A Fully Integrated Solution to Seaport Waterside Surveillance

Port of Miami
Miami-Dade County Seaport Department
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Description: Port of Miami

A department of Miami Dade County, the Port of Miami ('Port") is among America's busiest ports and it is recognized throughout the world with the dual distinction of being the Cruise Capital of the World and the Cargo Gateway of the Americas, in consequence, the Port is a vital contributor to the local, state, and national economies. Over four million passengers passed through the Port last year as well as approximately seven million tons and over 800,000 TEUs (twenty-foot equivalent units) of cargo. This commercial trade contributes over $17 billion annually to the South Florida economy and helps provide direct and indirect employment for over 176,000 jobs. An important force behind the development of the Port to world-class status, however, has been the unwavering support of its elected officials and civic leaders. Early on, they recognized the importance of the Port of Miami to the economic wellbeing of the community; as a result, port management has been able to develop the infrastructure, acquire the equipment, and implement the latest technological innovations to meet the demands of its cruise and cargo customers.

With approximately 520 acres dedicated to rolling stock, container yards, refrigerated warehouse space, gantry crane facilities, seven modern cruise terminals, and administration offices for the use of the Port, government agencies, several shipping lines, maritime organizations and cruise lines, the Port offers a wide variety of choices of popular multi-day cruises. Ports-of-call easily reached from Miami extend from the Bahamas to the Eastern and Western Caribbean, Mexico, Key West, South America, and beyond. In addition, the Port has partnered with the Greater Miami

Convention and Visitors Bureau to promote awareness of Miami as the premier homeport and an emerging port-of-call as well as a destination offering pre-cruise and post-cruise activities.

Part of the success of the Port can be attributed to its strategic geographic location, which places it at the crossroads of the major shipping lines in the hemisphere as well as its close proximity to many popular cruise destinations. Additionally, the Port benefits from Miami's emergence in recent years as the international business center of the Americas, with an increasingly sophisticated and diversified trade-supported community.

The Port is a major player in international and local economies generating global economic activity with interactions between Miami-Dade County and numerous trading partners. The Port serves many leading shipping lines that call on more than 100 countries and 250 ports across the world, serving the markets of Asia, the Caribbean, Central America, Europe, the Middle East, North America, and South America. Latin America and the Caribbean continue to account for more than half the cargo tonnage moving through the Port of Miami, ensuring its continued distinction as the Cargo Gateway of the Americas. The shift in Asian trade to East Coast ports via all-water routes through the Panama Canal has resulted in the Far East being the fastest-growing region for the Port. Trade with Asian countries represent more than one-fourth of the total tonnage handled at the Port of Miami, while Europe accounts for the remaining share; with the announced enhancement of the Panama Canal, both cargo and cruise

businesses are expected to grow as new services will claim the Port of Miami as their preferred port-of-call.

Introduction

The Radar/AIS Waterside Surveillance System was of one of the most cutting-edge technologically challenging security-centric family of projects recently implemented at the Port of Miami. Among the many systems that collaborate on enforcing security measures at the Port, the new ***Waterside Surveillance System*** is the most deserving of the above mentioned "state-of-the-art" systems in both its design and its implementation. The system was implemented by the Port of Miami Information Technology Section in close collaboration with the solution providers and the project integrator. The system provides Port Security and Law Enforcement Officers with cutting-edge surveillance tools which are fully integrated with other pre-existing legacy systems at the Port.

The following chapters discuss important aspects of the system goals, development process and accomplishments: Why was the system needed? How the system-requirements were defined and then implemented obtaining full integration with the existing legacy systems at the Port; what were the benefits and costs? What were the key-performance indicators defined and measured during (and after) the development process? How the solution looked like at the end and how users' expectations were met and surpassed.

Finally, this paper explains why the system is worthy of the AAPA Information Technology Award based on its high level of innovation, the efficient use of cutting-edge

technology, as well as its wide applicability and reusability as a model for other ports in the nation and worldwide.

Goals and Objectives: Business Problem

A full implementation of the Port's various Access Control Systems and advanced Video Management Systems had satisfied the requirements for landside security. Unfortunately there was not an automated solution to assist the Seaport Security Officers to monitor the waterways surrounding the Port of Miami. As large vessels docked on the Ports shoreline restricted visibility of both equipment and the Security Officers, a system that could monitor the surrounding waterways from off-Port property looking in towards the Port would be required. It needed to provide real-time situational awareness and record activity in key areas around the Port facilities during all hours (day and night) and under all weather conditions. An integrated Video System would also be required to provide day/night visibility of identified targets. Ideally this system would also be available to the Port's Law Enforcement Officers that protect the shoreline in waterborne patrol boats.

Discussion

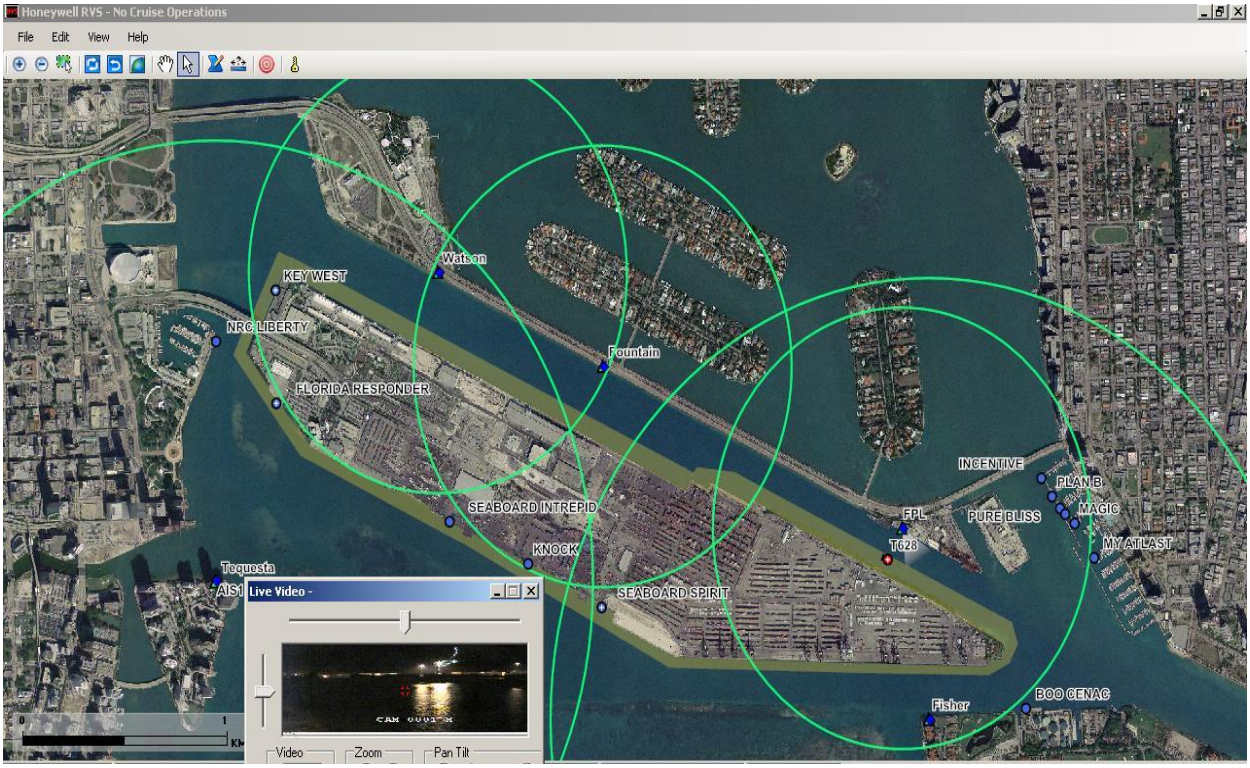
Background and Project Description: A detailed analysis of the waterside security requirements was completed with the goal of defining the project's Scope of Work. Due to the complexity of the requirements and the cutting edge technology required to meet the requirements, the solution was developed through the active participation from

Honeywell Security, Adesta Group, Florida Department of Transportation, Miami-Dade County Police Department (MDPD), U.S. Coast Guard and the Port of Miami Security Division. The main objective was to detect, identify, track and graphically display all targets (stationary or moving) in the waterways surrounding the Seaport. Additional requirements included the seamless integration with the Port's legacy security systems and other business related applications.

Five off-port sites were identified that would provide the most effective coverage possible. Three of those sites were the rooftops of private multi-floor Condominiums which required the approval of the Condominium Board of Directors and the negotiation of Lease Agreements. The other two locations required approval from the State Department of Transportation as 80' poles would be required to mount the equipment adjacent to a busy thoroughfare. . A major accomplishment of this project was the attainment of approval for all five sites.

The resulting system deployed sophisticated off-the-shelf radar technology that that integrates Radar, Automatic Identification System (AIS), Video, and Sensor data to provide the highest value wide area surveillance system available. Radar Video Surveillance sensors automatically detect intruders in user defined Alarm Zones. Alarms are generated to alert security personnel and PTZ cameras are automatically directed to the intruder. Video is recorded and distributed over a wireless Local Area Network to provide both recorded history and real time situational awareness to Port of Miami Security and Law Enforcement personnel.

The system is comprised of a FCC licensed wireless network, a combination of sensors, receivers, software servers and client workstations. The system provides a wide area surveillance solution by leveraging the strengths of each of the system components (Radar, Video, and AIS). Radar and other passive long range sensors are used to detect and track targets. Target data is collected in the field and routed to a control center where a server processes the target data. Target data processing is based on user defined configurations that include sensors, rules and responses. The rule processing is used to prioritize target data and identify a response to be executed. Responses include alarming and automated video capture. The target data is displayed using a client application that uses a Port of Miami GIS overlay. The client application also supports displaying the locations of sensors, cameras, AIS targets, video streams, and all other RVS System components.



Because Radar Video Surveillance automates detection, tracking, and alarming, based on the Port's security plan, security personnel can perform tasks other than monitoring the detection system. When an alarm is received, officers can identify the threat and make a security decision before it reaches the perimeter - increasing the time available to respond to potential threats. The integration built in to the system with the Port's LENEL On-Guard Access Control System eliminates the need for our officers to respond to alerts received from two disparate systems. Alerts that are generated in the Radar Surveillance System are sent to our Access Control System in real-time.

Radar Alarms generated in Access Control System

Target T2234 with priority 9 detected | Fountain | Entering AOI	1:46 PM 2/1/2010	RVS DataConduIT	None
Target T2264 with priority 9 detected | Watson | Entering AOI	1:46 PM 2/1/2010	RVS DataConduIT	None
Target T2345 with priority 9 detected | Watson | Entering AOI	1:47 PM 2/1/2010	RVS DataConduIT	None

Another component of this system which is due mentioning is the integration that has taken place to assure it is used to its utmost potential. We have taken advantage of the AIS data to update our legacy Berth Planning System with Actual Vessel Arrival and Departure Information. This integration point assures we have accurate and real-time vessel arrival and departure information 24 hours a day.

Objectives and Methodology

The system objectives were clearly defined at the beginning of the project which were then included in the Project Charter upon approval from the stakeholders. In close collaboration with the Port's Security Division and the Miami-Dade Police Department, goals and requirements were defined. Events, objects, actors, and use-cases were also defined. A Quality Control Approach to Project Management minimized the risk throughout the implementation of the system by the use of unit and system tests associated to project milestones.

Platform Specifications (Hardware and Software): The Waterside Surveillance System is composed of ten mayor ***software*** elements:

Software Application Names	***Description***
Microsoft Server 2003 Standard Edition	RVS Server operating system.
Microsoft SQL Server 2005	Database server application.
Intrusion Event Manager (IEM) Service	Rule processing engine for the RVS system.
RVS Client	Graphical User Interface application that shows target data and provides RVS system configuration.

AIS-Handler	Delivers the necessary functionality for the RVS Client to show AIS targets.
GPS-Handler	Delivers the necessary information for the RVS Client to locate targets on the Port Image.
Honeywell Digital Video Manager	Delivers video streams from the PTZ cameras into the RVS Client port image.
I-Boot Remote Power Manager	Distributes, manages, and controls power supply levels to all units at each site.
WSS-LENEL Interface	Utilizes a set of DataConduit LENEL services to post WSS-generated alarms into the LENEL OnGuard Alarm Monitoring System.
BPS-LENEL Interface	Utilizes a Message Queuing service to “listen for target information” from the AIS server and then to “post ATA/ATD information” into the BPS.

The Waterside Surveillance System is composed of nine mayor ***hardware*** elements:

Component Name	*Component Description*
Marine Radar Sensors	Honeywell Marine Radar (5)
AIS Receiver	NobleTec AIS Receiver (1)
GPS Tracking	GPS Base Station and field transponders used for mobile asset tracking (1)
Video System	Video Server (1) and CCTV Cameras (5)
Electronics Enclosure	Weather proof NEMA 4x enclosure that contains the power, network and interface control boxes for the radar, AIS and video components. (5)
RVS Server	Server hosting the RVS Intrusion Event

	Manager service application (1)
RVS Client Workstation	Workstations that host the RVS Client application as well as the P-Sea radar application (5)
Alarm Server	Server that hosts the alarm processing software(1)
Toshiba ToughBooks	Hardened laptops installed on the MDPD patrolling boats (2)

Project Costs: The total project cost of $1.5M included the following:

- Wireless Survey required to secure FCC Licenses for the Wireless Communications System
- Perform geotechnical soil tests to engineer appropriate sized direct-buried poles
- Manufacture and installation of 2 concrete poles engineered to withstand a steady 45 mph wind and a maximum wind of 150 mph
- Manufacture and installation of 5 radar, camera and microwave communication mounts
- Provision, installation and configuration of 5 radars, 20 cameras (4 per pole – 1 PTZ and 3 fixed) at appropriate heights to provide required radar coverage, and 6 microwave radio and antennas
- Provision and install AIS antenna
- Provision and installation of securable NEMA 4X communication cabinet to protect the RVS network and sensor equipment.

- Provision and installation of high-temperature and intrusion detection sensors in the Communication cabinet for high temperature and intrusion notification.

Performance Measures:

The following Key Performance Indicators where defined and measured for the system:

KPI	**Target**	**Achieved**
Detection	90%	89%
Aerial-coverage	Full	Full
Visibility	Full	Full
Traceability	90%	88%
Integration	Full	Full
Portability	Full	Full
User-friendliness	Acceptable	Enhanced
Configurability	Acceptable	Enhanced

Justification for the Award

The implementation of the Port's new Waterside Surveillance System has impacted four important areas: Security, Safety, Environmental Protection, and Berthing Planning.

Having a real-time inwards view of the island represents an important step on hardening the measures to counter terrorist attacks initiated from the water and/or land features surrounding the island.

Receiving instantaneous alarms at our Command Center when a target exceeds the speed limit is a twofold achievement: Firstly, it alerts MDPD Officers in the Security

boats and thus allows them to intercept speeders which prevents collisions and accidents that destroy life and property, and secondly it helps to enforce Environmental Protection rules that protect flora and fauna.

By instantaneously posting the AIS readings into our Berth Planning System, operational information becomes more accurate and timely for the internal Port users as well as for our partners in the Port community. Another important result is that all berth-related billing information becomes easily auditable.

The Port of Miami has been among the leaders at implementing integrated maritime centric application systems. An intelligent selection of the best solution-provider in the market, combined with the use of the latest software development tools as well as the use of the Rapid Application Design techniques have allowed for the completion of this fully integrated Waterside Surveillance solution which to our knowledge is the first of its kind and scope ever implemented in the Seaport industry.

Integration between the Waterside Surveillance System and the Port's Berth Planning and Access Control Systems has allowed the Port to meet its security needs and at the same time provide an invaluable set of secondary benefits that very positively impact the successful operations of other divisions within the Port, our Business Partners, Customers and Local, State and Federal Law Enforcement Agencies.

The innovation and vision required to design and implement this one-of-a-kind system configuration for a complex Seaport RVS solution is noteworthy. This system represents the modern way of doing proactive surveillance in Seaports both in The United States and abroad.

Conclusion

A ***Waterside Surveillance System*** was designed and implemented at the Port of Miami by the Port's Information Technology Section in collaboration with the RVS-technology providers (ADESTA and Honeywell) as well as GTSI acting as the project integrator. This new system provides the Security Officers, as well as Law Enforcement with a cutting-edge graphical interface that continuously and reliably delivers the most current waterside traffic conditions surrounding Port. As an important byproduct, the interface between Waterside Surveillance and Berth Planning Systems (based on the AIS capture threads) allows the Port to maintain real-time vessel arrival/departure information.

The new Port of Miami Waterside Surveillance System fulfilled all stakeholder expectations and original requirements. It continues to evolve with new technological upgrades and parameter tuning and thus is a model for other Ports throughout the nation and it is worthy of an AAPA Information Technology Award.