehicle occupant and pedestrian identification
  - Video forensics capability
  - Facial recognition

Spiral 1 vs. Spiral 2 (Chandelier)

	Spiral 1 – 9 COTS Cameras	Spiral 2 (Chandelier): 48 CMOS Sensors
Sensor		  “Chandelier” Basketball
Size	24” Diameter	13.5” Diameter
Status	Operational as of 2008, field testing since December 2009	In development, expected Fall 2011
Resolution	2.2 cm @ 150 m in high resolution region 6 cm @ 150 m in medium resolution region	2.0 cm @ 150 m everywhere in the scene
Pixels	100 megapixel	TBD
Frame Rate	4 Hz	TBD
Compression	JPEG (software)	JPEG2000 (custom hardware)
Data Rate	3x compression (0.2 GB/s, 0.72 TB/hr)	10x compression (0.289 GB/s, 1.03 TB/hr)
Data Servers	9	2

Spiral 2: Leverage Custom Electronics

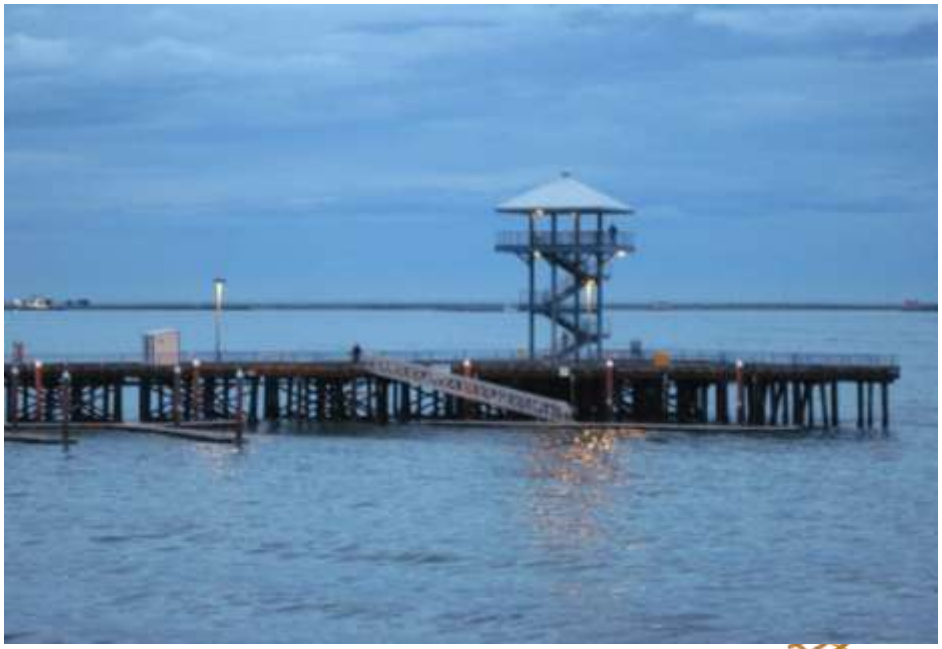
- **Spiral 2: Targeting Fall 2011**
  - **Sensor**
    - **360 degree coverage**
    - **100+ megapixel**
    - **>4 fps color**
    - **48 Sensors, 5 megapixel each**
    - **(leverage DOD-funded airborne persistent surveillance)**
    - **Higher resolution everywhere in the scene**
  - **Data Servers**
    - **Custom JPEG compression hardware (Analog Devices ADV212)**
    - **Fewer servers needed (2)**
  - **Viewer/Video Analytics**
    - **Reuse and develop video analytics and viewer from Spiral 1**

Summary

- The Wide Area Surveillance project is creating a High Impact Technology Solution with the Imaging System for Immersive Surveillance (ISIS)
- System capability development is being guided by requested functionality and operational feedback from the user community
- This “cutting edge” technology is years ahead of the current commercial offerings
- The initial Spiral 1 demonstration, and extended operational “test bed” at Logan International Airport will allow a large cross section of potential users to experience the utility of this type of system

Maritime imaging systems

- Visible, infrared, processed imaging
- Rapidly deployable systems
- Multi-sensor integration
- Unmanned platforms



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Imaging System– IR Cameras

- Issue: At high humidity levels, LWIR (7-14) cameras lose contrast due to a low noise equivalent delta temperature (NEDT)
- MWIR (3 – 5 microns) have a 4x improvement in temperature sensitivity due to cooled InSb detector (Indium(III) Antimonide)

- **Spectral band: 3-5 microns**
- **Continuous zoom 100-500 mm**
- **FOV: 5.5° x 4.1° to 1.1° x 0.8°**
- **Weight: 17 lbs.**
- **Length: 21 in.**
- **MTBF > 7500 hrs**

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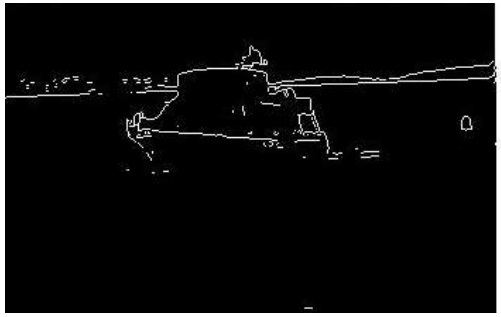
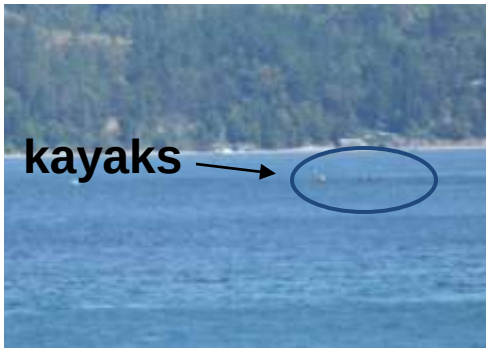
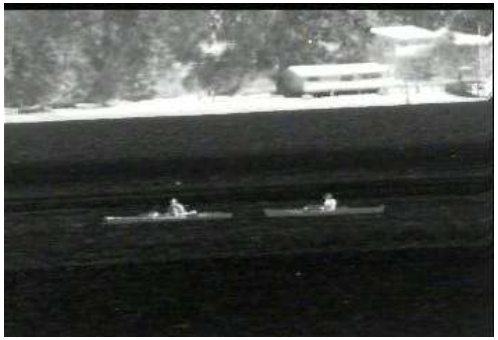
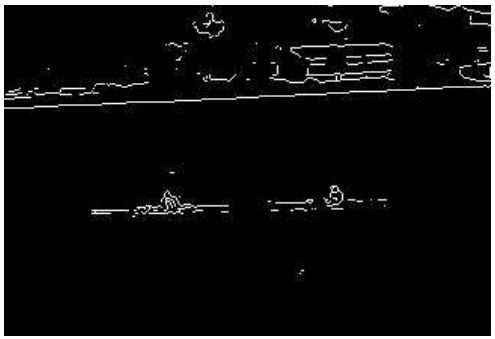
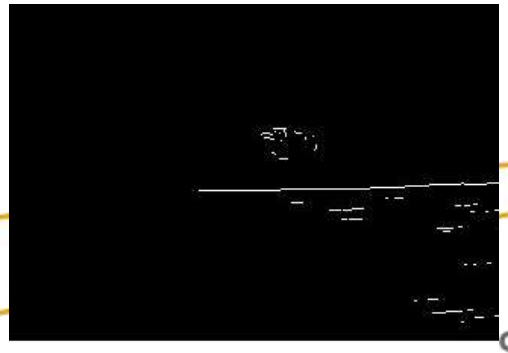
Imaging Systems – Visible, IR, and Processed

Optical Image	IR Image	Sobel Edge Detection Applied to Image	Approx. Range
			1.5 km
			2 km
			1.8 km

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Multisensor Integration

- Integration of disparate sensor systems and data formats
- Compatible with existing communication platforms
- GIS reference for integration
- Real-time, secure data exfiltration
- Synchronized to multiple mobile platforms

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Unmanned Platforms

- Full autonomous mission execution in re deployments
- Payload Integration of COTS and custom support maritime threat detection
- 40-50 lbs payload capabilities
- Continuous Communications – Iridium/G
- Uses photovoltaic panels/Li-ion batteries GPS, communications, and payload ope
- Station keeping and way point navigatio

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Focus on Small Maritime Vessel Risk

- The ***DHS Small Vessel Security Strategy*** approved in April 2008.

  "**Small vessels are, however, readily vulnerable to potential exploitation by terrorist, smugglers of weapons of mass destruction** (WMD's) narcotics, aliens, and other contraband, and other criminals."

  - Objective B.ii: **Develop a robust layered defense** by expanding and enhancing maritime radiological/nuclear detection capabilities to international, Federal, state, local, Tribal, and private stakeholders.
  - Objective C.v: Expand research into and invest in advanced maritime radiation/nuclear detection technology for human portable radiation detection equipment, mobile standoff radiation detectors, and fixed detectors that could be deployed on or near the waters in the vicinity of small vessels.

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Small vessel layer of defense

- Active layer of defense
- Unified CONOP
- New boat mounted detector systems
- 350+trained and equipment officers

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Long range detection of radiation

Systems capable of detecting and tracking or locating radiological/nuclear threat material at extended range (~100m) during mobile detection or mobile portal monitoring operations.

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Wide Area Sweep or Search

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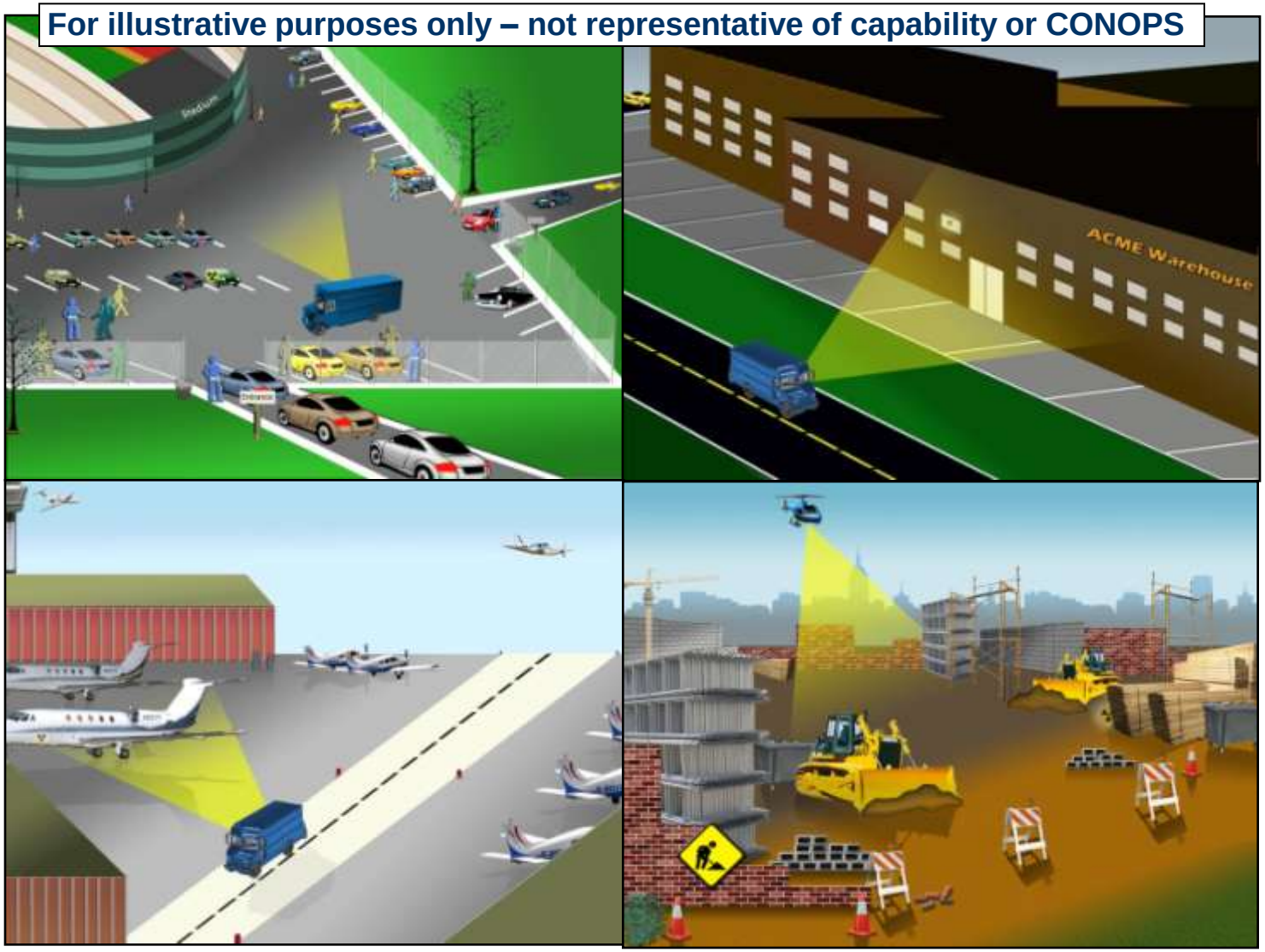

Chokepoint

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Mobile to Mobile

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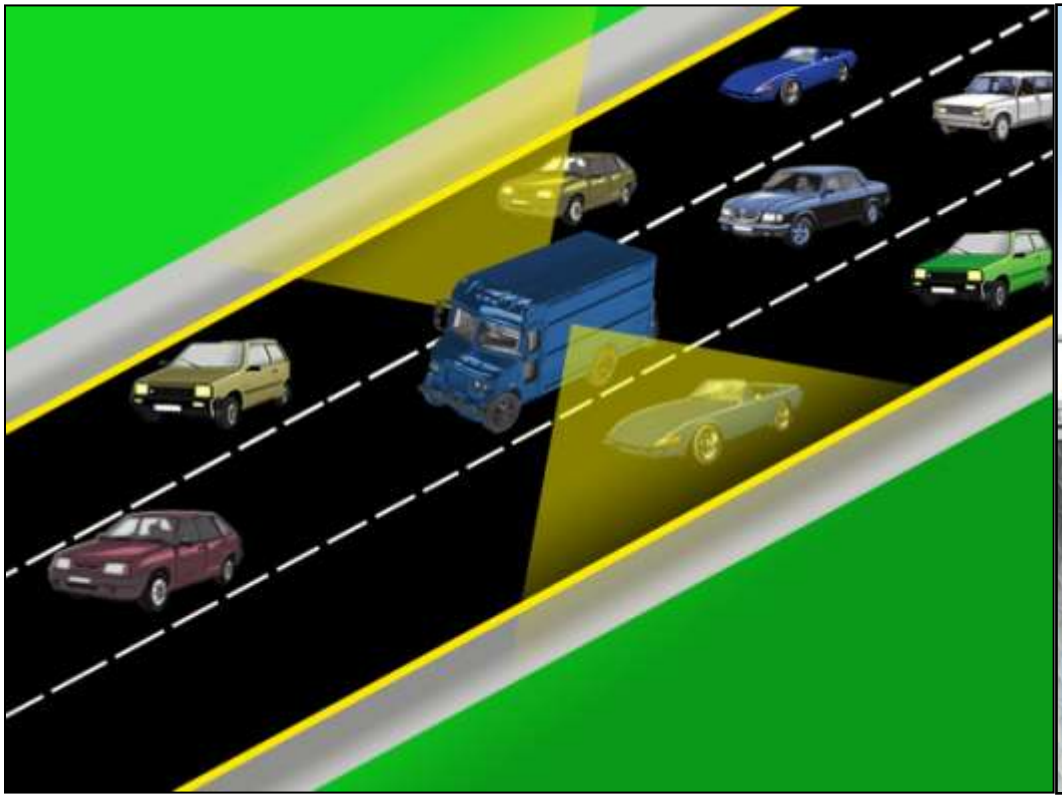

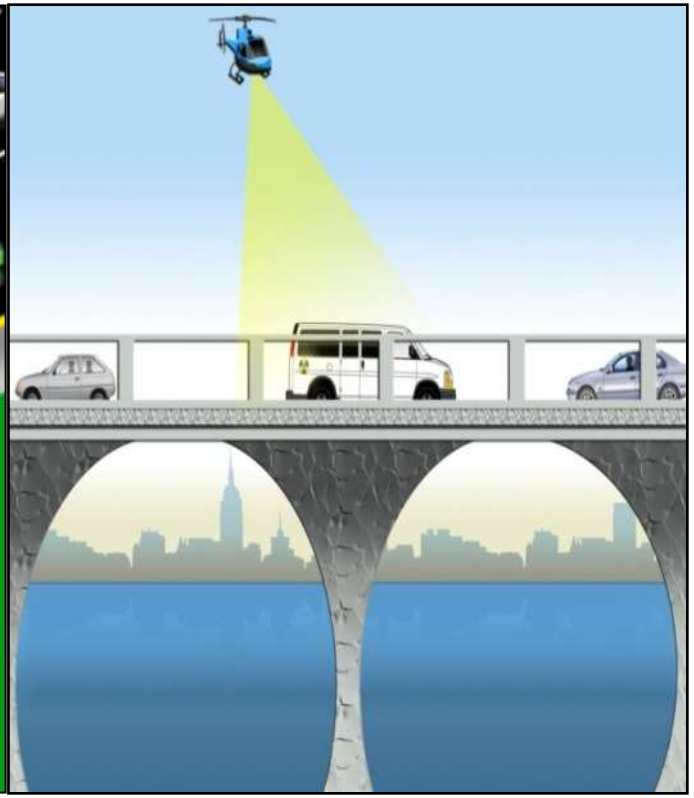

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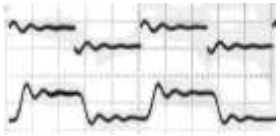
Real-Time System for Stand-Off Measurement of Structural Stability

Payoff:

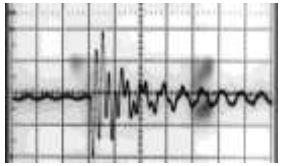
- **Simple, fast sensor alignment, ad hoc system**
- **Identifies collapse precursors and displays threat level**
- **Operates on all types of structures & structural materials**
- **Low cost sensors exposed to collapse risk**
- **High bandwidth, high accuracy measurements (floor/roof sag, vibration, creaking, cracking)**

NIST Prototype



Simulator Test

NIST Prototype



Structural Acoustic Signature

Product Description:

- **Technology to assess and monitor structural health by detecting surface motion and indicates structural integrity**
- **Ultrasonic non-contact sensors w/wireless data link**
- **Load cells, Inertial Navigation System (INS), accelerometer, in miniature packages**

.Acoustic Sensor

Technology Developer: National Institute of Standards and Technology (NIST)

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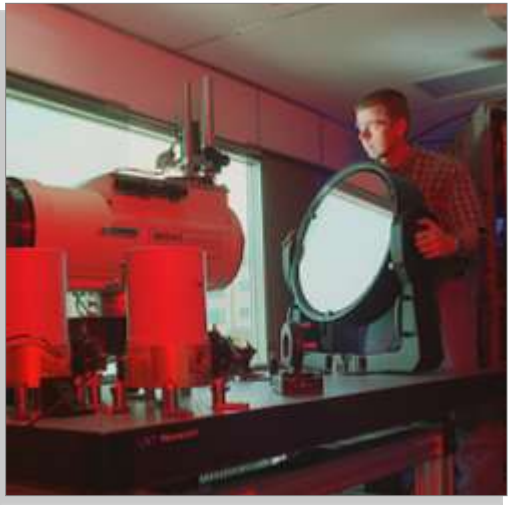
Questions?



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