HarborGuard-Pro Waterside Security System

Concept of Operations
Waterside Security System Concept

• Protection Requirements
  – Constant monitoring of unattended waterside approaches to critical facilities
  – Detect and identify vessels within the areas of interest surrounding critical facilities
  – Warn and alarm when intruders enter security zones
  – Provide Situational Awareness
  – Capability of integrating with external security system

• Virtual site survey
  – Determine possible sensor locations
  – Coverage and visibility analysis of candidate sites

• Klein Marine Baseline System
  – HarborGuard-Pro with Series 2000 Micro-Radar
    • Radar detection/tracking capabilities
    • HarborGuard-Pro site security features/functionality
  – FLIR EO/IR Camera System
    • Features and functionality
Protection Requirements

- MTSA or ISPS Code Compliance
- Monitor Scheduled Vessel Movements
- Protect Unattended Waterfront Approaches to Critical Facilities
  - Small High Speed Craft Threats
  - Swimmer & low observable threats
  - Floating IED Threats
- Real-time Information Presented to Security Stakeholders
  - Small Target Detection Maritime Radar(s)
  - EO/IR Sensor(s)
  - AIS
  - Perimeter surveillance radar(s)
Radar Line of Sight Visibility Analysis Tool Example

Candidate radar Site A - Radar Coverage (green) prediction

Radar Located at Site A

Candidate radar Site B - Radar Coverage (green) prediction

Radar Located at Site B
Klein Marine Baseline System
HarborGuard-Pro with Series 2000 Micro-Radar

- Flexible situational awareness display
- Integrated presentation of radar data, camera video & data, AIS, mapping and alarm processing
- Configurable “Multi-view” windows may be freely moved and resized
- Capability for defining alarms that occur on user configurable events:
  - Targets entering user defined areas
  - Targets passing through controlled gate
  - Targets being in close proximity to another target or to a reference point
- Alarm event may be reported using audible or visual alarms, and/or by sending messages to other sub-systems, i.e. to initiate recording
- Manual or automatic control of pan/tilt cameras
  - Camera controlled through on-screen joystick
  - Camera controlled automatically from Radar or AIS derived tracks (slew-to-track)
  - Camera controlled automatically based on incoming threat or triggered alarm event
Series 2000 Micro Radar

Light Weight - Low Power – High Performance

**Series 2000 Micro Radar sensor**
- Light Weight with soft start motor
  - Antenna/Scanner weight: 41 lbs (18.75kg)
  - Ideal for mobile applications (vehicles, vessels)
- Enhanced Capability Radar sensor
- Solid State X-Band Transceiver (no Magnetron)
- Coherent, Pulse Compression
- 6ft Antenna Array, 1.2° horizontal beam
- Optional 4ft Antenna Array, 1.8° horizontal beam
- COTS design with enhanced capabilities for small target detection
- High performance Receiver – 5dB noise figure
- 22-48 RPM scanner
- IP Network interface
  - Simplifies remote operation
- Power Requirements: 12-24VDC, 40W

**RadarPro-SPx Advanced Radar Processor**
- PC Based system
  - Two versions: 2U rack-mount chassis and rugged, weatherproof IP65 housing
- Windows 10 with KMS RadarPro-SPx software
- Unique signal processing
  - Pulse Processor matched to antenna beam pattern
  - Improves target S/N
  - Suppresses radar interference
  - Reduces rain clutter
  - Scan Average Processor
  - Scan-to-scan integration
- Tracker
  - 1000 targets
  - MHT – Multiple hypothesis tracker
- Client/Server Support (HarborGuard® Client/Server)
  - Controls the RadarPro server; returns status, receives radar data, plots and tracks
- Image Format
  - scan converted output
  - Image compression
- Network Protocols
  - TCP/IP, UDP

[Diagram of Series 2000 Micro Radar system]
# Small Target Detection Performance

**Series 2000-Micro Radar 6ft Antenna at 48 RPM**

<table>
<thead>
<tr>
<th>Target Description</th>
<th>Radar Cross Section RCS</th>
<th>Radar Antenna 20m Above Sea Level</th>
<th>Example target:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small open boats, fiberglass, wood or rubber at least 4 meters long… target at 1m above the surface</td>
<td>1 m²</td>
<td>3.6 nautical miles 6.7 km</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Inshore fishing vessels, sailing boats, speed boats… target at 2m above the surface</td>
<td>3 m²</td>
<td>4.9 nautical miles 9.1 km</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Low observable vessel, kayak, jet ski, canoe… target less than 1m above the surface</td>
<td>0.25 - 0.5 m²</td>
<td>2.5 nautical miles 4.6 km</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>
HarborGuard-Pro with Series 2000 Micro-Radar
Small Target Detection & Tracking

Radar tracking
Kayaker at 1.1 nm (2200 yds)

Slew-to-track
Camera following radar target
FLIR EO/IR Camera Systems
Short or Long Range EO/IR Camera Options

Option 1
1 - Long Range, cooled Mid Wave IR

FLIR Model PT-602CZ-HD Multi-Sensor, PAN/TILT/ZOOM Camera System including:
- MWIR, cooled Thermal Sensor with 19-275mm continuous zoom lens, 640x512 resolution
- Color Daylight Camera, CCD low light 1080 HD sensor
- Pan/Tilt Mechanism, 360 deg continuous pan, ± 90-deg tilt
- 24VAC operation
- PT-Series Power Supply Assy, 110/220VAC to 24VAC
- AXIS P7214, 4-Channel Video Encoder (interface for HarborGuard/Radar)
- PT-Series Pedestal Mount Assembly with adapted plate

Option 2
2 - Short Range, un-cooled Long Wave IR

FLIR Model PT-608-HD Multi-Sensor, PAN/TILT/ZOOM Camera System including:
- LWIR, un-cooled Thermal Sensor with 75mm lens, 640x480 resolution
- Color Daylight Camera, CCD low light 1080 HD sensor
- Pan/Tilt Mechanism, 360 deg continuous pan, ± 90-deg tilt
- 24VAC operation
- PT-Series Power Supply Assy, 110/220VAC to 24VAC
- AXIS P7214, 4-Channel Video Encoder (interface for HarborGuard/Radar)
- PT-Series Pedestal Mount Assembly with adapted plate
Baseline System - Notional Diagram
Expert Services & Support

- **Concept of Operations Support**
  - Maritime Surveillance SME’s
  - Compliance with relevant rules & regs (IEC, IMO, IALA, MTSA, ISPS)

- **Site survey**
  - Identify candidate sensor sites for optimal system performance
  - Detailed predictive performance analysis (radar, viewshed, GIS tools)

- **System Design and Integration**
  - Custom engineering; software integration and hardware integration
  - Detailed installation, cabling and structural drawings

- **Installation support**
  - Installation supervision, set-to-work and commissioning
  - FCC licensed radar technicians

- **Operator and maintainer training**
  - Factory or on-site training

- **Life cycle support**
  - 24/7/365 phone & email support
  - Detailed maintenance plans
  - Extended warranty and service contract options
  - Spare parts support
Thank you!

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