



Marine Solution Overview

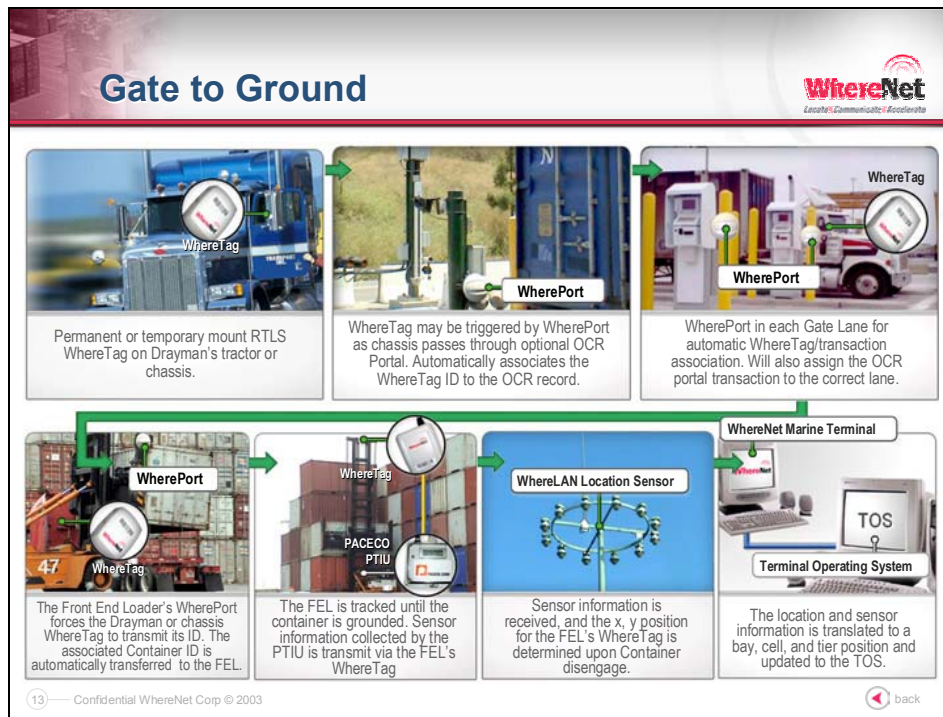
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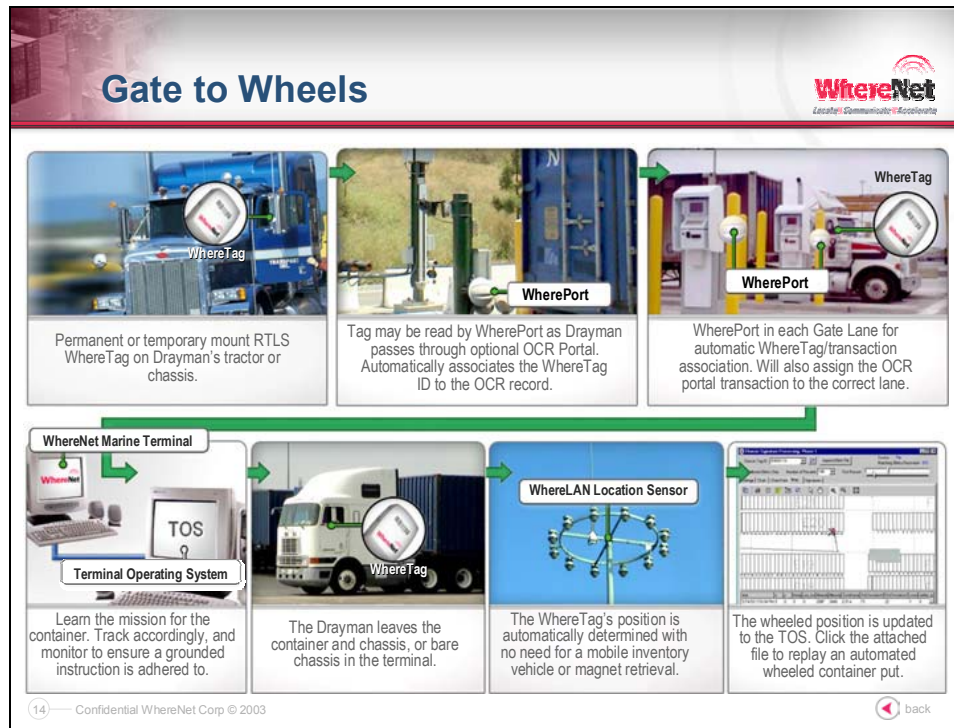
A. WhereNet Marine Solution Overview

WhereNet provides a complete solution for Real Time Container Tracking. The proposed solution includes the infrastructure, tracking devices, and software to support tracking Container Handling Equipment(CHE), as well as 3rd party truckers (Draymen) via the gate to enable an automated handoff of the container ID to the terminal operating system (TOS). The solution will support an automated update of the container's grounded position in the terminal whether it is delivered by a street truck or UTR to WhereNet enabled Front End Loaders.

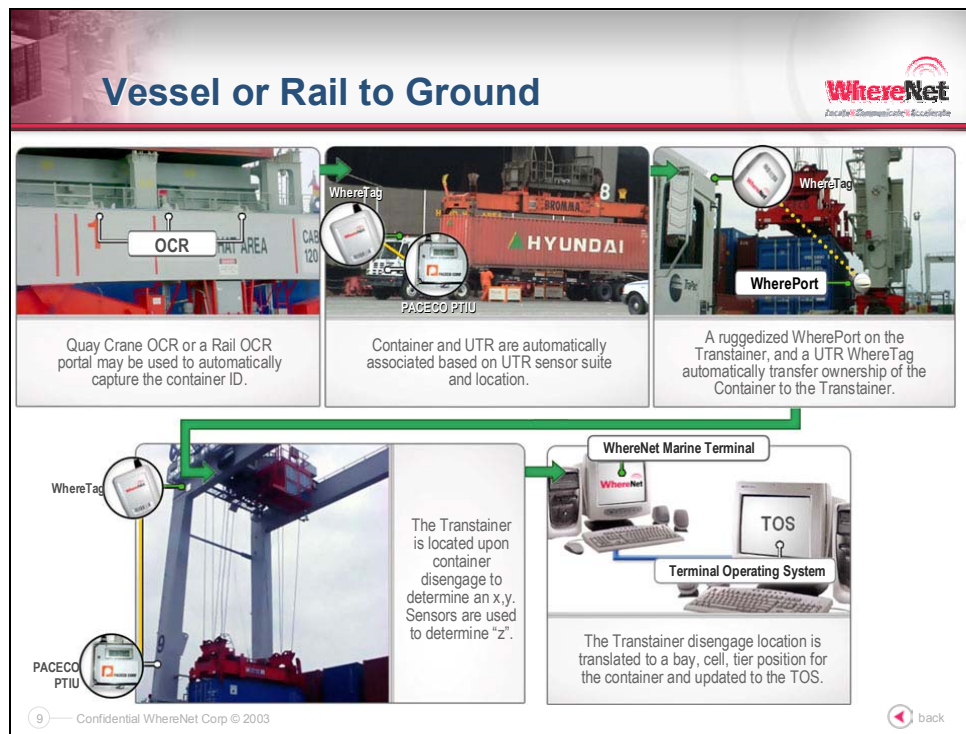
The process for the Drayman looks like this for Gate to Ground:



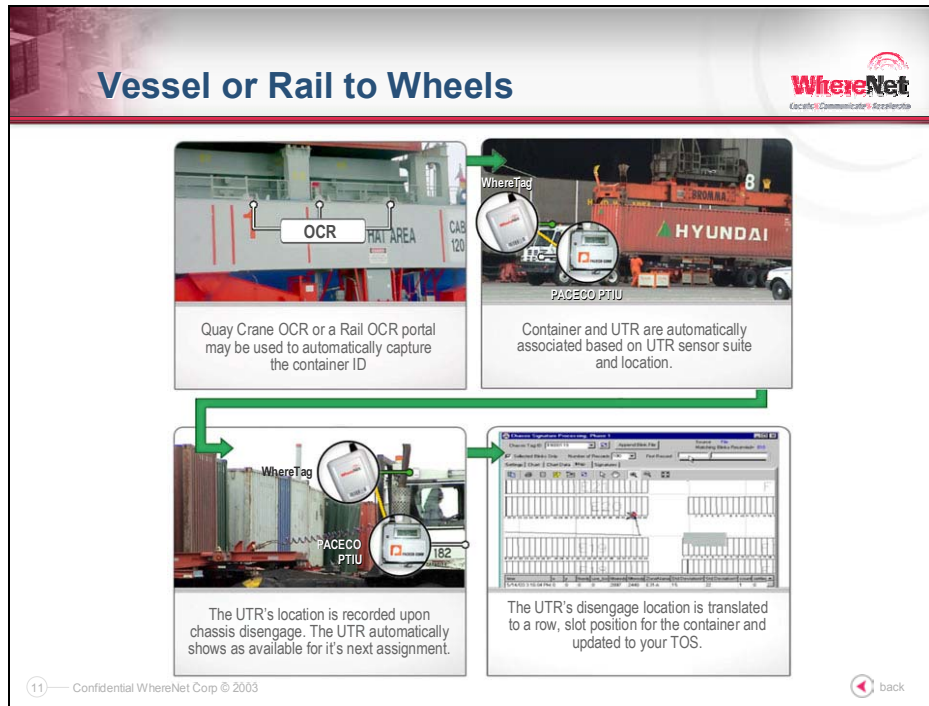
For Gate to Wheels, WhereNet will compare the park instruction with the park signature created by the Drayman's visit to the terminal. The process looks like this:



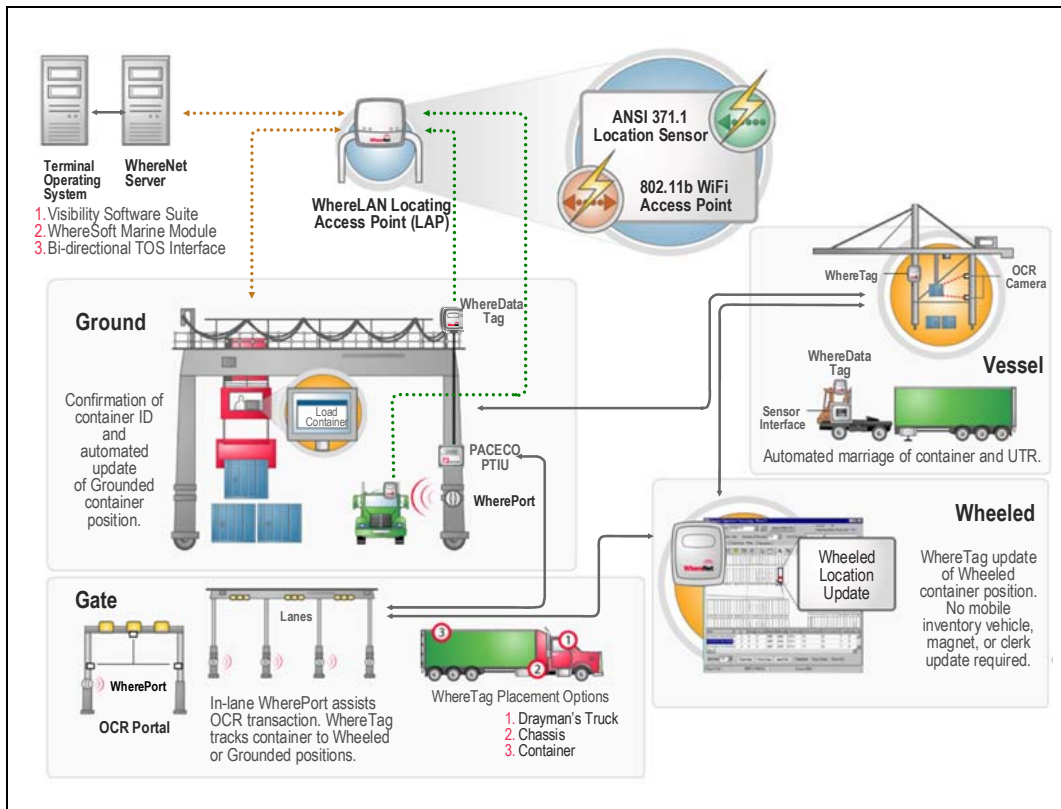
WhereNet also supports an automated marriage of the container ID at the vessel for tracking the container ID to a grounded or wheeled position in the yard. In this case, the container ID is married to the UTR. That process looks like this for vessel to ground:



And like this for vessel or rail to wheels:

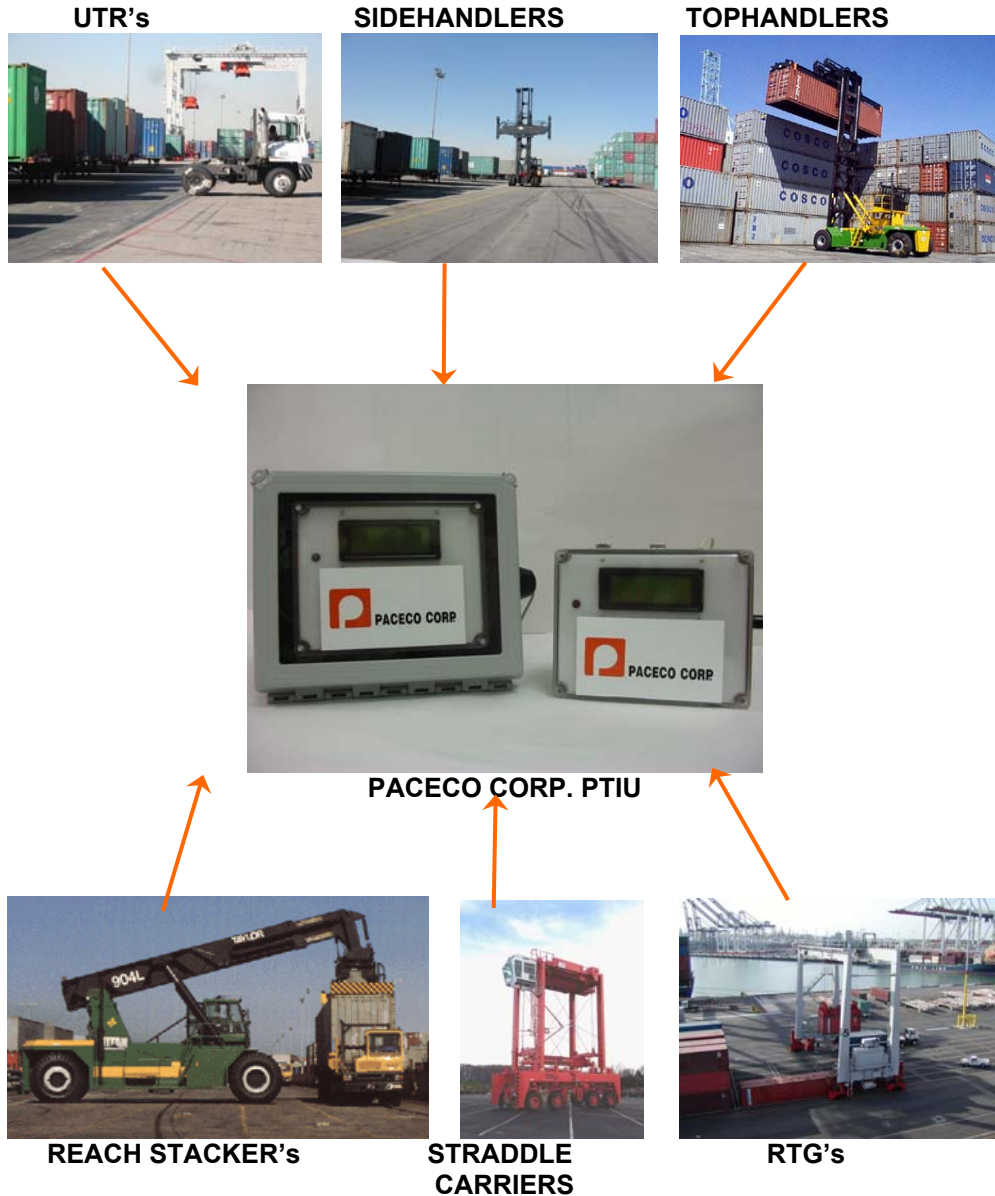


Any internal moves within the terminal are also recorded. The following schematic provides a useful overview of the complete solution:



B. The following is an overview of how the PTIU is used to support WhereNet's Marine Solution.

PACECO® CORP. (www.pacecocorp.com), inventor of the world's first container handling crane and still today a leader in high quality container handling equipment; has developed a "Position Tracking Interface Unit (PTIU)" to transmit marine terminal equipment sensor data through the WhereTag III and into the WhereNet RTLS System. This device greatly simplifies sensor transmissions by providing a common platform that connects WhereTags III ST tag directly to sensors on Container Handling Equipment (CHE).



The main function of the PTIU is to continuously monitor what the equipment is moving, who is using the equipment (with operator logon), what the equipment is doing (idling, moving a container, etc), and other diagnostic data (such as fuel level), while the equipment is in operation. The PTIU responds to *events*, things that the equipment does that are important to the WhereNet inventory tracking software. When such an event occurs, the PTIU sends data to the WhereTag, which in turn allows the WhereNet RTLS to update what that specific equipment did. For example, when the operator of an RTG moves the RTG spreader, no events are sent to the WhereNet RTLS; but when the operator locks the spreader on a container, the PTIU sends this event data to the WhereNet RTLS because it affects the location of container inventory. Figure 1 (below) shows this event-based data exchange in schematic form.

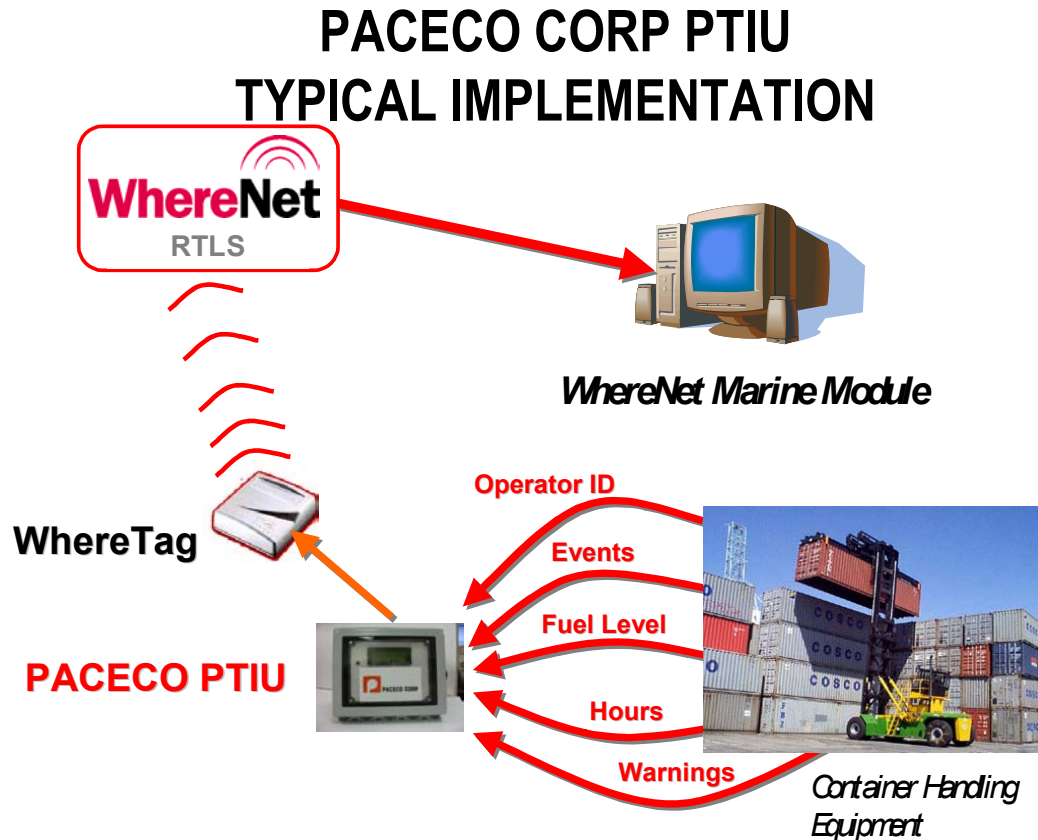


Figure 1 – The Role of the PTIU in the WhereNet RTLS System

Because Container Handling Equipment (CHE) has different purposes in the role of container handling, the PTIU must monitor the required sensors on the given equipment to be able to respond to the correct events that affect container inventory. For a Tophandler or RTG, the events of locking onto a container and moving the container would be similar (although the sensors that sense this might be different). For a UTR, the events monitor are fifth wheel engage/disengage, and the presence of a container. The goal of determining what is happening to container inventory is still the same, yet the events and sensors that are used to gather this data might be completely different depending on the CHE in question. The proceeding outline describes the data that is captured and what events cause the PTIU to transmit to the WhereNet RTLS on the specified equipment.

**OUTLINE OF EQUIPMENT SENSORS MONITORED BY THE PACECO PTIU
(LISTED BY EQUIPMENT TYPE)**

1. PACECO**RTG & STRADDLE CARRIER PTIU**

- a. Trolley Position (Lanes: Truck, A,B,C,D,E,F)
- b. Hoist Stack Height (Four High on non-PLC RTG units, Five High on PACECO PLC RTG Units)
- c. Spreader 20/40ft, Landed, Twistlock Lock/Unlock*
- d. Environment Windspeed Too High* (*Option*)
- e. Operator ID (*Option*)
- f. Operator Signed In with ID Card – Equipment Is Enabled And Started* (*Option*)
- g. Equipment Vehicle Fuel Level (*Option On Units Without Electric Fuel Gauge*)
- h. Equipment Vehicle Fuel Level Too Low* (*Option On Units Without Electric Fuel Gauge*)

2. PACECO UTR PTIU

- a. Fifth Wheel Engage/Disengage*
- b. 20/40 Container On Trailer Detection*
- c. Two 20ft Containers On Trailer Detection* (When Loaded In Specified Order)
- d. Transmission In/Out OF Reverse*
- e. Vehicle Speed Higher Than Set Limit Detected* (*Option*)
- f. Operator ID (*Option*)
- g. Operator Signed In with ID Card – Equipment Is Enabled And Started* (*Option*)
- h. Equipment Vehicle Fuel Level (*Option On Units Without Electric Fuel Gauge*)
- i. Equipment Vehicle Fuel Level Too Low* (*Option On Units Without Electric Fuel Gauge*)
- j. Number of Times Vehicle Brakes Applied
- k. Vehicle Battery/Alternator Voltage
- l. Collision Sensor – Triggers When a Vehicle Collision Occurs* (*Option*)

3. PACECO SIDEHANDLER & TOPHANDLER PTIU

- a. Hoist Stack Height** (Up To Four High)
- b. Spreader 20/40ft, Landed, Twistlock Lock/Unlock**
- m. Vehicle Speed Higher Than Set Limit Detected* (*Option*)
- c. Operator ID (*Option*)
- d. Operator Signed In with ID Card – Equipment Is Enabled And Started** (*Option*)
- e. Equipment Vehicle Fuel Level (*Option On Units Without Electric Fuel Gauge*)
- f. Equipment Vehicle Fuel Level Too Low (*Option On Units Without Electric Fuel Gauge*)
- g. Collision Sensor – Triggers When a Vehicle Collision Occurs* (*Option*)

4. PACECO REACH STACKER PTIU

- a. Trolley Position (Lanes: Truck, A,B,C,D,E,F)
- b. Hoist Stack Height (Four High on non-PLC units, Five High on PACECO PLC Units)
- c. Spreader 20/40ft, Landed, Twistlock Lock/Unlock*
- d. Environment Windspeed Too High* (*Option*)
- e. Operator ID (*Option*)
- f. Operator Signed In with ID Card – Equipment Is Enabled And Started* (*Option*)
- g. Equipment Vehicle Fuel Level (*Option On Units Without Electric Fuel Gauge*)
- h. Equipment Vehicle Fuel Level Too Low (*Option On Units Without Electric Fuel Gauge*)

*Sensed data that triggers a transmission event to be sent to the WhereNet RTLS. The other data that is not event based is sent to the WhereNet RTLS along when a send event occurs.

**For accurate placement, Tophandler and Sidehandler data is streamed continuously to the WhereNet RTLS.

Other Data That Can Be Monitored On the CHE by the PTIU

Because the PTIU is an intelligent device, it is easy to add options and features that monitor an almost unlimited amount of equipment and user data that goes beyond the primary goal of monitoring events that track container inventory movement. Some of the following options available as direct plug ins include Ignition Disable, Proximity Card Scanners, RTG Wind Speed sensing, Fuel Level sensing, and an MDT display panel. Such options allow for additional efficiency gains in the terminal while providing greater visibility to how terminal equipment is being used and by whom. The following sections describe these options and how they would integrate into the PTIU and the WhereNet RTLS infrastructure.

OPTIONS - Operator Equipment Login by Proximity Card

We are all familiar with the application of proximity card readers used for building access, monitoring and control. As terminals get more secure, many terminals already have such an access system or are in the process of implementing such a system for terminal access. The standard for access control that most of us are familiar with for building entry was developed by HID® Corporation. These readers come in a variety of styles and shapes as shown in Figure 2.



Figure 2 – Proximity Cards & Readers

PACECO CORP. has adapted this very same technology to the PTIU for terminal equipment. The concept is to have the operator of the equipment be assigned a low cost proximity card that is swiped when starting the equipment. This card ID data is sent to the WhereNet RTLS so it is instantly identifiable who is operating the terminal equipment and when. In addition, there is an ignition disable option, which requires the card to be swiped *before* the equipment can be started. Figures 3 & 4 show the card and reader attached to the PTIU.



Figure 3– Proximity Card with PTIU Card Reader Option



Figure 4– Contactless Login

OPTIONS - Fuel Level Sensing (Standard on Equipment with Electric Fuel Gauges)

For Equipment that has an existing electric fuel gauge, the PTIU has inputs to read from the fuel sender and send this data out through the WhereTag to the WhereNet RTLS.

On Equipment without an electric fuel gauge, a fuel level sensor can be added to the equipment as an option.

OPTIONS – Wind Speed Sensing (For RTG’s Straddle Carriers)

This option is a bolt-on wind speed sensor that attaches to RTG's and Straddle Carriers. Wind speed is a major safety issue for such equipment. If wind speed gets too high for the equipment to be safe to operate, the PTIU can trigger an alert to the WhereNet RTLS so the operator can be notified and have the equipment shutdown.

OPTIONS – Equipment Collision Sensor

This option allows for the PTIU to monitor dual +/-100G accelerometer sensors. If a collision occurs while the equipment is being operated, the PTIU alerts the WhereNet RTLS for immediate action.

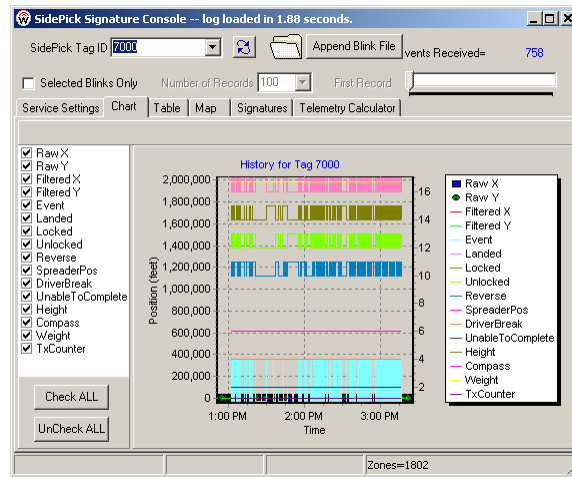
OPTIONS – 20x 2 Line MDT Display

This option allows for the operator to receive instructions on a low cost high-contrast/brightness 20x2 linedisplay with the addition of an 802.11b wireless LAN connection.

This display is easily replaceable if damaged and presents a low cost alternative to having a high cost data terminal installed in the equipment.

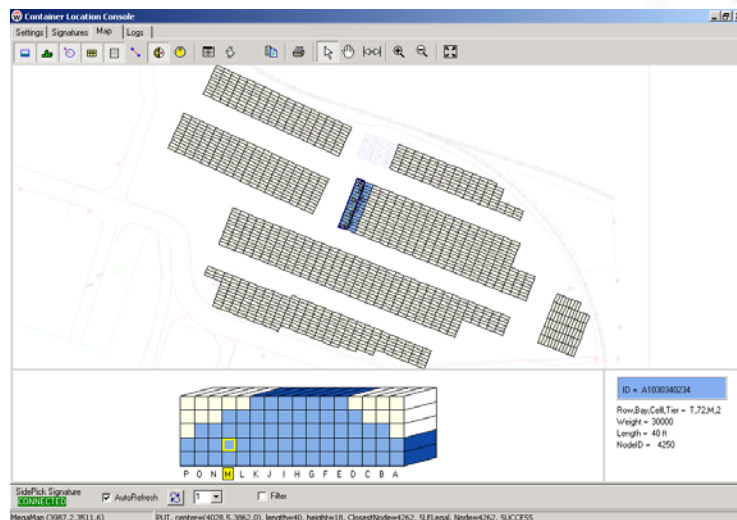
C. WhereNet Software

WhereNet's Solution includes the necessary software to process the data that is received from the PTIU. The solution includes a signature processing console for each type of CHE in your terminal. This is a screen shot of the console for the side handler:



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Once the signature is understood, the container's new position must be translated from an x,y,z position in the terminal to a row, bay, cell & tier position so that it may be passed to the terminal operating system. For containers, the module which performs this bit of magic is the container stacking module. It looks like this:

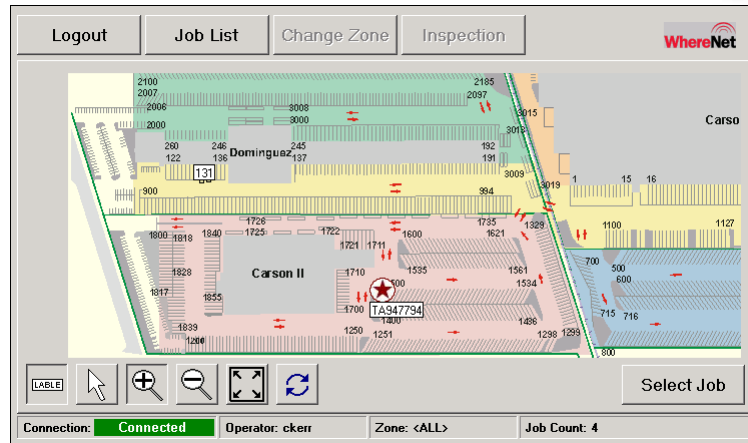


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The location information may also be shared with your UTR Drivers and CHE operators. The user interface which could be leveraged for this application is currently deployed at WhereNet customers NYK Logistics and ES3. It looks like this:







Easily display the start and finish point for each move



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D. Summary

WhereNet’s solution enables you to track a container within your terminal regardless of whether the container is being moved by a UTR or Drayman. The architecture of the solution offers a number of advantages over a DGPS solution including:

	RFID	RTLS	GPS
		Access Control, Transaction Capture Wheeled Location, Virtual Fencing	
Positive ID on entry / exit	Yes	Yes 	No
Confirm container ID	UTR Only	Yes 	UTR Only
Confirm wheeled park position	No	Yes 	UTR Only
Securely monitor yard location	No	Yes 	UTR Only

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The architecture of the solution minimizes installation costs, exposure to labor, and ongoing maintenance. The ability to inexpensively tag any asset allows you to leverage the initial investment in infrastructure with little incremental cost. The advantages of the WhereNet solution are as follows:

WhereNet v.s. Alternate Solutions



WhereNet Solution Advantages:

- **Single infrastructure meets Gate and Ground requirements**
 - One source for complete tracking detail
- **Low incremental cost to track additional assets**
 - inexpensive, easy to deploy tag tracks trucks, chassis, Genset, radios, etc.
- **Total solution provider**
 - Hardware, Software, Support
- **Deployment experience**
 - APL, TraPac, NYK Logistics, Ford, Honda, BMW, GM
- **Transportation and Logistics focus**
 - Manufacturing, Shipping, and Distribution deployments are paving the way for imbedded tracking applications

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WhereNet offers a complete solution that is deployed globally in a number of mission critical environments.

The Case for Constant Visibility and Security for Smart Containers

With the exception of high valued assets (bank vaults, nuclear storage areas, etc). many of our pre September 11 security procedures for the transportation and related industries relied primarily on identifying instances where established procedures were not followed as a way to detect inadvertent or deliberate breaches of security. Unfortunately, terrorists follow the established security procedure when necessary to avoid detection and look for other ways and areas to breach security undetected. We must therefore find other methods of monitoring security and detecting intentional security breaches.

In the shipping industry, the volume of imports coming into our ports currently overwhelms our ability to inspect, monitor and detect attempts to clandestinely import items of the terrorist, drug traffic, and smuggler trade. Technology provides solutions to address this problem.

The Problem

Most existing electronic asset security systems or electronic security seals rely on detecting tags at known entry /exit points. Foolproof and tamperproof container security requires constant, real-time monitoring of a container to address the wide range of security issues, as well as providing side benefit to port operation business process improvements, that will the adoption of the “Smart Container” concept more palatable to the shipping industry.

Local Area Tracking and Monitoring of Sea Containers

At various logistics centers, such as a marine terminal, a higher level of location granularity (3m as compared to 100m such as GPS, or no visibility such as a E-Seal portal solution) is required for both security and for business operations. WhereNet RTLS (Real Time Locating System) is able to track the location of wireless tags in real time throughout a marine terminal. The solution consists of small active 2.4Mhz transmitters which can be affixed to a given container. The tags “wake-up” at user-defined intervals of time (from every couple of seconds to every few minutes) and transmit their ID Number and up to 96 bits of data over 1,000ft to a network of antenna infrastructure which can track and locate the tag to a 3 meter radius. The WhereNet antenna infrastructure, in addition to providing “tag it and track it” capabilities, also provides an integrated radio-frequency (RF) infrastructure which conjoins Real Time Locating Systems (RTLS) with Radio Frequency Identification (RFID), Wireless Local Area Networks (WLAN) and wireless messaging, into a single solution to enable a multitude of Marine terminal applications, as deployed at APL in Long Beach, CA. WhereNet's location and communication system offers terminal operators the latest technology in asset management tools for planning, scheduling, and optimizing mobile yard resources. WhereNet's single, integrated wireless infrastructure for real-time location, messaging, telemetry, and 802.11b applications allows terminal operators to manage their yard more efficiently than ever before -- resulting in reduced operational costs, increased

productivity, and dramatic return on investment. The WhereNet system provides the following core benefits for terminal operators:

Position Detection - keeps track of the real-time location of every tagged asset in the terminal, including containers, container handling equipment, cranes, chassis, and tractors.

Gate Transaction - automate check-in and check-out from the yard, or loading and unloading from ships. Every gate transaction is time-stamped and captured providing event management data streams. Operators can also leverage this data for historical analysis of business processes.

Telemetry - monitor container and terminal operating equipment sensor data for accident notification, preventive maintenance, driver verification, and equipment utilization.

Terminal Operating Software Interface. Interface with terminal operating software, allowing for automation and verification of clerk transactions that are currently input manually.

Security Applications - Through a definition of zones and business rules specified by the customer, the WhereNet system can trigger alarms and alerts to notify personnel of security

SkyBitz and Wherenet have integrated their respective offerings to provide a new Constant Visibility Solution (CVS) for sea containers. The combined WhereNet-SkyBitz solution provides the first a cost effective end-to-end tracking system that both decreases the costs and improves the security of containers from load to unload. This solution is commercially available through WhereNet and its distribution partners .

Security requires that any event which occurs that may indicate a threat must be immediately flagged for further scrutiny. The WhereNet-SkyBitz's solution meets this security requirement in three ways. The simplest is that the tracking is constant and omnipresent. If the mobile terminal is prevented from communicating then an alert is automatically generated (i.e. absence of a 'heartbeat' indicates a problem). Secondly, any local alarm (e.g. electronic seal has been breached) is instantly transmitted to the WhereNet-SkyBitz tag and through our wireless backhaul either to the Marine Terminals security office or to the SkyBitz Service Operations Center in Dulles, Virginia. Thirdly if the container track deviates from its assigned routing an alarm is generated. The combined solution delivers advantages in cost, coverage, power management and ease of installation which will make true sea container security a reality.

Permanent Container Seals with Constant Visibility

The proposed solution will utilize modulated magnetic sensors, and an integrated RTLS/GLS device, which monitors door openings/closings and generates unique ID numbers upon each opening of the container door. Modulated magnetic sensors are placed on the inside of the door and on the container. When the door to the container is closed, the modulated magnetic sensors engage and a unique Shipment ID number inside the GLS/RTLS device is generated. This Unique ID number, along with the Container ID itself, is then automatically transmitted either via the RTLS or GLS wireless backhaul to the port of arrival. Accordingly, if at any time during the container's journey the

RTLS/GLS device fails to “report-in” and the Shipment ID Number and Container ID number do not match, alerts can be sent. Tags can generate a pseudo random number encryption, so the Shipment ID number cannot be falsified. In addition, the system would also require proper security clearances for those looking to gain access to the look up table for the keys. If an added layer of security is needed, the WhereNet RTLS system can also “finger print” the RF transmission of each transmitting tag, making duplication of the tag impossible. The benefits of such a system are as follows:

No additional labor or training is required to set and/or manage the locking mechanism. The signature of each transmitting unit is both unique and electronically sophisticated, making false detection of other electronic devices, including WLAN's, virtually impossible. This includes attempts to intentionally create "counterfeit" tags. The system has real-time visibility of all tags, and any attempt to destroy or "shield" a tag will cause an alarm based on disappearance. Such a system is virtually impossible to defeat. Since the RTLS does not rely on entry / exit scanning, there is no exit point, including airborne or subterranean, that can be used to subvert the system. RTLS has additional features, not achievable with other surveillance systems, based on having real-time location of each tag:

- Certain tags entering or leaving protected zones can generate alarms.
- Tags can be required to be in proper association for physical proximity, movement or for entry / exit of secure areas. Usage examples here include verifying authorized individuals to handle certain assets, proper equipment attached to an asset, etc.).
- Tags connected for telemetry of the status of assets (temperature, fuel levels, proper function, etc.) can quickly be located in case of alarm.
- Container seals can be monitored indoors and outdoors, as well as in/on the hull of a ship with a single WhereNet antenna.

Temporary/Disposable Container Seals with Constant Visibility

Inherent in the ability of the WhereNet-SkyBitz tag to track and monitor the location and status of a container, can also be the ability to read the status of a temporary/disposable container seal, from any vendor. The WhereNet-SkyBitz tag can come equipped with a small reader which can occasionally “ping” the RFID tag, and transmit the data of the tag, via the wireless backhaul of the WhereNet-SkyBitz tag.