RFID for Maritime

Authored By: Ann Grackin

July 2005

Copyright ChainLink Research 2002-2005
About ChainLink Research

ChainLink Research, Inc. is a Supply Chain research organization dedicated to helping executives improve business performance and competitiveness through an understanding of real-world implications, obstacles and results for supply-chain practices, processes, and technologies. The ChainLink Inter-Enterprise Model is the basis for our research; a unique, real-world framework that describes the multi-dimensional aspect of links between supply chain partners.

For more information, contact ChainLink Research at Harvard Square Center 124 Mount Auburn Street, Suite 200 N., Cambridge, MA 02138. Tel: (617) 762-4040. Email: info@clresearch.com. Website: www.clresearch.com.
Table of Contents

Executive Summary ............................................................................................................ 1

The Challenge ................................................................................................................... 1

From Sea to Shining Sea: End-to-End Processes in Maritime ............................................. 3

Maritime End-to-End Requirements and Solutions with RFID ........................................ 6

What End-User Firms Want ............................................................................................. 6

What 3rd Parties Should Do ......................................................................................... 8

RFID in Maritime for Real ............................................................................................ 9

RFID for Real: Initiatives and Case Studies .................................................................. 10

RFID Solutions and Applications .................................................................................. 12

RFID Applications Today ............................................................................................ 12

RFID Maritime Stack ..................................................................................................... 13

Tags ............................................................................................................................... 13

Readers .......................................................................................................................... 13

Middleware ................................................................................................................... 14

Application Networks .................................................................................................... 14

Moving Above the Tags ............................................................................................... 15

RFID Maritime Solution Providers ................................................................................ 18

Savi Technology ............................................................................................................ 18

Maersk .......................................................................................................................... 20

NaviTag .......................................................................................................................... 20

WhereNet ...................................................................................................................... 22

A few New Players ........................................................................................................ 23

Services and Solutions .................................................................................................. 24

VeriSign .......................................................................................................................... 25

Governments and Public-Private Partnerships get in the Act ........................................ 25

Port Concerns ............................................................................................................... 25

Government Roles ....................................................................................................... 26

3rd Party Maritime Service Enabled by RFID ............................................................... 27

Conclusions .................................................................................................................... 28

Addendum ...................................................................................................................... 30
Executive Summary

THE CHALLENGE

Supply Chains today are global. And a huge amount of the world’s consumable products, automobiles, computers, and perishables move across the ocean. Statistics vary, but most of what you drive, see, and sit on, and the packaging of these items, travels on the ocean to get to your business or home. Globalization and the virtualization of the supply chain have increased the challenges in controlling the ocean chain. Outsourcing has replaced the exotic thinking about imports. Supply chains may be cheaper, but demanding customers still want supply chain flexibility. Products can travel on their ocean cruise from 2 to 8 weeks, eliminating many of the gains of the 1990s in supply chain effectiveness, due to technology and process improvements (from APS[1] to ‘Just in Time’, etc.)

There are many challenges associated with ocean shipping. Staggering losses (estimates are around $50 billion each year) occur due to cargo theft. Piracy (the modern Blue Beards) still roams the high seas. In addition, after 9-11, security concerns in the transportation industry have increased. New regulations and the threats of more regulations have been introduced in the process.[2]

Many enterprises are exploring and implementing RFID and related technology as a way to solve these problems. In fact, RFID has already been successfully used in a variety of Maritime business process areas and can provide real value to a global firm. RFID in Maritime is not an unproven strategy. We will discuss the trials and success.

In this report, we will address the Maritime application of RFID. We will look at:

- The end-to-end processes that span Maritime;
- The RFID solutions and applications—it’s not just about Tags;
- And the key technology providers in this growing field.

[1] Advanced Planning and Scheduling
[2] For source information and updates on these requirements go to: www.customs.gov/xp/cgov/import/commercial_enforcement/ctpat/
With each policy change and technology innovation, this disruptive technology—RFID—creates opportunities for firms to evaluate new services and new business models. Yet we must not miss the speculative nature of some endeavors. In addition, firms are able to address process change by taking advantage of large ocean carriers to not only move their freight, but to also manage their logistics. So 3rd party providers are becoming part of the technology model. RFID is looking a bit like the internet boom right now—with all the shows and advertising. The good news is that much of the efforts and technologies in the Maritime space were piloted before the hype—BW vs. AW (Before Wal-Mart and After Wal-Mart), also BH (Before Hype). RFID in Maritime is clearly a BW endeavor and many applications are already implemented. Business cases have been done, and in many cases firms have already gained value. That is not to say that the innovation is not in the fast lane. But Maritime has a credible story to tell (vs. retail) when it comes to working RFID applications.
From Sea to Shining Sea: End-to-End Processes in Maritime

Maritime Code of the People’s Republic of China

Article 68

At the time of shipment of dangerous goods, the shipper shall, in compliance with the regulations governing the carriage of such goods, have them properly packed, distinctly marked and labeled and notify the carrier in writing of their proper description, nature and the precautions to be taken. In case the shipper fails to notify the carrier or notifies him inaccurately, the carrier may have such goods landed, destroyed or rendered innocuous when and where circumstances so required, without compensation. The shipper shall be liable to the carrier for any loss, damage or expense resulting from such shipment.

Notwithstanding the carrier’s knowledge of the nature of the dangerous goods and his consent to carry, he may still have such goods landed, destroyed or rendered innocuous, without compensation…”

[By the way, there are also prison sentences from 3 to 7 years (editor’s note)].

So, do you know where your shipment is? Do you have control over your assets—really? Have you filed the right paperwork? And since your container is 7,000 miles away, can you be sure that the quality of your goods is protected?

Supply Chains today are global. And a huge amount of the world’s consumable product and hardware move across the ocean. In addition, firms are able to take advantage of large ocean carriers, to not only move their freight, but also manage their logistics. The value for 3rd parties has never been more obvious, to provide RFID and global visibility to their clients. However, in the global scene there are many entry points into process and solution improvements.

Your products are YOU! Your equipment is either making money or losing money for you every day. Your risks on the open ocean are huge. And port space is not getting any bigger. Yet more shipments are being squeezed through, creating big delays and added costs to your supply chain.

In the creation of this report, ChainLink Research conducted interviews and meetings with an extensive list of logistics managers, port managers, ocean carriers, freight forwarders and technology firms. They were excited and frustrated by the opportunities to make business improvements.
Opportunities are endless, but the cases we reviewed had a few key qualities as a core:

**Process:** They are inter-enterprise in scope. You tag it, we ship and track it, the customer ‘reads’ it. These endeavors are BIG, and required collaborations of providers as well as the user base—suppliers and customers.

**Enablers:** Leveraging the whole RFID application stack (not just tags, but multi-frequency technologies, middleware, network applications and satellite). And interestingly, technology use here is not stagnating, waiting for standards to settle out.[3]

**Performance:** Business benefits were key here. Although September 11th is a psychological presence in global trade, the reality is that the expected burden as yet has not materialized to the extent expected (as far as RFID sales go). 9-11 was not the number one compelling driver. Firms have focused on making sure that they have assessed the security risk, but more relevant to their needs is that they had an ROI associated with their business initiatives.

**Policy:** They were global in scope—in other words, they have to address trade and corporate regulations. And from a security perspective, firms have to address regulatory issues, as well as their own corporate security strategies to ensure compliance and true protection for themselves—and their customers. Successful Maritime endeavors are most often an outcome of successful public-private partnerships.

“*The Maritime Transportation Security Act instructs the Coast Guard to establish regulations requiring all vessels calling at U.S. ports to have vessel security plans. With a July 1 effective date, all vessels arriving at U.S. ports have to be fully compliant with the new International Ship and Port Facility Security Code (ISPS) and the amendments to the International Convention for the Safety of Life at Sea (SOLAS). The Coast Guard deserves considerable credit for simultaneously and successfully partnering with domestic and international industry stakeholders, the International Maritime Organization and other governments, other federal agencies and the U.S. Congress to accomplish this. The Coast Guard’s approach to the implementation of the ISPS Code and SOLAS amendments, not only faithfully implements this new international regime that the Coast Guard played a key role in creating, but it enhances maritime security through the use of a consistent, uniform international approach for an industry, which operates within the jurisdictions of all the maritime trading nations of the world. Vessels that are not compliant with the Code will be denied entry to U.S. ports. The Coast Guard regulations will ensure that every vessel has an approved security plan, designated and trained personnel responsible for defined security actions and communications, procedures for communicating with ports and other vessels, procedures for monitoring and controlling physical security and access to the vessel, and the installation of Automated Identification Systems transponders…”*

*US Senate Committee Commerce, Science and Transportation*

Many industries are impacted, and have opportunity as well, based on these changes:

- **Food**: Import focus on quality, and validation of country of origin

- **Packaging**: Finding innovative methods to ensure secure and discrete labeling and tagging

- **Hard goods**: Components and finished products through the entire life cycle through disposal

- **Soft goods**: Packaging, pricing through the retail chain

- **Pharmaceuticals**: Pedigree, quality and nontampering. Ensuring proper dispensing, delivery and disposal.

- **Ocean Carriers, themselves**: Repair, maintenance and tracking of their global assets to maximize revenues.

There are many other industries whose products sail the seas, whose fate may be managed or improved by the use of RFID.

With that said, let's delve into a deeper view of the requirements, processes and initiatives.
Maritime End-to-End Requirements and Solutions with RFID

These are still early days for RFID—in a mass scale—in most industries. Maritime applications are also early days—but the foundation, which is quite costly, is being put in place.[4] We will address these foundational investments, strategies and projects later in this paper. But first, let’s look at where the needs are.

WHAT END-USER FIRMS WANT

So, what are the fundamental business challenges and priorities that users want to address? Although security gets all the press, it does not provide the investments return that businesses like to focus on. Our survey (figure 1) shows these concerns:

- **Trace and Track:** This term has a broader context than knowing where the shipment is. Today, firms want to track the chain of custody. Who actually, physically and financially has the product? They want to dynamically manage—diverting assets to the current needed recipient. This is being tried in diverse businesses from P&G to the US Department of Defense.

Figure 1

[4] And with the recent announcement of Savi Networks, the joint venture by Hutchison Port Holdings and Savi, teaming the technology with one of the world’s largest ocean/port enterprises, the investments in the Maritime solutions are growing.
• **Supply Chain Execution** goals: Faster cycle time—even a few days less in the port, yard or on the seas—can impact operating costs, saving inventory costs as well as demurrage costs.

• **Security**: This is important to people, but many are not sure of the level of investment they should make here, beyond the basics. But who touched my product is a real concern throughout the supply chain, and is a real concern for many businesses.\(^5\) Smart cards for port or yard entry, equipment use, etc. have been deployed in many environments.

• **Brand Protection**: This concept is about both theft and quality—validation that the product is safe and well managed. Is this a "real Gucci bag" or a knock-off! There is also a growing concern in the consumer population around nontampering. Cold Chain concerns have been highlighted by the Pharmaceutical, Food and Personal Products (Cosmetics, etc.) industries.\(^6\)

Although the deftness of supply chain process, visibility and security are key, users have a growing list of stated concepts and requirements from RFID enabled applications and processes in Logistics.

---

<table>
<thead>
<tr>
<th><strong>Best in Class Requirements:</strong></th>
<th>(Table A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets in Motion</strong>:</td>
<td>Rather than a fixed warehouse location, this is a what supply chain professionals would like. So diverting assets or rerouting shipments—an expressed desire of Defense, Automotive, High Tech etc.—could be accomplished through an RFID enabled data architecture and collaborative networks. <em>This means creating data synchronization.</em></td>
</tr>
<tr>
<td><strong>Visibility and Availability</strong>:</td>
<td>Customers buy at the item level—at the component and feature level. Part of their decision to buy has to do with availability—when can I have it. That requires item-level granularity across the supply chain. <em>This means nesting.</em> We will return to this concept when we address the data structures and solutions for RFID.</td>
</tr>
<tr>
<td><strong>Process Automation</strong>:</td>
<td>The synchronization of information makes the process work—fully automated receiving (accurate receipt and routing of goods) and fully automated stock-checking (eliminating physical inventory counts, achieving 100% inventory accuracy, accurate and rapid realignments). Although many supply chain partners’ systems somewhat talk to each other, they lack high quality and truly near real-time information. Again, users, expect RFID to speed and improve the process. <em>This means Real Time Locating Systems (RTLS).</em></td>
</tr>
<tr>
<td><strong>Service and Repair</strong>:</td>
<td>Depot maintenance and material locating capabilities; material expediting. <em>This also means Real Time Locating Systems and adherence to UID policy for Defense suppliers.</em> The actual container management as well, especially refrigerating containers, need constant repair. Assets not in use lose money every day for their firms!</td>
</tr>
<tr>
<td><strong>RFID enabled Logistics</strong>:</td>
<td>Flow thru centers, cross docking, smart pallets/ smart containers/ faster more accurate receiving, shipping, auto-generation of ASN and the like. <em>This means assurance of sound implementation of various RFID and wireless devices to ensure seamless reads, communication between devices and middleware to the web.</em></td>
</tr>
</tbody>
</table>

---

\(^5\) FDA directives, as well as shrinkage ROI has been determined.

\(^6\) Read *Cold Chains are Hot* by Carla Reed, ChainLink Research: [www.clresearch.com/research/index.cfm?type=19](http://www.clresearch.com/research/index.cfm?type=19)
For each of the business requirements, there seems to be a strong and direct correlation between user needs and RFID solutions approaches.

**WHAT 3<sup>RD</sup> PARTIES SHOULD DO**

Most users (both shippers and customers), when their global logistics problems arise, turn to 3<sup>rd</sup> party partners for some or all of their Maritime solutions. From a 3<sup>rd</sup> party perspective, their goal is to increase service delivery to the customer and to increase margins by adding value and service to their customers. Waiting shipments without transportation, waiting trucks without shipments, lost containers, etc. erode profits to the 3<sup>rd</sup> party as well as the shipper.

In addition, customers are asking their 3<sup>rd</sup> party to take on the IT role for them. This need is driving huge investments in ocean as well as rail, truck and other Logistics businesses (3PL, freight forwarders, etc.) Transportation firms are in a good position to be a provider, since so many customers never see the contract manufacturer, or in any way ever touch their shipments. Some one has to see what’s going on.

---

[7] DEMURRAGE - The freighter of a ship is bound to not detain it, beyond the stipulated or usual time, to load or deliver the cargo, or to sail. The extra days beyond the lay days (being the days allowed to load and unload the cargo) are called the days of demurrage. The term is likewise applied to the payment for such delay, and it may become due, either by the ship’s detention, for the purpose of loading or unloading the cargo, either before, during or after the voyage, or in waiting for convoy.
In the response to this need, the leading enabling 3rd party firms, as well as technology firms, are making huge investments. For example:

- Savi Networks—a new entity created by Hutchison Port Holdings and Savi Technology to address the port customers.
- Maersk Logistics, never to be left out, has also been making huge investments building their own RFID and visibility hub for their customer base.
- The ports of Singapore and Rotterdam have long standing RFID solutions, deploying yard applications for Real Time Locating Systems for over 10 years.
- The DoD tags containers with active/secure tags for shipments around the globe to increase supply chain visibility, since the Bosnia mission.[8]
- Ports across Asia, the US and Europe have pilot programs[9] and deployments. (Even Air Canada is now tagging all their containers—but that is a story for another report).

RFID in Maritime for Real

So, what has been done? Although global firms look to end-to-end solutions, the reality is that, in many cases, this will be way in the future. It’s, whose end are we talking about? What is the logical starting point for visibility and the ending point for integration? There are so many instructive application areas, with a logical thought process (real application) and where true value exists—that biting off a major component of the value chain and getting started on change can provide significant improvements.

[8] Total Asset Visibility project with the Army and GTN with Transcom
[9] www.chainlinkresearch.com/research/index.cfm?topic=&industry=&type=2&free=0&search=Smart+Secure+Tradelanes+%28SST%29&imageField.x=9&imageField.y=7
RFID FOR REAL: INITIATIVES AND CASE STUDIES

We provide here both existing investments/projects, as well as positions that firms are taking to complete the Maritime RFID application space. There are three main maritime related RFID applications – Shipment tracking, Yard management and Container security. In addition, managing Inter-modal shipping and International Trade Regulations Compliance are included.

<table>
<thead>
<tr>
<th>Application</th>
<th>Description/Summary</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yard Management</strong></td>
<td><strong>Key Drivers:</strong> Increased efficiency reduced handling cost; this appears to be the initial driver of RFID programs that have some actual success stories since the 1990s. &lt;br&gt;<strong>Capabilities:</strong> &lt;br&gt;Yard solutions: &lt;br&gt;• Tag containers entering the yard are effectively put in the proper locations, and located if they are not in the right location. &lt;br&gt;Chassis can also have tags and readers to synchronize location where containers are put, as well as to identify vehicles coming in and out of the yard: &lt;br&gt;• Space allocation &lt;br&gt;• Data Collection and integration &lt;br&gt;• Yard Entry and Exit management</td>
<td>• Port of Singapore (PSA) deployed 1000s of RFID transponders into the asphalt to create a multi-dimensional tracking grid in 1993. Texas Instruments was the supplier. The Port of Singapore tracks many thousands of multi-ton cargo containers daily, and also manages arrivals and departures of up to 50 ships. PSA spent close to $910 million in 1993 on development projects. A centralized system manages the placement and location of containers. &lt;br&gt;• Port of Rotterdam: European Combined terminals, one of the largest operators of container handling systems in Holland’s massive port of Rotterdam. Buried RFID transponders guide automated guided vehicles (AGVs). Deployment began in 1990 using Texas Instruments technology. The new automated terminals achieve a much higher efficiency than its manned counterparts. All container transfers are controlled by automated guided vehicles, and unmanned bridge cranes carry out stacking operations – all without human intervention. &lt;br&gt;• SSA Marine, a large, privately held container terminal operator and cargo-handling company in Seattle, is deploying the WhereNet wireless Marine Terminal Solution at four West Coast ports this year. “The goal is to help ports handle as many containers as possible.” &lt;br&gt;• NYK Logistics at Long Beach has deployed the WhereNet® real-time locating system and WhereNet yard management solution to help manage more than 50,000 inbound and 30,000 outbound ocean freight containers.</td>
</tr>
<tr>
<td><strong>Container Security</strong></td>
<td><strong>Key Drivers:</strong> Security, Financial Loss, Government Compliance &lt;br&gt;<strong>Summary:</strong> Large number of recent projects driven either by vendors trying to prove solution viability or by government funded projects &lt;br&gt;<strong>Government Initiatives:</strong> &lt;br&gt;• U.S. Customs and Border Patrol (CBP) &lt;br&gt;• Container Security Initiative (CSI) &lt;br&gt;• Customs Trade Partnerships Against Terrorism (C-TPAT) &lt;br&gt;• Operation Safe Commerce (OSC) &lt;br&gt;• Secure Trade in the APEC Region (STAR)</td>
<td>• Asia-Pacific Economic Cooperation (APEC) launched a program in early 2002 to focus on Secure Trade in the APEC Region (STAR) and promote the efficient and secure movement of goods across borders. The first STAR initiative, STAR-BEST (Bangkok Laem Chabang Efficient and Secure Trade), served as a demonstration project that tested concepts and technologies for implementing a supply chain security system. The project affixed RFID sensor seals then tracked containers throughout their route from Laem Chabang, through ports in Taiwan and Korea, and on to the Port of Seattle, using a real-time, web-enabled software application developed by Savi Technology. After arriving at the Port of Seattle terminals, the containers were discharged from the ships and the e-seals checked before the containers left the premises. Next, they were sent to their final destination point where operators with hand-held computers verified the containers’ origin and contents. &lt;br&gt;• NYK Logistics at Long Beach (see above)</td>
</tr>
</tbody>
</table>
## Container Security

- **Maritime Transportation Security Act (MTSA)**
- **International Ship and Port Facility Security Code (ISPS)**
- **Smart and Secure Tradelanes Initiative (SST)**

Hi-G-Tek, EJ Brooks, and Savi Technology were part of an independent six-month study conducted by the CHCP, a public-private partnership organized by the US DoT’s Maritime Administration (MARAD) and industry members from transportation companies, terminal operators, port authorities, analysts, and technology providers.

- **Operation Safe Commerce (OSC), a Public/Private Partnership.** A U.S. Transportation Security Administration initiative done in conjunction with private sector companies—tracking from South America containers which were then sealed with container seals. As the containers traveled by truck and then by ship through the supply chain, they were tracked with RFID transponders and GPS satellite tracking.

- **Smart Secure TradeLanes:** Hutchison Whampoa Ltd. (HWL), PSA Corp. Ltd., and P&O Ports, which together operate 70 percent of the world’s ports, as well as Savi Technology. The Port Authority of New York and New Jersey also signed up as a participant in the program.

## Intermodal

**Drivers:** Supply Chain efficiencies; productivity  
**Capabilities:** Direct and track containers and transfer between modes, through the port:  
- They can validate/match shipments with transfer and transfer/shipping instructions and track the process. They can transmit status as work is completing, and time/date stamp a shipment as it leaves the port.  
- This tracking can be done by mobile readers as well as by GPS.  
- In addition, semi-active monitor tags can be placed in the containers or pallets to monitor containers.

**Ports:** Seattle, Tacoma, Long Beach, Singapore, Hong Kong, Charleston, etc. all have huge intermodal capabilities with RFID in play at various stages.

## Compliance

**Capabilities:** Active tags can contain significant data about the shipment as well as link to the network application that has all the appropriate shipping information. All information about the shipment and the validation can be done automatically.

Shippers like HP and Bose use NaviTag to link their shipments to ITL document management capabilities in the NaviTag network application.

## Logistics

- **Pick/Pack/Ship**  
- **Inbound receive/uncrating/validations/putaway, etc.**  
- **Tracking/pallets**  
- **Spare Parts Logistics**

UPS Logistics, APL, Maersk, etc., are doing these activities as well as end customer applications in global firms.

← cont. from, Table B
RFID Solutions and Applications

RFID APPLICATIONS TODAY

Solutions: today and tomorrow

Solutions are on an evolutionary trail. As more intelligence gets put into devices—especially readers and other local systems, more functionality will be housed in the myriad of devices. Today, devices perform basic reading and alerting capabilities, but not much else. Since the move of ‘readers’ from beyond the four walls applications (out of the warehouse) the need for great intelligence in readers will grow—security, authentication, data validation, operator instructions, and real business applications.

Sites implement a wide area network, wireless access points to integrate to the Internet. (In time, think about smarter access points that can handle more than just signals, but can handle data management functions as well.) In other words, instead of readers transmitting data within the facility to the warehouse system, they will be able to send the signal to the Internet, for example, by-passing the traditional approach to procuring and implementing software. This capability, over time, will have a profound effect on the software license business, since it reduces the need for multiple software licenses (site licenses) for applications like WMS\[10\]. This transformation will take several years, though. Expect Cisco, who of late has been messaging themes like “RFID Enabled Network” and “The Intelligent Network”, to add value here. Cisco’s ubiquity in the internet, wireless and corporate markets could have a profound effect on the future development of RFID in the enterprise, as well as beyond the four walls.

Enterprise Application Integration (EAI) software, which was built to connect business applications such as planning and ERP, is going through changes now, as these vendors push their RFID solutions. Scale is key, but these vendors also need to add value beyond routing transaction data.

The application market for RFID enriched applications is quite new. The traditional application stands to benefit by higher quality data, but RFID also opens the door for many new views of understanding customers, environments, processes and employee performance, especially on the local level.

RFID solutions fit into a matrix of business application and processes, as well as their unique technologies. And supply chain operators understand the integrated value of a global view. RFID data will probably tax the current infrastructures due to the speed of transactions and the increased number. Beyond the infrastructure upgrades (readers, routers, etc.), software upgrades might be expected due to their lack of an RFID nested data model and ability to scale. Users are beginning to learn about this issue in their pilots.

\[10\] Warehouse Management System
Having said these opening remarks, let’s look at the stack that you need in Maritime.

**RFID Maritime Stack**

The RFID market can be looked at from a technology view, as well as a solution view (Yard, Container Security, etc). Industry requirement (aka Gen 2 standards, ISO, etc.) will also impact the technology. So, the best way to view this is to look at the technology stack.

<table>
<thead>
<tr>
<th>Tags</th>
<th>Readers</th>
<th>Middleware</th>
<th>RFID Networks Applications</th>
<th>Complementary Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold the Data:</td>
<td>Fixed</td>
<td>Reader management</td>
<td>Referential item information systems for passive data (ONS and other)</td>
<td>Closed Loop:</td>
</tr>
<tr>
<td>Active Tags:</td>
<td>Hand-held</td>
<td>Filter and aggregate</td>
<td>Document Libraries such as trade documents</td>
<td>• Warehouse/Inventory</td>
</tr>
<tr>
<td>Monitoring:</td>
<td>Mobile/ Read/ Write and Transmit</td>
<td>Publish subscribe data from routers, applications, web and air</td>
<td>Hosting and RFID enabled business application</td>
<td>• Store Operations</td>
</tr>
<tr>
<td>Passivity Unique ID</td>
<td></td>
<td></td>
<td></td>
<td>• Mfg/MES Kanban, MES, etc.</td>
</tr>
<tr>
<td>(EPC code or UDI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Rich multi-frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensing/Bio Metrics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Tags</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td></td>
<td>Reader management</td>
<td>Referential item information systems for passive data (ONS and other)</td>
<td>Closed Loop:</td>
</tr>
<tr>
<td>Hand-held</td>
<td></td>
<td>Filter and aggregate</td>
<td>Document Libraries such as trade documents</td>
<td>• Warehouse/Inventory</td>
</tr>
<tr>
<td>Mobile/ Read/ Write and Transmit</td>
<td></td>
<td>Publish subscribe data from routers, applications, web and air</td>
<td>Hosting and RFID enabled business application</td>
<td>• Store Operations</td>
</tr>
<tr>
<td>GPS</td>
<td></td>
<td></td>
<td></td>
<td>• Mfg/MES Kanban, MES, etc.</td>
</tr>
<tr>
<td>Sensing/Bio Metrics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Tags</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td></td>
<td>Reader management</td>
<td>Referential item information systems for passive data (ONS and other)</td>
<td>Closed Loop:</td>
</tr>
<tr>
<td>Hand-held</td>
<td></td>
<td>Filter and aggregate</td>
<td>Document Libraries such as trade documents</td>
<td>• Warehouse/Inventory</td>
</tr>
<tr>
<td>Mobile/ Read/ Write and Transmit</td>
<td></td>
<td>Publish subscribe data from routers, applications, web and air</td>
<td>Hosting and RFID enabled business application</td>
<td>• Store Operations</td>
</tr>
<tr>
<td>GPS</td>
<td></td>
<td></td>
<td></td>
<td>• Mfg/MES Kanban, MES, etc.</td>
</tr>
<tr>
<td>Sensing/Bio Metrics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Tags</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Later we will review the major players and what they provide.

**Tags:**

By now you should have a basic definition of what a tag is. But what many people don’t include is active tags. These devices can be many frequencies (not just Gen 2, 915 MHz, the so-called passive tag). Longer range Tags like 433 MHz (as well as 802.11/2.4 GHz) can be used in yard, warehouse or repair depot environments.

Trace and Track of shipments require long range devices. Most users will need a combination, where tags talk to tags, cartons to container devices, or sensor to GPS.

Since many customers require Gen 2 on the carton and container, you will be addressing multi-tag solutions in Maritime.

**Readers:**

Again, most readers of this report understand the differences between fixed and mobile devices. The one point that we want to make is that readers will get more application specific and in general more intelligent as developments move along. Most readers have lots more real estate to put more intelligence on the device.
Middleware:

Although ChainLink embraces the need for middleware, the RFID specific translation of RF transmission into application readable transactions (as well as device management), we think that this need will ultimately be met by both smart readers, as well as by routers (and smarter access points) that will be introduced into the market. The router will be able to capture voice/video/RF and provide a single IP platform for the enterprise. This will aid the CIO with fewer moving parts and lower costs for the overall Telco/Internet budget.

There are a handful of pure play vendors in this space. Although they are not considered specifically Maritime in scope, we might as well mention their names here: Acsis/DataPass[^11], ConnecTera, GlobeRanger, and OatSystems. Each has taken a slightly different approach towards solving the middle issue, so it’s worth looking at each firm if you need to buy an independent middleware (odd as that sounds) solution.[^12] Savi also has middleware called SmartChain. Several years ago they proactively got a standards effort going with their partners to ensure a heterogeneous capability among vendors to integrate within the community.

Middleware is also often embedded in many complimentary applications like Transportation, Trade and Warehouse management, Store Operations and ERP. And traditional EAI vendors (enterprise integration like TIBCO, webMethods, IBM’s WebSphere, BEA, etc.), have embedded RFID specific code into their existing applications.

Application Networks:

We group VeriSign (ONS) and Savi (a rich hosted RFID solution) in the Network bucket. Either web or satellite access to the application rules here.[^13]

These concepts are really in the early phase of understanding by the business community at large, although there is a well developed foundation in web-based communication. Once users understand the simplification equation here—implementing RFID and at the same time connecting to a logistics network—they become very intrigued by the concept. IT also sees the value in reduced hardware infrastructure management challenges and cost. In addition, convergence on IP networks (aka voice, video, wireless and RF) will simplify the view and reduce the total cost of ownership in the virtual world.

Networks are an essential layer of the RFID stack to provide the Data Synchronization that is one of the key goals of RFID programs. And in Maritime, the global process that cares for container security has got to have at its core an independent multi-enterprise solution to trace, validate, track, alert, etc. across the chain.

[^11]: Only for SAP users
[^12]: Catch the Parallax View Vol. 3, No. 5 on RFID Middleware: [http://parallax.chainlinkresearch.com/issues/03_05.cfm](http://parallax.chainlinkresearch.com/issues/03_05.cfm)
[^13]: Read On Demand Now, CLResearch’s report on hosted and on demand solutions: [www.clresearch.com/research/index.cfm?type=19](http://www.clresearch.com/research/index.cfm?type=19) as well as Parallax View for many writeups on Networks
**MOVING ABOVE THE TAGS**

With all the AW\(^{[14]}\) noise in the market now, many firms can get lost in the noise. Maritime uses the whole stack of technologies that we have discussed to accomplish its tasks. In Maritime, the reality is that there are a few providers of note. And the good news here is that they are willing to provide a whole stack of solutions for their clients.

For buyers, focusing on what problems you are solving, what questions you are asking of the system, or what information it is providing, is the key to understanding a solution.

**Another View of the Stack**

Referring back to the list of user requirements (table 1, pg 9), the key for RFID in Logistics in the future will be to get *within* the shipment, i.e., to provide visibility. Today, 3\(^{rd}\) party and most enterprise solutions are not able to bridge between the shipment levels and link into the item level information. These types of capabilities are required—not desired—by the global leaders.\(^{[15]}\) This requires an understanding of the data model.

---

\(^{[14]}\) After Wal-Mart

\(^{[15]}\) The US Department of Defense UID strategy

[www.chainlinkresearch.com/research/detail.cfm?guid=D7D38A76-BDF6-40AE-B52C-E86D76C903C1](http://www.chainlinkresearch.com/research/detail.cfm?guid=D7D38A76-BDF6-40AE-B52C-E86D76C903C1)
The term for this is Nesting. Nesting is a data architectural approach (figure 4) that allows multi-dimensional views of the data. Traditional integration cannot provide this, since there are many systems moving in and out of fire walls to integrate, and multiple data structures to deal with.

So users need to think about what process they will deploy, what question they need answered, and therefore what data they will need the system to have access to. The deployment of Service-Oriented Architectures (SOA) is critical for firms in order to get access to their world. They also need to think through how Data Synchronization techniques[16] should be employed and deployed into their firm. Data Synchronization enables many of the business requirements in brand protection and supply chain execution.

Network applications will rule the high seas. Networks enable data synchronization, since they allow multiple firms to access one source of data, creating a single version of the truth (SVoT).[17]

[16] Aka VeriSign, EPC-IS, etc.
[17] See upcoming report on Data Synchronization by Carla Reed from ChainLink Research

Figure 4
In addition, the adoption of network applications means that users do not have to install and manage IT hardware onsite to manage applications. Integration with powerful devices will allow direct communication between sites and applications, and, in many cases, eliminate the need for local servers to manage applications like locally installed WMS. This, in turn, will allow users to reduce the total cost of ownership of these applications.

As firms use Network applications for transportation and RFID, they are getting quite sophisticated about asking for the multi-dimensional integration. Aerospace visionaries, for example, talk about planes proactively diagnosing their problems and signaling their destination locations to provide parts and services upon arrival, then getting them back in the air! Clearly, no longer can a stovepipe approach work here!

In all cases, though, RFID in Maritime is about stack solutions—devices communicating between devices, devices to software, software to satellite, software to internet.

Futuristically, the explosion in interest and demand will allow innovative firms to develop new and more powerful solutions fairly rapidly. Not only the technology will evolve, but also, as technologies get adopted, the prices of devices will drop.
RFID Maritime Solution Providers

There are a few key players who have well reasoned solutions with genuine case studies. Maritime applications, due to the multiple subscribers to the data, will be dominated by network providers, just as the transportation market is for transportation planning and scheduling. There are a stack of devices, as we mentioned before, and most of the vendors (below) will provide the data collection, some middleware at minimum (see comparison chart on page 24), and help you to create a solution.

SAVI TECHNOLOGY

Savi is the obvious leader in the RFID enabled network. Although many people in the market think about Savi tags and readers, the real power and value that Savi brings is the network application that brings the globe together. Savi has been building this infrastructure for several years, implementing with rich revenue sources—both commercial clients and the US Army. Savi has been involved in several public-private partnerships and new joint ventures like Savi Networks LLC[18], as well as consortia like Smart Secure Tradelanes (SST).[19]

Savi also has customers in the retail sector that extend the Savi solution through to consumer oriented applications, ensuring Electronic Product Code (EPC) integration. So, Logistics, Defense and Retail can all be supported—on a global basis.

Savi took the approach to build a nested data model, so that they can aggregate/disaggregate from the shipment all the way to the item. This gives Savi a distinct advantage to build not just a tag and reader company, but a real business solution. This allows them to deal with multidimensional business problems—correlating issues between various business stovepipes. Savi produces ‘data rich’ active tags, coupled with partnerships for passive and other Automatic Identification Technology (AIT) devices such as sensors, barcodes and satellite tracking systems for in-transit visibility. This allows Savi to deal with all types of RFID tagging, tracking, and tracing applications throughout the whole chain.

A key requirement in many Logistics processes is to identify and divert assets in motion. This is a key desire on the part of the Secretary of the US Army, to make them more agile and able to respond to demand—not unlike a retailer. Without visibility to what’s on the ship, or in the container, etc., this kind of responsiveness is not possible.

[18] Formed between Hutchison Port Holdings and Savi Technologies

[19] For more on SST: www.chainlinkresearch.com/research/index.cfm?topic=&industry=&type=2&free=0&search=Smart%20Secure%20Tradelanes+%20SST%20&imageField.x=9&imageField.y=7
Savi’s architecture takes a different approach than the other network providers—using a more ‘federated’ or distributed approach. The reference data is also distributed, which creates a high performance, scalable, fail-safe environment.[20] They also have championed a common data standard for device vendors, Universal Data Appliance Protocol (UDAP), which is inclusive of diverse frequencies, as well as industry standards. Part of what Savi can provide—and has also addressed—is security between the devices' layers, tag to reader to servers, etc. Most of the other general network applications (hosted business solutions) were not designed around an RFID core, so they have little capability—actual knowledge—about how this should work. This gives Savi a lead.

What they offer:

Savi is a technology stack and solution provider and has been in the business long enough to have a product for all seasons, so we don’t want to do a huge list here. But noteworthy is:

- Global network solution that is accessible over the internet, satellite, etc. In Savi language, their SmartChain solutions include a middleware platform that links with networks of choice, including Savi’s, as well as transportation security and asset management applications. This is a distributed model, so it scales globally. Their architecture is inclusive of EPCglobal Network.

- Tags and reader—the EchoPoint family, dealing with active and passive solutions.

- Savi signposts, a key product family of signposts (fixed readers) can be used both in yard, warehouse, and in extreme circumstances. Savi also has a mobile satellite reader that can fit in a briefcase and move down the line with the troops. This need for setting up mobile ‘posts’ in fixed locations is a problem not only for the military, but also for businesses like mining, exploration, remanufacturing and repair.

Savi is at the core of the Smart and Secure Tradelanes (SST) network, the largest industry-driven initiative to improve the security and efficiency of transporting containerized cargo that extends to 16 seaports worldwide, including six of the ten largest. The SST rollout should give Savi an explosion of transactions to manage—and more revenues.

Savi certainly has the market attention and power at this time in RFID to make the TMS vendors ‘bow to their presence’, viz a vie potential partnership models to provide RFID, International Trade, Yard applications and rail/ground extensions to their platform.

One wonders what the Transportation network vendors will do here!

[20] Savi, GT-Nexus, Verisign, etc. use this approach.
**MAERSK**

Maersk Data is the only organization who is not a player today, who could mount a grand entrance for the international trade business. Maersk originally bought technology from Vizional Technologies to provide a scalable distributed data architectural foundation needed to initiate such a project. Maersk Data, though, got sold to IBM, and it appears that both Maersk and Vizional went their own way. The original development work between Maersk and Vizional was to support Operation Safe Harbour.

Maersk Data has now taken on the on-going development and enhancements to create a hosted/network application for Maersk Logistics components of the solutions—specifically RFID enabled middleware/integration. Although Maersk has been working on a solution capability that includes the stack, we really feel that this is still very much in development. They have the capital to do whatever they want, but even for the mighty Maersk, the investment required to build these solutions is daunting! We thought that with the Maersk muscle, we would see more. But don't count them out!

---

**NAVI TAG**

RF engineers know each other. This small but growing community of players—many of whom have worked together—wind up being CEOs or founders of cool companies. NaviTag is a good example, with a founding team that has deep roots and know-how in RF technology.

NaviTag provides Secure Supply Chain solutions to commercial and government shippers. This includes end-to-end real-time tracking and security monitoring of shipments in-transit anywhere in the global supply chain. They also provide wireless biometric smart cards, anytime web access to shipment data, and validated authentic shipping and trade documents online. Although NaviTag has customers in many verticals—high-tech, Defense, Electronics, Homeland Security, US Government, Consumer Electronics, Specialty Chemicals and Retail providers; their applications focus on the shippers’ concerns—cargo tracking and container security, as well as other Secure Supply Chain capabilities.

NaviTag has several NaviTag innovative products. Customers can engage at multiple levels—purchasing devices, as well as integration and visibility of RFID through the NaviTag

---

[21] Vizional is still trying to stay alive in the RFID middleware market.
portable satellite data gateway. So, whether you are dealing with personnel security (smart cards), container security (active devices), or paperless trade (online shipping documents), NaviTag has a stack of solutions to help shippers save money and comply with new US Customs requirements.

We haven't given much space to activation units or the use of PDAs in the Maritime Solution. But these handy multi-purpose devices are becoming ubiquitous in the supply chain. These devices, though most often seen in personal or ‘mobile office’ environments, become a standard component of most yard applications, allowing users to read and write to tags and perform other IT functions. So your implementer naturally has to have the skills to program logic into the devices. This is quite common in many mobile application environments, which you see everyday, from home service, delivery, retail and other logistics applications.

Another thing to note at this point is the use of global satellite carriers. These capabilities are also part of the everyday working arsenal of a global logistics application. Used every day across the oceans and continent by the world’s largest logistics firms, these approaches are well established. NaviTag uses established global satellite networks such as Argos and Iridium that carry your global transaction to the NaviTag secure Datacenter, and then push the information out to your enterprise. Users need only a browser to access their shipment data. It is amazing how digital burst technology, first developed by the military, has transformed satellite communication to an affordable everyday solution.

So, what do they provide:

The *self-contained NaviTag*. The reusable NaviTag is designed to be attached to any carrier-supplied ISO container or trailer without modifications. Its design includes a transmitter, antenna, locking mechanism, and door and light sensors into one single, rugged package.

*NaviTagView*. As we have mentioned repeatedly, the real heartbeat of these applications is the global information communications capabilities. There are tags galore (and more coming everyday from Korea, China, etc.), and the prices will get lower and the choices richer. Few have global remote reporting capability such as NaviTag. However, having one player who can ensure a total solution still is a very attractive option for shippers and their customers. NaviTag provides global coverage and avoids the spectrum license costs of local or regional wireless solutions. NaviTagView also creates an online library of shipping and trade documents so that users can access and collaborate with paperless transactions to cut costs and comply with secure trade regulations.

*Activation Unit*. As we mentioned before, these are PDA devices, in this case from Palm, that has been programmed for use by their customers.
The Tags. NaviTag offers a whole range of products. But the big star is their active remote reporting tag with security sensors that monitors containerized cargo in-transit. So if some one attempts to open the container or break in by cutting through the walls, the NaviTag automatically sends an alert message to the NaviTag Datacenter through its global satellite network, and then onto users by email, FAX, SMS or by XML link.[22]

It’s like how you get your cell phone and cell service. Devices and their communication protocols are industry standard, inexpensive, get activated easily, and go to work. Start-up costs are extremely modest, and firms can start small and grow.

What is interesting about NaviTag is their capability to provide intermodal Maritime solutions in an easy to adopt and cost affordable way. A customer can start with a few active tags on their ocean containers in a pilot program that includes global satellite coverage, and expand to cover all their secure supply chain needs. We found this approach to be non-intimidating for firms who are not sure what they will do—and who will do it for them. This is a good approach for anyone. But for small shippers, it seems like the way to go. Maritime for the Masses!

WHERENET

WhereNet specifically provides Real-Time Locating System (RTLS) technology, offering capabilities for several application areas, including yard and asset tracking in many industries. The company also designs and develops its own branded hardware. So, they support functions like locating containers and managing the flow in a port, yard, etc., or tracking expensive assets for large equipment/industrial operations.

What many people don’t understand when declaring that the ‘price of tags is high’ is how it relates to the functions they are performing, the value it is adding.[23] For example, tracking very expensive and fragile products. Or the revenue your equipment earns for you (where is that machine when we need it.). If you look at the savings or the revenue earned, then deploying active tags in many environments might actually add value and make money for the firm! You got that, readers?

[22] We have only seen this approach from Savi and NaviTag
[23] Tag prices should be amortized over the life of the device and number of uses, as well.
So, companies like WhereNet can bring this kind of value to a firm. Asset tracking makes money for firms. It’s not just about passive tracing and tracking concepts. In a yard application, you not only can get locating ability, but you can be proactive about where you put your containers (aka parking assignments), manage moves, automate the data entry/collection (as assets enter and leave the yard), and update the whole string of IT systems that rely on up-to-date supply chain information.

So inventory management, product validations, managing quality, the conditions of the container and the yard can all be done by such an implementation. There are lots of yards out there that have yet to implement. And many ports are in some form of disarray. So there is large growth potential. Again, there are strong benefits associated with these applications such as reduced cycle times through locating and managing the entry and exit process and increased utilization of the yard. There is one thing about ports; they are the oldest real estate locations in any nation, and big cities have usually grown up around them. In other words, they will be hard pressed to get more land. So utilization is the key value proposition.

The WhereNet Offering:

WhereNet provides a stack solution—tags, readers and software—that integrates into locating access points (WhereLAN). These access points, naturally, are an industry standard. So, if you are using non-WhereNet devices for two-way mobile data communications (highly likely in a large port), you can still be ‘connected’. WhereTags and WhereLAN locating access points create a real-time locating system (RTLS) environment.

A FEW NEW PLAYERS

Many new players are getting into the act. With Cell phones, PDA devices (readers) and 433MHz devices (Tags), you too can set up a yard or global visibility solution. And with China emerging as a world electronics leader, as well as hosting some of the largest ports in the world, you can expect the emergence of Chinese solutions.[24]

But closer to home, we have vendors supporting the logistics market like Vizional, Avante, Altobridge, Ingersoll-Rand.[25] Sensor technology has only begun to be thought about. Technologies are in the market, but with many more in the lab waiting to be launched. As standards and awareness increase, expect to see more firms jump into this market—especially from Asia.

[24] Stay tuned later this year for ChainLink Research’s report on China and RFID.
Comparing the majors:

A concluding look at these providers will highlight how Savi has become the dominant player in Maritime RFID. Figure 5 represents a comparison of the key vendors discussed in this report.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Savi</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ●</td>
<td>There are ~60 Operation Safe Harbor initiatives that are integrating to the SST program — Tags, Readers, Middleware, &amp; Network.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maersk</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>Maersk’s goal is to be an Integrated provider using their hub to provide end-to-end services. Yard/Intermodal makes sense.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VeriSign</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>ONS capability at this time / But may gain Retail connectivity from Mfg in Asia. Would make sense that they could create item level to shipment data connectivity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NaviTag</td>
<td>● ● ● ○ ○ ○ ○ ○ ○ ○ ● ● ●</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>● ● ● ○ ○ ○ ○ ○ ○</td>
<td>NaviTag can sell tag/reader as stand alone or connect with their DataCenter product.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5

There are key vendors who provide devices like Intermec and Symbol who have a real role to play here, and users can readily substitute their devices (tags, readers, etc.). But for this report we focus on the ability to provide end-to-end as a core tenant in the solution.

**SERVICES AND SOLUTIONS**

No discussion today would be complete without mentioning VeriSign.
**VERISIGN**

VeriSign will have a major role to play in the global RFID game. VeriSign was selected by EPCglobal to provide item level data synchronization enablement. Pilots are in progress. We believe that VeriSign is a true global secure firm that is most likely to succeed at interoperable, global secure data synchronization.\[26\]

The question is: will EPC-IS become adopted, which is a big question from the consumer retail applications, and may not be as big a deal in the Maritime Space. There is a need for a utility player who can connect various eco-systems, an opportunity in the Maritime area, since everything passes through a port! Linking across are the electronic components destined for automobiles, computers, or home electronics. Examples abound, where communications, trace and track, life cycle management, customs, etc., and connection with end customers—all flow from a single shipping container. VeriSign capabilities can be accessed through Savi, WhereNet, Transportation or Exchange players.

**Governments and Public-Private Partnerships get in the Act**

It is clear that many Maritime solutions are so huge that they are built over many years, and/or require public-private partnerships to really work. Or large units of the US government can build them. In this report there are several RFID network solutions in industry and government, but we are only addressing Maritime approaches.

**PORT CONCERNS**

- *Competition:* Today’s ports represent large investments over time. And there is growing competition here to use their port as your port of entry to the trade block, such as Normandy vs. Rotterdam or NY vs. Charleston.
- Competition addresses the speed, ease and convenience of getting out of the port. Ironically, it costs billions to build a port, but its over-riding goal is to get out of the port as quickly as possible!
- *Host Nation’s economy:* So the stakes are high for the nation\[27\]—not just for the port operator. If you look at a map, you can begin to understand the options for shippers to get their goods into local trading markets.
- *Security:* Theft, terrorism.
- *Compliance:* Managing regulations.
- *Environment:* Pollution, damage to the environment, equipment, etc.
- *Equipment:* Care and repair.

\[26\] For more information on Data Synchronization and Demystifying ONS, read: http://parallax.chainlinkresearch.com/issues/03_04.cfm

\[27\] Stop at my coffee shop for your cup of Joe, before you get on the road from France to Italy!
These are top-most in the minds of port operators, carriers and shippers. We could write a book just about ports!

**GOVERNMENT ROLES**

The work of governments is highly integrative between agencies as well as with partners, these days. At least that is the goal. So, for example, there are many RFID/Maritime applications in Defense moving goods and troops through ports, onto the high seas and into their ‘markets’.

Then there are the Public-Private Partnerships to fund pilots, make sure that their technology works in their environments (frequencies etc.) and enable the attraction of business! For example:

**METI RFID Maritime Pilot:**

The Japanese Pilot funded by METI (Ministry of Economy, Trade and Industry) under Japan’s International Trade Field Trial are aimed at using RFID enabled solutions for major shippers moving products to and from Japan and other ports in the United States, Europe and Asia. Mitsui was selected for this pilot and has worked with Savi and Fuji/Xerox to manage the trace/track and container port security out of Japan and into Hong Kong and on the way to the market place.

The product-filled containers were certified and electronically sealed by authorized personnel at their point of origin at a warehouse in Japan. From there, they were tracked using the RFID enabled solution at key checkpoints while transported by truck to the Port of Yokohama. Ocean vessels then transported the containers to the Port of Hong Kong, where trucks routed the shipments to an inland distribution facility, where the containers were electronically unsealed by authorized personnel.

This leads us to a discussion on the 3rd party roles in RFID.
3rd Party Maritime Service Enabled by RFID

Especially with compounding end-customer requirements, enhanced regulations, etc., brand firms, who outsource or manufacture overseas, do seek their carriers and 3PL/LLPs to provide more value added services. We have covered some of these concepts already in this report.

IT services have become a larger and larger component of the leading firms. And customers are looking for guidance and leveraging of the 3rd parties’ scale as well as local presence provided by their 3rd parties. How do 3rd parties make money in this market?

Early markets strategy:

- This includes education, process knowledge, design, and consulting.
- **Implementation:** This includes integration, bulk purchases of equipment (tags, etc.) and operations.
- **Security management:** Both information security as well as physical security.
- **Data Management services:** Data assurance, data entry and data base management.
- And larger opportunities to acquire deals since your service offerings have become larger.

Small and large global firms look more and more to their 3rd party providers who have capital, scale, both IT and logistical connectivity, to provide a variety of end-to-end services for them. And as the most powerful companies in the world (aka Big 5 Retailers, Big Electronics Firms, Big 4 Aerospace and Defense Firms etc.) pile on more compliance, firms are generally unable to address the myriad of regulations, compliance of B2B, logistics activities and information technology requirements.

The largest Maritime firms have the access to markets and capital to provide these end-to-end services. (See what it cost in the conclusion on the next page.) And that is huge!

Logistics services have become so much in demand[28] that even firms that had very little expertise in logistics—specifically the Aerospace/Defense sector such as Lockheed, Northrop Grumman and Raytheon (to name a few)—have now started logistics businesses due to this increasing demand for logistics. We are already seeing the emergence of RFID enabled service there. The largest pallet management firm in the US—Chep—has built an RFID network with GlobeRanger to track their pallets with tagging. This represents a new thinking of the value propositions for customers, and thus a new business model. And new firms like Hunter Paine Enterprises have composite material pallets that can meet FDA, cleanliness, recyclable and various quality and endurance standards also embedded with active technology.

[28] US 11% spend on Transportation and related growing, as well as outsourcing more manufacturing overseas.
Conclusions

Interest and investment in the Maritime RFID space continues to grow. The eco-system is unique, as compared to other types of solution communities. There are lots of hardware players, a few 3rd party providers, but only a few key major Maritime whole stack solution providers who will manage your solution from Sea to shining Sea.

Some shippers and their customers will buy many of these solutions from 3rd party players. That is not to say that users shouldn’t directly reach out to domain leaders (like Savi, NaviTag, WhereNet, etc.) to create business solutions for them. But users can build their own solutions or access these vendors’ technology through 3rd parties.

As we have mentioned repeatedly, the real heartbeat of these applications is the global information communications capabilities. There are tags galore (and more coming everyday from Korea, China, etc.) and the prices will get lower and the choices richer. They will generally not be the differentiating factor in your choice of a Maritime application partner. However, having one player who can ensure a total solution is still a very attractive option for firms.

Creating and managing complete solutions for a global enterprise takes partnerships between these players. Robust technologies, port managers and shipping firms have to make huge investments in order to create this capability. These are not investments for the faint hearted.

So what will it cost?

MACRO PICTURE

If we look at what other endeavors have cost to build, we can get a concept of the cost involved. A lot of leverage and convergence plays out here with Public-Private partnerships that go into a port solution. A concept that might be instructive was the $2.4 billion Alameda Corridor at the Los Angeles and Long Beach, California ports, where federal, state and local governments collaborated with private transportation enterprises to fund and build an impressive intermodal infrastructure system. The completed Alameda Corridor, opened in April 2002, greatly reduces port congestion, lowers port and shipper/carrier operating costs, and makes security measures more effective. Ultimately, the returns are there for the economy and the participants—but it is daunting to think about this! Globalization makes economies interdependent, but that also exacerbates security and protectionists’ concerns. This means that it’s in everyone’s best interest (beyond a regulatory stance) to invest in creating these environments.
Singapore, China, France, the Netherlands and other governments, of course, have similar investments to enable commerce through state of the art ports.

BUILDING AN RFID MARITIME SOLUTION NETWORK

In order to create the dream solution, the cost is somewhere north of $250M. If you look at the base capital to launch Savi Network, around $150M, investments made by people who know this business well, and already have plenty of product to leverage into the business, you can start to understand, not only what an end-to-end platform can cost, but begin to think, as a shipper, about the breadth of service that can be provided to your global firm by signing on to a solution like this. These can link to your transportation network provider (such as GTN Portal) through integration. There is huge value in there!

SOLUTION VALUE

End-users and port operators need to address the ROI associated with the issues that we discussed earlier (figure 1, page 6)—trace and track, asset utilization and deployment, space utilization, quality, security and supply chain. Security will never be enough of a driver for most business users to create a large investment. There has to be, and is, a supply chain value proposition for users. This technology can be rolled out in measured ways for users.

WHERE WILL IT ALL GO?

Stronger signals, smarter devices, more device players and more 3rd party strategies. Scientific inventions in longer battery life, with more friendly effects on the environment, nanotechnology creating devices that hold more intelligence and at the same time require less power—all these and more will soon be seen in this market.

WHAT SHOULD YOU DO?

Shippers and their customers have great options. 3rd parties are learning. We do not believe that firms should abdicate the management of end-to-end tracking. Port managers and ocean carriers, though, are getting into tech, especially RFID in a big way—but their span onto dry land is limited. So if you’re looking for global synchronization, global visibility, you will need to turn to a unique technology player, either in partnership with a 3rd party, or with one of your own. Ultra large firms tend to design their own hubs, but for the rest of us, reaching out to these types of firms is the way to go. These projects, for users, take some time to truly roll out. Starting out in a simple way can be done with the firms we discussed in this report. Get beyond the hype and do some of your own learning, through piloting. RFID today is as much about art as it is about science.

And art is such a personal thing!
Addendum

Vendors listed in this Report:

Acsis - pg 14
Altobridge - pg 23
APL - pg 11
Avante - pg 23
BEA - pg 14
Chep - pg 27
Cisco - pg 12
ConncTera - pg 14
EJ Brooks - pg 11
EPCglobal - pg 19
GlobeRanger - pgs 14, 27
GT-Nexus - pg 19
Hi-G-Tek - pg 11
Hunter Paine Enterprises - pg 27
Hutchison Port Holdings - pgs 6, 9, 18
Hutchison Whampoa Ltd - pg 11
Ingersoll-Rand - pg 23
Intermec - pg 24
Maersk - pgs 11, 20
Maersk Data (sold to IBM) - pg 20
Maersk Logistics - pgs 9, 20
Mitsui - pg 26
NaviTag - pgs 11, 20, 21, 22, 28
NYK Logistics - pg 10
Oat Systems - pg 14
PSA Corp. Ltd - pg 11
Savi Networks - pgs 6, 9, 18, 29
Savi Technology - pgs 9, 11, 18, 19, 26, 28
Symbol - pg 24
TIBCO - pg 14
VeriSign - pgs 14, 16, 19, 24, 25
Vizional - pg 23
webMethods - pg 14
WhereNet - pgs 22, 23, 28