

PureTech Systems Inc.

a Pure Technologies Ltd. company



Using Technology to Safeguard LNG & Petrochemical Terminals



July 2006



Agenda



Introduction

Threats to LNG and Petrochemical Terminals

Consequences of realized threats

Preparation and Prevention

Defining Maritime Domain Awareness

Securing Perimeters

Threat Scenario

Conclusion

Introduction



Larry Bowe, Jr. –

- Over 25 years experience in the high-tech hardware and software industry.
- 17 years developing mission critical software and systems including avionics systems and video security systems.
- Previously Director, Global Solutions Development for Honeywell and Vice President Business Development for Verint/Loronix.
- Bachelors of Science in Computer Science from Arizona State.
- Master of Business Administration from University of Phoenix.

Threats to LNG and Petrochemical Terminals



- Attack of docked ship via water with small craft and an Improvised Explosive Device (IED).
- Attack of ship or storage facilities via land by foot across perimeter using an IED.
- Attack of docked ships or storage facilities via land by vehicle through perimeter using an IED.



IEDs pose a serious threat.

Consequences



Event

- Fires / Explosions
- Chemical releases

Immediate Consequences

- Injury and death
- Infrastructure damage
- Vessel damage / loss
- Business disruption

Delayed Consequences

- Mass panic
- long-term illness/ death
- Environmental damage
- Economic Impact –
 - Port operations
 - Vessel loss
 - Energy shortages



Significant human and economic impact.

Preparation and Prevention



Preparation

- Vulnerability assessments
- Improved facility designs
- Improved physical security infrastructure
- Improved communications infrastructure
- Evacuation plans
- Rescue plans
- Fire response plans
- Security response plans
- Recovery plans
- Cross agency communication plans
- Emergency training and exercises



Maritime Transportation Security Act of 2002

Prevention

- Improved intelligence
- Restricted access
- Detection
- Armed vessels
- Vessel escorts



Ports reduce risks with preparation and prevention measures.



Maritime Domain Awareness



Comprehensive understanding of the current port situation

- Current areas of risks and threats.
- Authorized ship and personnel location and information.
- Anomaly detection – type, location, video.
- Automated communications - notify those with need to know and those responsible to act.
- Policy based responses and recovery.
- and more...

MDA – A comprehensive understanding of the current situation.



Threat Scenario



The Threats:

- Unauthorized small craft in proximity of LNG Tanker at dock.
- Unauthorized person breaches perimeter.
- Unauthorized vehicle breaches perimeter.

The Response:

1. Detect, locate, classify, and track the threat.
2. Open communications - Notify Coast Guard, Terminal Security, and Port Security. Share information among responders.
3. Shut off pipeline valves.
4. Restrict access to tanker.
5. Sound warning alarm to small craft.

The Recovery:

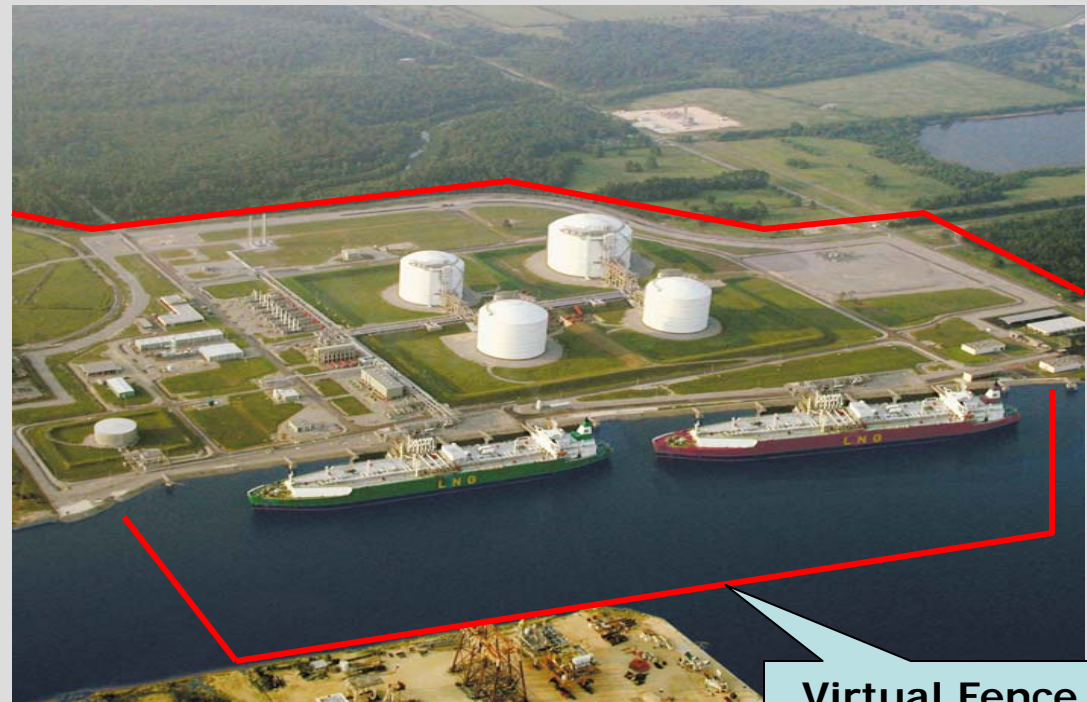
1. Execute recovery procedures and checklists.
2. Notify all involved that coast is clear.
3. Return operations to normal.
4. Lessons learned report.

Securing Perimeters to Protect Against IED Attacks



What defines the perimeter of the port?

- Land-side
- Water-side
- Variable depending on threat level



Port perimeters are expansive and dynamic.

Sensor Considerations



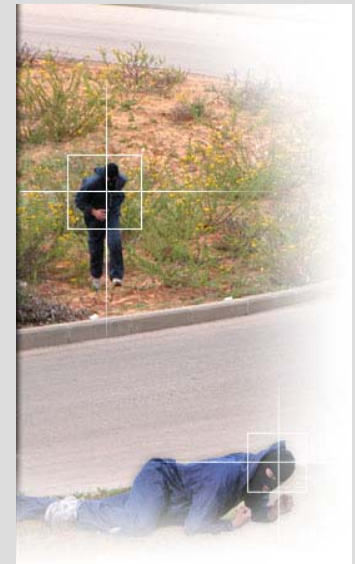
- Sensor selection considerations

- Required probability of detection
- Tolerable false alarm rate
- Required target detection range
- Target size
- Target speed
- Weather conditions
- Required response time



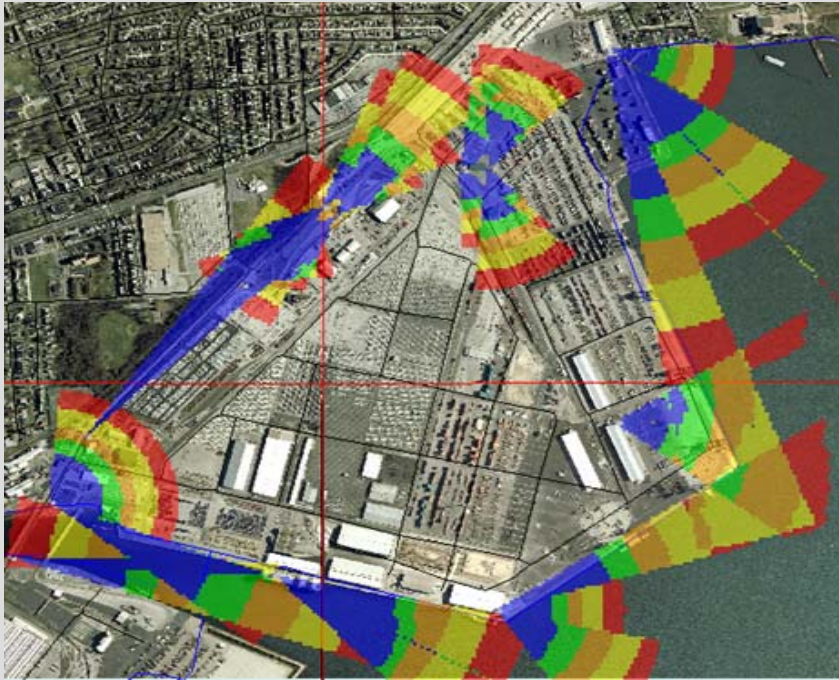
- Possible sensors

- Vision sensors
- Radar
- Acoustic sensors
- Fence sensors

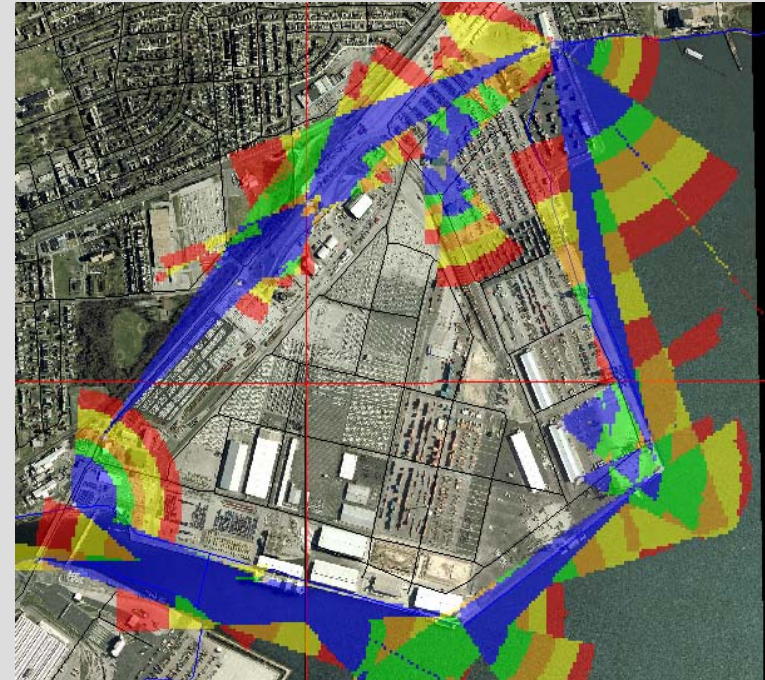


Operational requirements drive sensor selection.

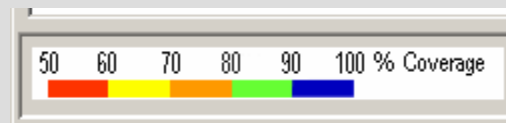
Sensor Coverage Assessment



Before



After



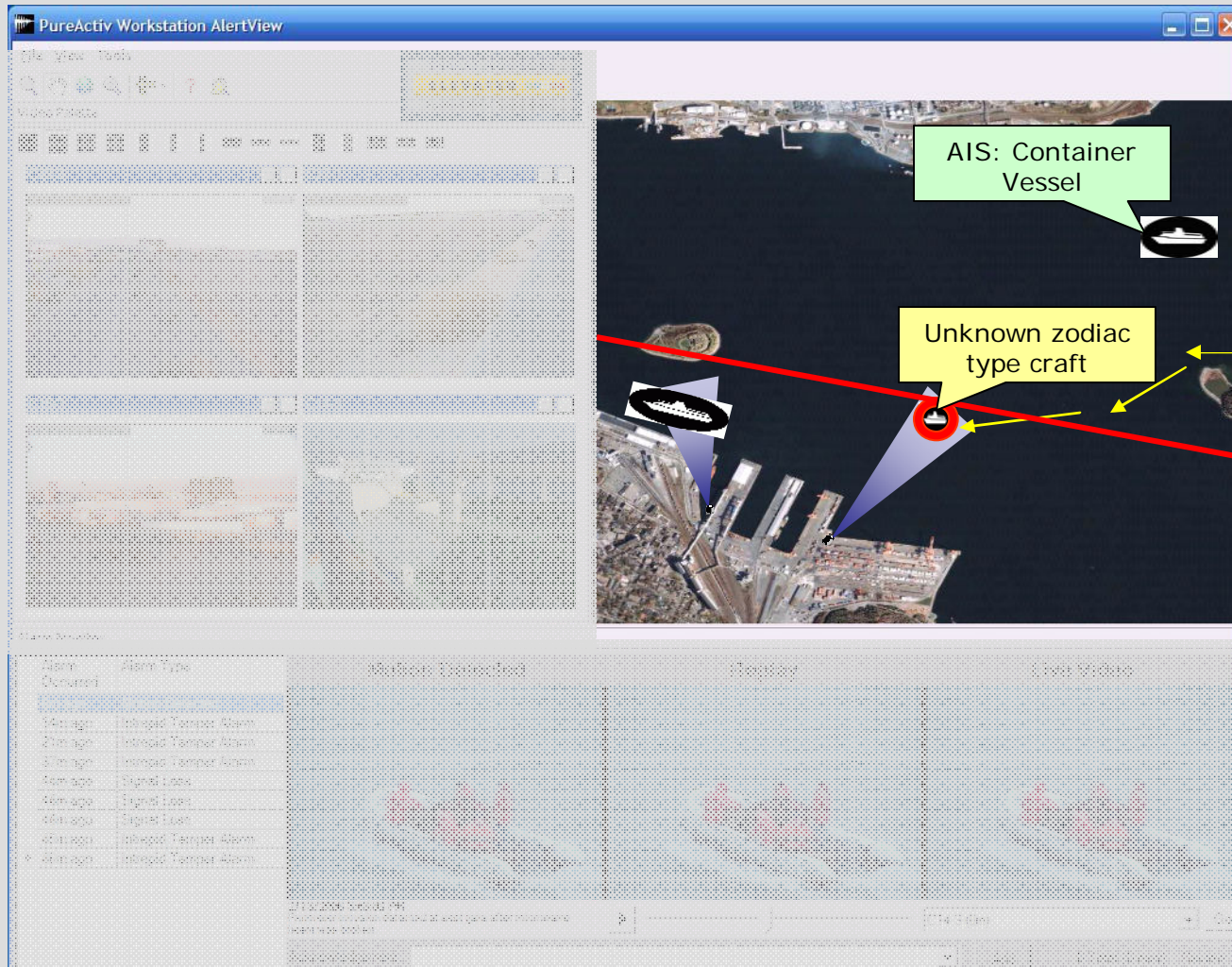
Proper sensor assessment yields improved detection.

Layered Approach to Sensor Coverage



A layered sensor approach enhances protection.

Interactive GIS Command and Control



- Live information is layered on top of GIS map.
- Camera locations and field of views are shown and updated in real-time
- Cameras are controlled by pointing and clicking on map

GIS technology enhances situational awareness.



Threat Scenario



The Threats:

- Unauthorized small craft in proximity of LNG Tanker at dock.
- Unauthorized person breaches perimeter.
- Unauthorized vehicle breaches perimeter.

The Response:

1. Detect, locate, classify, and track the threat.
2. Open communications - Notify Coast Guard, Terminal Security, and Port Security. Share information among responders.
3. Shut off pipeline valves.
4. Restrict access to tanker.
5. Sound warning alarm to small craft.

The Recovery:

1. Execute recovery procedures and checklists.
2. Notify all involved that coast is clear.
3. Return operations to normal.
4. Lessons learned report.

Response – Detect the Threat



Detect watercraft and not birds, surf, or wakes.

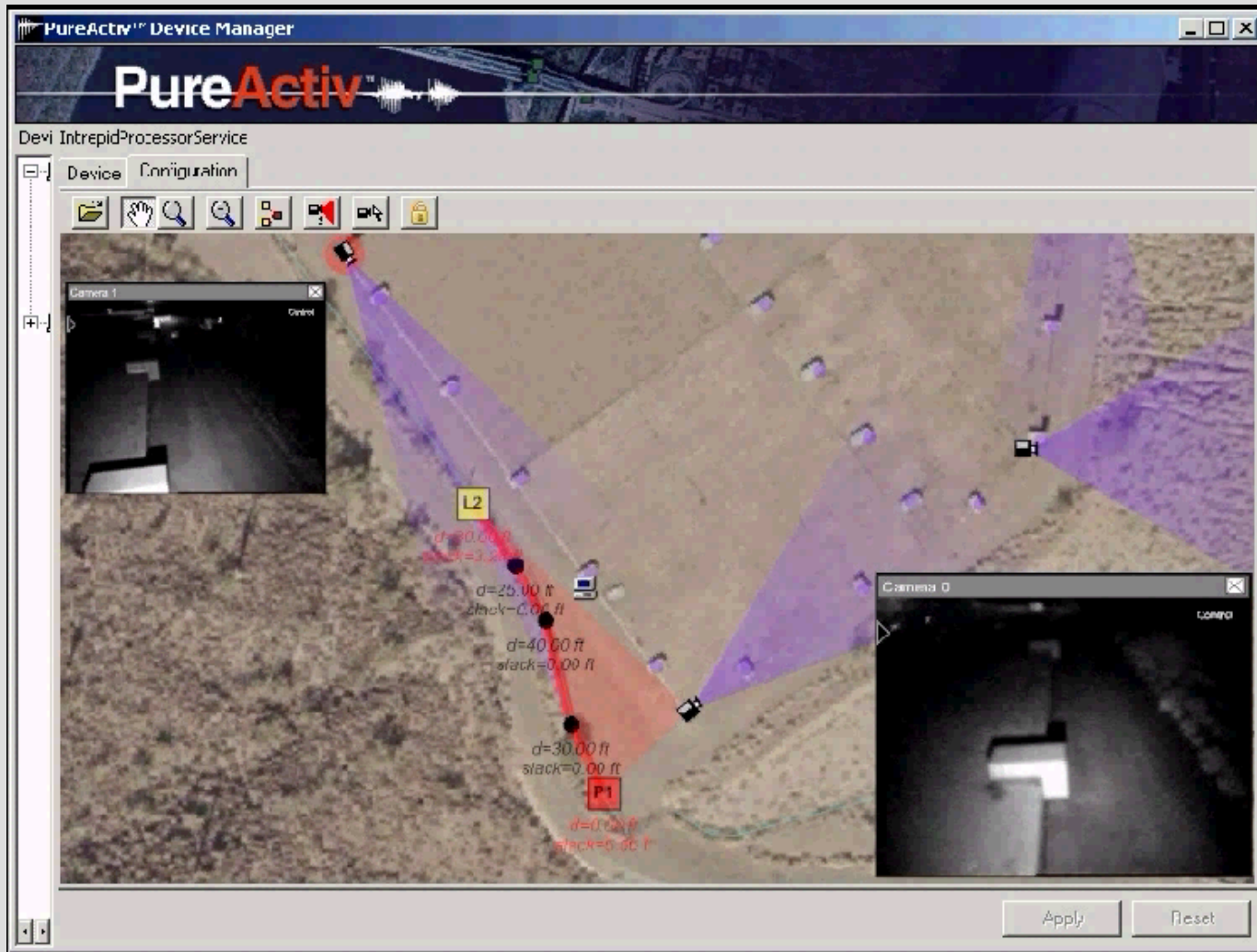


Detect people intruding tunnel but not trains.



Detect anomalies.

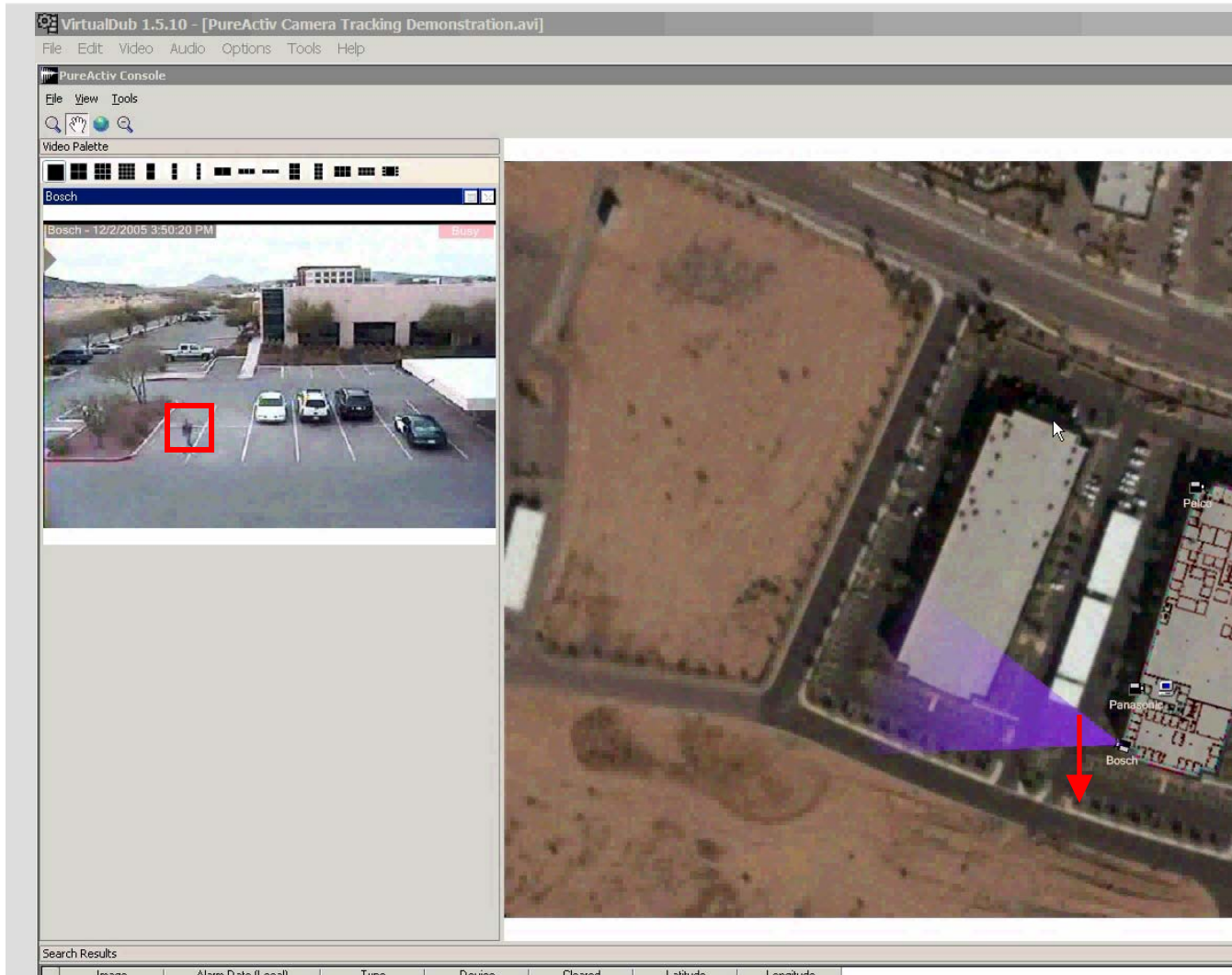
Response – Detect the Threat



Slue camera to sensor position:

- Fixed camera
- Radar
- Acoustic sensors
- Fence sensors

Response – Detect the Threat



Continuously slue camera to sensor position:

- Fixed camera
- Single PTZ camera
- Radar
- GPS receiver

rev

System automatically tracks targets that violate policy.



Response – Detect the Threat



System analyzes scenes for abandoned objects.

Response – Detect, Locate, Classify, and Track the Threat



The screenshot displays the PureActiv Workstation AlertView interface. At the top, a 'THREAT ADVISORY' banner indicates an 'ELEVATED' risk of terrorist attacks. The main display area is a radar map showing vessel tracks. A green callout identifies an 'AIS: Container Vessel' (authorized), while a yellow callout identifies an 'Unknown zodiac type craft' (unauthorized). A red line indicates a buffer zone, and yellow arrows point to the zodiac craft as it approaches. On the left, four video feeds (C23-3, C27-1, C15-3, C14-3) show various scenes. At the bottom, an 'Alarm Monitor' table lists recent events, and an 'Instant Message' box provides details for a zodiac intrusion.

Alarm Occurred	Alarm Type
12m ago	Intruded Tanker Alarm
21m ago	Intruded Tanker Alarm
37m ago	Intruded Tanker Alarm
44m ago	Signal Loss
44m ago	Signal Loss
64m ago	Signal Loss
45m ago	Intruded Tanker Alarm
46m ago	Intruded Tanker Alarm

Instant Message:
Zodiac at
Latitude - 116.11,
Longitude 47.42

February 11 11:16:43 AM 43.42445 11640.81m x 672.7m

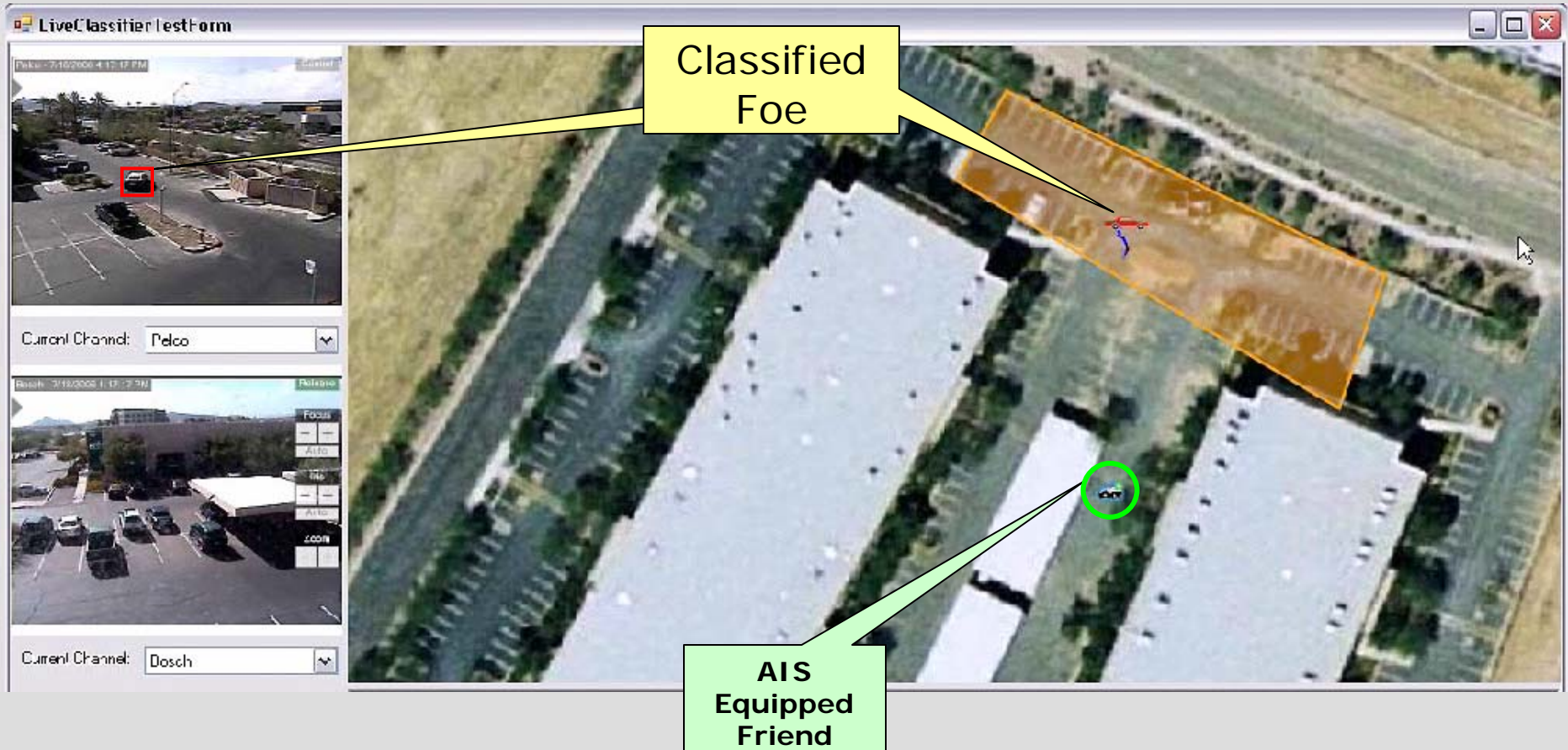
AIS tracks
authorized vessels

Radar and cameras
locate unauthorized
vessels

Alarms when buffer
zone is penetrated



Response – Detect, Locate, Classify, and Track the Threat

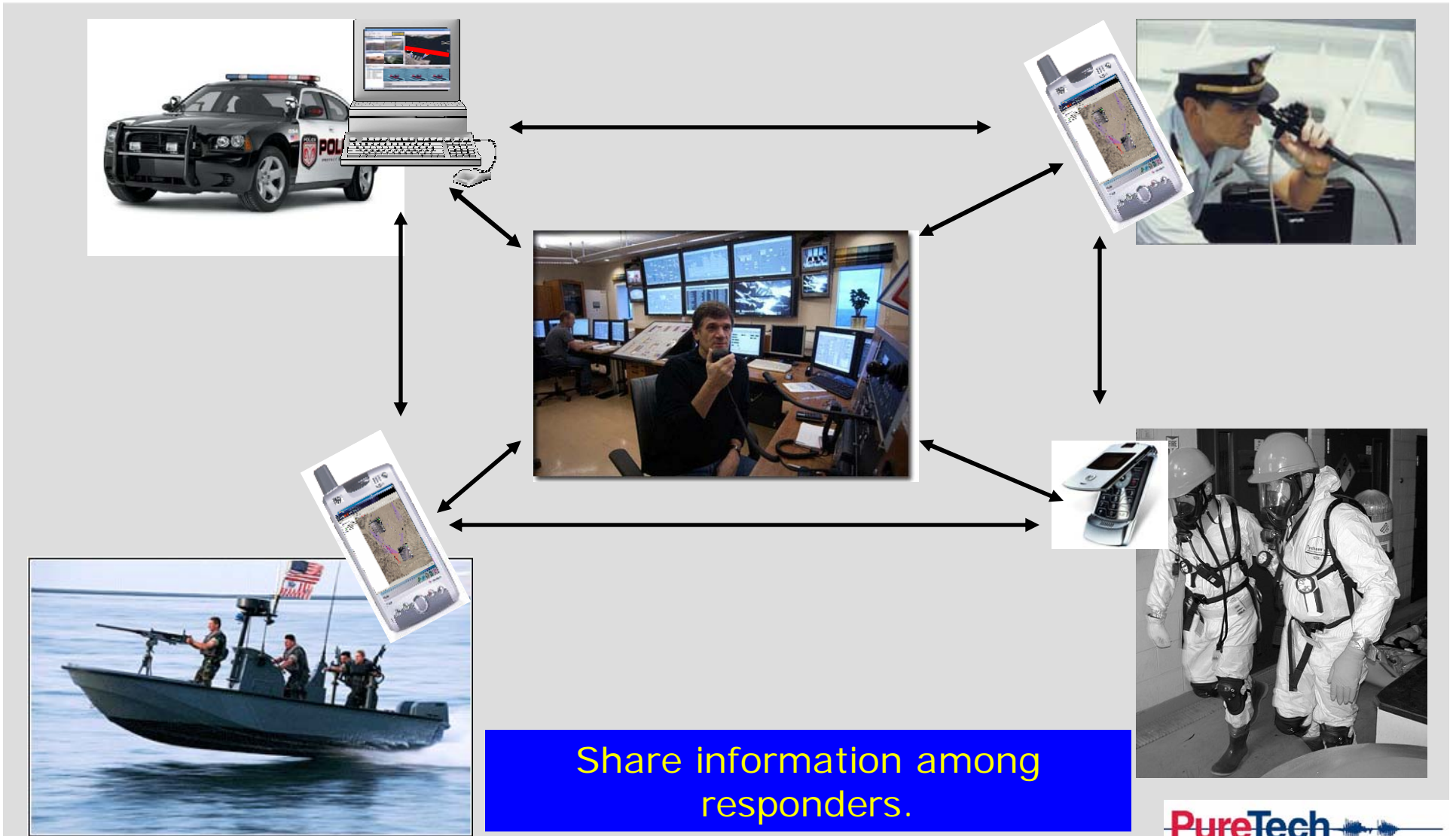


rev

System focuses on unknown targets in areas of concern.



Response – Open Communications



Share information among responders.



Response – Share Information



The screenshot displays the PureActiv Workstation AlertView interface. The main window shows a map with vessel tracks and labels for 'AIS: Container Vessel' and 'Unknown zodiac type craft'. Below the map is a table of alarm events and a detailed view of a 'Zodiac Detected' alarm.

Alarm Occurred	Alarm Type
6m ago	Motion Detected
14m ago	Intrepid Tamper Alarm
21m ago	Intrepid Tamper Alarm
37m ago	Intrepid Tamper Alarm
44m ago	Signal Loss
44m ago	Signal Loss
44m ago	Signal Loss
45m ago	Intrepid Tamper Alarm
46m ago	Intrepid Tamper Alarm

Instant Message:
Zodiac at
latitude -116.11,
longitude 47.42

Zodiac Detected **Replay** **Live Video**

2/13/2006 5:49:03 PM
Perimeter intrusion detected at east gate after microwave beam was broken.

Acknowledgement: [dropdown] [Add] 0 Total (0 new) [Review]

[Clear] [Dismiss Without Clearing] [Center Alarm On Map] [Popup Media]

February 13 -116.11166, 43.42446 840.91m x 672.1m

- Instant message sharing
- Still image of target
- Instant replay
- Live video
- Alarm acknowledgement
- Alarm clear



Response – Share Information Recovery - Confirm Area is Clear



The screenshot displays the PureActiv Workstation AlertView interface. At the top, there is a menu bar (File, View, Tools) and a toolbar. Below this is a 'Video Palette' with two video feeds labeled 'C23-3' and 'C15-3'. The main central area shows a 3D visualization of a plume model over a cityscape. Below the video feeds is an 'Alarm Monitor' section containing a table of alarm events.

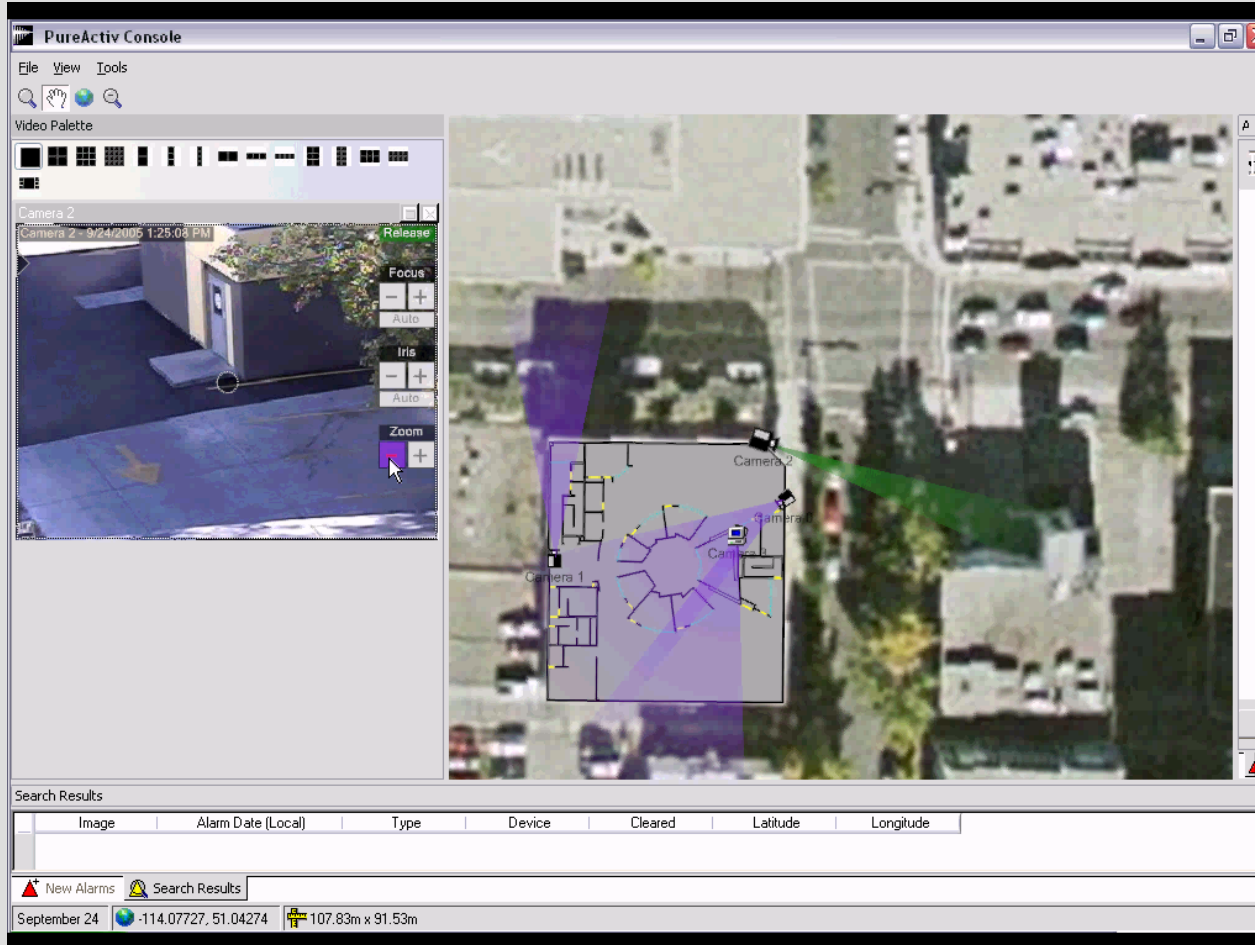
Alarm Occurred	Alarm Type
6m ago	Motion Detected
14m ago	Intrepid Tamper Alarm
21m ago	Intrepid Tamper Alarm
37m ago	Intrepid Tamper Alarm
44m ago	Signal Loss
44m ago	Signal Loss
44m ago	Signal Loss
45m ago	Intrepid Tamper Alarm
46m ago	Intrepid Tamper Alarm

Below the table is an 'Instant Message' box with the text: **Zodiac at latitude -116.11, longitude 47.42**. To the right of the table is a 'Zodiac Detected' section with three video thumbnails labeled 'Zodiac Detected', 'Replay', and 'Live Video'. Below these is a playback control bar showing the date and time '2/13/2006 5:49:03 PM' and a description: 'Perimeter intrusion detected at east gate after microwave beam was broken.' There are also buttons for 'Acknowledgement', 'Add', 'Clear', 'Dismiss Without Clearing', 'Center Alarm On Map', and 'Popup Media'.

Assess current plume models for evacuation.



Response – Share Information Recovery - Confirm Area is Clear

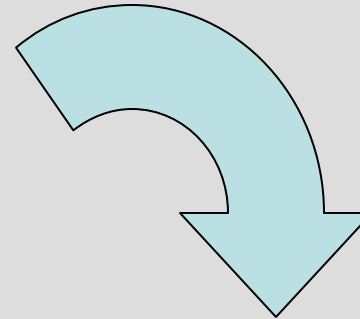
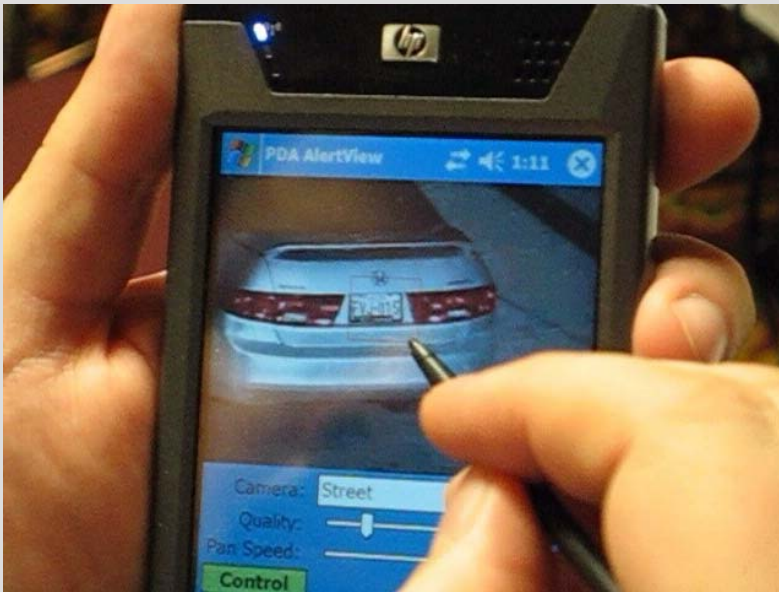


- Simple mouse or joystick control
- Control cameras by point and click
- Zoom map and video by dragging a rectangle
- Cameras' field of view shown on map

Responders control cameras to assess scene before entering.



Response – Share Information Recovery - Confirm Area is Clear



- Control cameras by point and click
- Receive alarms in real-time



- Acknowledge and clear alarms
- Mobilize security personnel

Responders control cameras to assess scene before entering.

Recovery – Assess and document event.



Alarm Search

Lobby: Image | Lobby: Video

Info | Acknowledgements

Date: 7/27/2006 4:40:29 PM **ACKs:** 0
Type: Motion Detected Cleared
Description: Motion Detected In Front Hallway - Alarm

Alarm Source
Site: PureActiv
DAQ: PureActiv Calgary
Device: Lobby
Location: Lat: 51.04249°N, Lon: 114.07715°W

From: 07/27/2006 15:52:37
To: 07/27/2006 16:52:37
Load Clear Results

Status: Any

Sites:
PureActiv
PureActiv Server Center

Alarm Types:
Possible Lens Blockage
Right Down Motion
Right Up Motion
Rightward Motion
Signal Loss
Signal Restored
Stopped Object
Triggered Video Alarm

Image	Alarm Date (Local)	Type	Device	Cleared
	7/27/2006 4:40:29 PM	Motion Detected	Lobby	<input type="checkbox"/>
	7/27/2006 4:39:31 PM	Motion Detected	Lobby	<input type="checkbox"/>
	7/27/2006 4:37:29 PM	Motion Detected	Lobby	<input type="checkbox"/>
	7/27/2006 4:34:12 PM	Motion Detected	Lobby	<input type="checkbox"/>



Recovery – Investigate further



Watch Zone

Ignore Zone

DAQ: PureActivCalgary

Algorithm: Motion Search

Channel: From: 07/27/2006 15:37:49 To: 07/27/2006 16:37:49

Grid Size	8
Maximum Gap	5
Movement Area	10
Sample Rate	4
Threshold	50

Sample Rate
Number of seconds between samples to determine motion. This value can be fractional, for instance 0.2 is five times per...

Regions... Cancel

Thumbnail images of video meeting search criteria.

Quickly search recorded video for motion of interest.



Enhanced Maritime Domain Awareness



THREAT ADVISORY
ELEVATED
Significant Risk of Terrorist Attacks

AIS: Container Vessel

Unknown zodiac type craft

Alarm Occurred	Alarm Type
6m ago	Motion Detected
14m ago	Intrepid Tamper Alarm
21m ago	Intrepid Tamper Alarm
37m ago	Intrepid Tamper Alarm
44m ago	Signal Loss
44m ago	Signal Loss
44m ago	Signal Loss
45m ago	Intrepid Tamper Alarm
46m ago	Intrepid Tamper Alarm

Instant Message:
Zodiac at
latitude -116.11,
longitude 47.42

2/13/2006 5:49:03 PM
Perimeter intrusion detected at east gate after microwave beam was broken.

Acknowledgement: Add 0 Total (0 new) Review

Clear Dismiss Without Clearing Center Alarm On Map Popup Media

February 13 -116.11166, 43.42446 840.91m x 672.1m

Current areas of risks and threats.

Authorized ship and personnel location and information.

Anomaly detection – type, location, video.

Automated communications - notify those with need to know and those responsible to act.

Policy based responses and recovery.



Conclusion



Technology can aid in safeguarding LNG and petrochemical terminals by enhancing Maritime Domain Awareness.