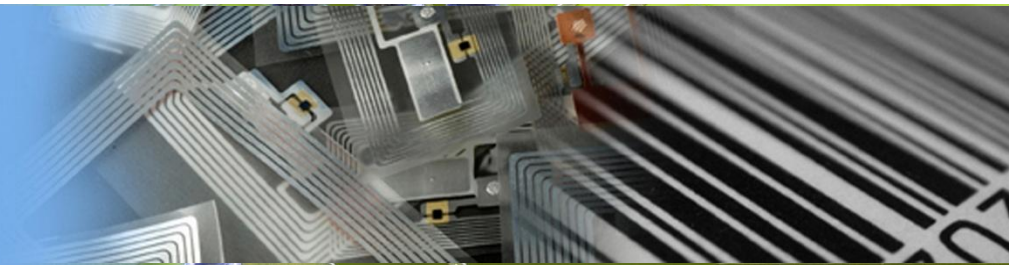
MAY 2012

WHITE PAPER

AutoID Practice

Michael Liard – *Director, AutoID*



Understanding RTLS

What it is, How it's Used & What You Need to Know before Deploying

ZEBRA TECHNOLOGIES

VDC research

TABLE OF CONTENTS

INTRODUCTION

What is RTLS?

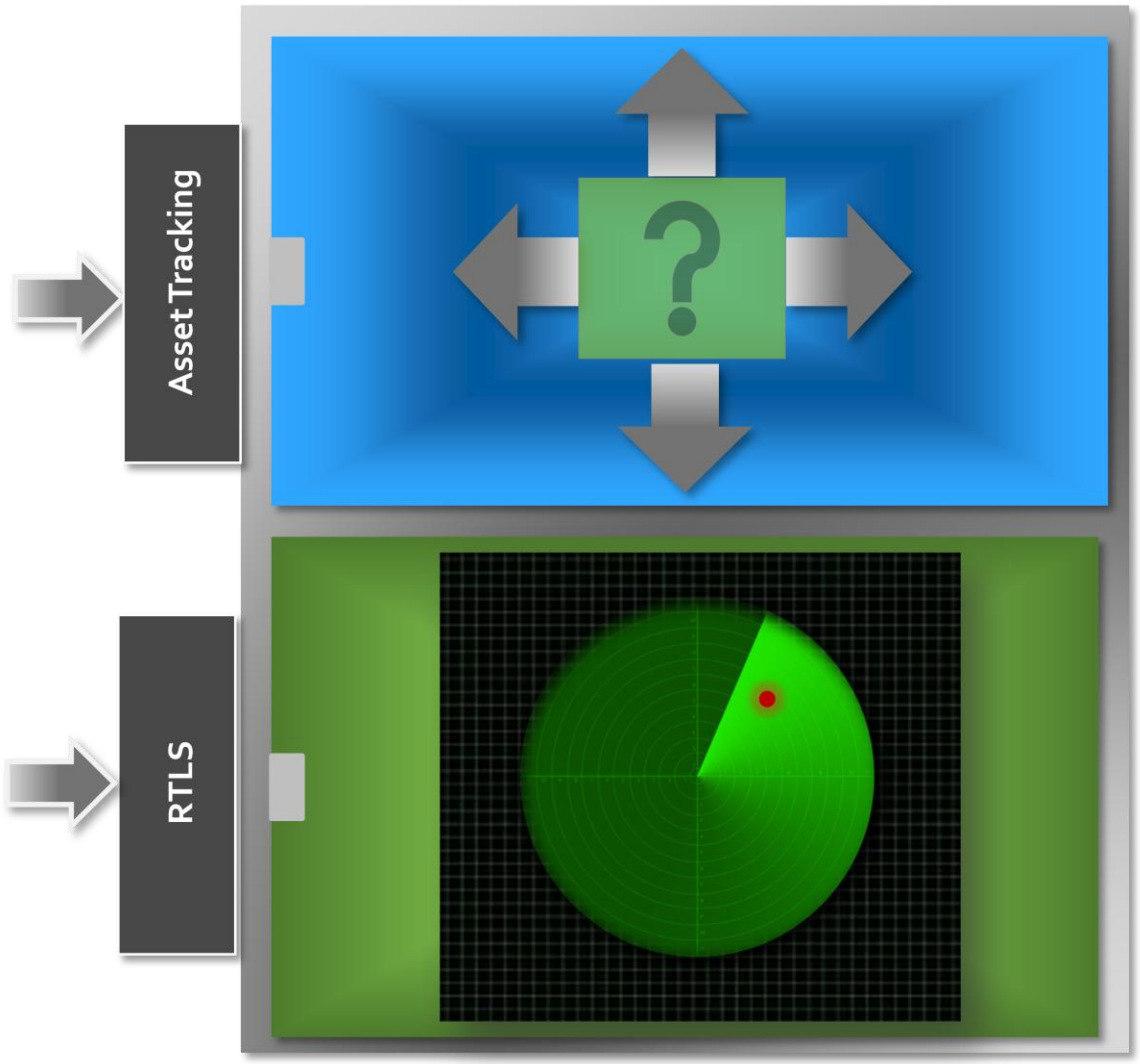
Real-Time Locating Systems (RTLS) are precise positioning systems that not only enable a user to identify and track many different types of key objects; such as assets, tools, equipment, containers, WIP (Work in Process) items, people and/or animals, but also provide this information in real time through automatic and continuous feedback. In other words, an RTLS solution provides the enterprise with immediate information on precisely where something is and/or has been – and in some instances what it has done – via constant communication between the system and the object being tracked.

Anything being tracked by RTLS has a tag affixed to it which can be located by the infrastructure of the system. An alternate implementation can leverage devices that are location aware (i.e., can determine their own location) and can report their location to the infrastructure (e.g., cell phone for GPS tracking). The tag or location aware device stores the unique identity and sometimes additional information (e.g., current and last location, users of the object, product origin, physical conditions, maintenance records, compliance, etc.) about the object on which it is attached or representing. The information stored on these devices, along with real time positioning of the object, is then communicated back to an associated business system. A typical topology provides real time visibility, normally via a map or GUI (Graphical User Interface), as well as associated real time planning, execution and reporting functions. The data may also be integrated into a wider ERP (Enterprise Resource Planning) solution by providing updates to key business processes such as warehouse management, production planning and scheduling, transportation planning and other related applications.

Because RTLS solutions track objects, they are commonly confused with Asset Tracking systems. RTLS can be used to provide Asset Tracking; however, not all Asset Tracking systems are RTLS. The difference between these two systems lies in the continuous communication between the objects being tracked and the system. Asset Tracking solutions are not considered to be RTLS unless they are configured for automatic and continuous reporting. In most traditional Asset Tracking systems, the tag interacts with the system only when it is read at predetermined points (e.g., doorway or portal). This means that the system bases the location of the asset on where it was last read and not where it actually is. In other words, the system will know that an asset is in a certain area, but it will not be able to precisely locate where in that area the asset is. For example, an Asset Tracking system can tell that an object has entered a warehouse if the tag is read as it moves through the dock door; however, it typically is not able to specify where the asset is in the warehouse. This is not the case with RTLS systems. As a result of their continuous and automatic communication between the tag and the system, RTLS solutions provide the precise location of the asset. This concept is illustrated in Exhibit 1.

Exhibit 1

The Difference between Asset Tracking & RTLS



Asset Tracking systems can tell that an asset is in a room, whereas an RTLS solution can tell not only that an asset is in that room, but also where in the room it is located.

The constant communication provided by RTLS solutions yields a level of visibility that Asset Tracking systems are typically not capable of the ability to track objects while in motion. Mobility is critical for many enterprises. It is a core component to their operations, business processes and ability to compete. As such, a significant (and growing) number of critical objects within the enterprise (e.g., assets, people, animals/livestock) are highly mobile and are supporting business processes that are based on mobile platforms. But despite the importance of mobility, most enterprises have limited visibility into the core objects supporting those mobile processes. This can be seen in the tracking and managing of the assets and people in industrial manufacturing, aerospace, process industries, logistics, military/government, field service and health care, among others.

As mentioned before, RTLS can provide Asset Tracking capabilities, but this is only one of a growing list of applications the solution is used to support within the enterprise. The inherent properties of an RTLS solution lend itself to be able to be leveraged for applications such as:

Exhibit 2

COMMON RTLS APPLICATIONS	
APPLICATION	**DESCRIPTION**
Asset Management	The tracking, management and utilization of an asset(s). An asset is defined as anything tangible owned by a company or individual that is held for business use with the intention of providing future benefit and not expected to be converted to cash in the current or upcoming fiscal year. Assets are valuable to their owners - financially, operationally, or sentimentally.
Human Resource Management	The management of a company's workforce as it relates to operational and compliance activities. These systems are leveraged to ensure employees are able to achieve corporate goals and objectives. Common applications include time/attendance, process compliance, time-on-task tracking and employee or object association.
Supply Chain Management	The management of interconnected businesses and business processes related to the manufacture, distribution and sale of products and services. Supply chain management refers to the movement and storage of raw materials, inventory, work-in-process and finished goods from the point of origin through to the point of consumption. Supply chain management pertains to both inbound and outbound logistics and the tracking of the assets (e.g., containers, vehicles) used by these processes.
Sensing & Monitoring	The integration of sensors (i.e., data loggers) that are used to monitor the physical environment of an object. Common sensors include temperature and humidity.
Maintenance Repair & Overhaul (MRO)	MRO is defined as all activities – technical and administrative – that are conducted as a means to ensure and/or restore an object (e.g., tools, equipment, vehicles) is able to perform its required function.
Compliance	Compliance is the act or process of adhering to a demand or regimen specified by a government, industry or customer. Compliance ensures conformance to specified use requirements or standards.
Safety/Security	The management, assurance and compliance of safety and security for the enterprise, its employees, assets, products and processes. Common applications include worker safety, evacuation and emergency mustering.

THE BASICS OF THE TECHNOLOGY

The location and communication technologies being used to support RTLS systems are diversifying. The use of the technologies is largely dependent upon the installation and use environments, application, and compliance/regulatory requirements, as well as the existing legacy infrastructure. In many instances, companies are opting to leverage technologies already being used in their enterprise such as Wi-Fi or Active RFID, as a means to reduce complexity and costs. For example, some systems that are using both indoor and outdoor requirements can use the same infrastructure, whereas others may need to leverage different technologies for solely indoor use. Additionally an application that requires accuracy to 1ft would require different technologies than one that requires accuracy of 10ft. Primary technologies used in RTLS solutions include, but are not limited to:

- **Active RFID location tracking solution:** determines location via communication with a battery supported radio frequency-based transponder capable of transmitting and/or receiving information independent of the reader (e.g., ISO 24730, UWB).
- **Passive RFID-based location tracking solution (i.e., EPC UHF):** determines location by receiving power from an array of RF power transmitters that energize passive RFID tags, (e.g., EPC Gen2, ISO 18000-6) within an area of coverage and allow locating by using sectored antennas to determine Angle of Arrival (AoA).
- **GPS (Global Position System) location tracking solution:** determines location via communication of a GPS device and GPS satellites.
- **Assisted - GPS (A- GPS) location tracking solution:** determines location via readings from both GPS satellites and cellular base stations/towers and is supported by a location server. Typically more accurate than GPS-only systems.
- **Wi-Fi-based location tracking solution:** determines location via correlation from interactions with mapped Wi-Fi access points and GPS.
- **Out-of-Band (OoB) proprietary RF/sensor-based location tracking solution:** determines location leveraging proprietary solutions and technologies such as ultra-wide band (UWB/IEEE 802.15.4f), infrared and ultrasound.

THE VALUE OF RTLS

The information and functionality RTLS systems offer are providing tremendous value to the enterprise. The increased visibility and information is proving to be invaluable and highly actionable for enhancing and streamlining the operations and processes of the using enterprise. Typical benefits include:

- **Operational improvement:** more streamlined and efficient processes resulting in improved throughput, resource utilization and error-proofing, as well as significant reductions in operational costs such as search time on task, rental item reduction and process error.
- **Improved and more informed decision-making:** faster, more efficient information distribution enables the most actionable employees to react quicker.
- **More effective maintenance and compliance:** the ability to store information on the object is being leveraged to support MRO activities as well as ensure government, industry or customer compliance (e.g., cleaning, calibration). Complete records can be rapidly accessed to ensure proper handling.
- **New service opportunities:** In many instances, the information and visibility provided by RTLS solutions are being used by enterprises to develop new offerings (and revenue generating opportunities) and benefits that can be passed on to their customers. For example, shipping companies can offer real-time visibility into the transportation of goods (via the web) to their customers as well as offer physical condition monitoring services … for an additional fee or as part of a package of services.
- **Competitive advantage:** More efficient operations, cost reductions, better decision making and new dynamic offerings to customers ensure a competitive advantage to most early adopters of RTLS systems. This advantage is enhanced as the solution continues to penetrate the rest of the enterprise and value chain.

The real measurement of value for RTLS is not just founded in concepts and theories; it can be seen in the numbers, the actual metrics businesses are using to measure success. The following information is from a global survey of over 350 enterprises using RTLS conducted by VDC Research in January 2012. The data presented was provided directly from the enterprise and all values are in respect to the company's RTLS solution. They say a picture is worth a thousand words.

Exhibit 3

Enterprise Respondent Average Time to Reach ROI for RTLS

(N=356)

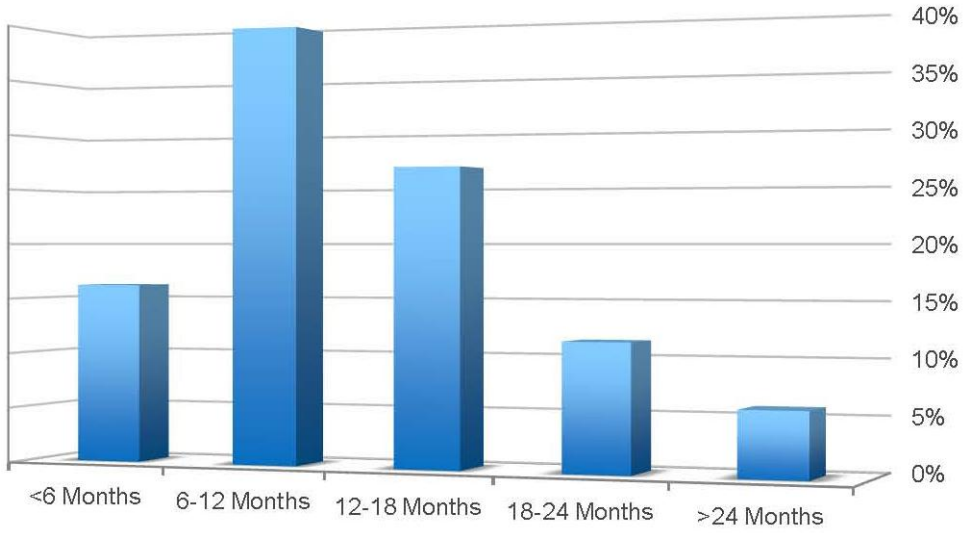


Exhibit 4

Enterprise Respondent's Percent Improvement in Asset Utilization Associated with RTLS

(N=316)

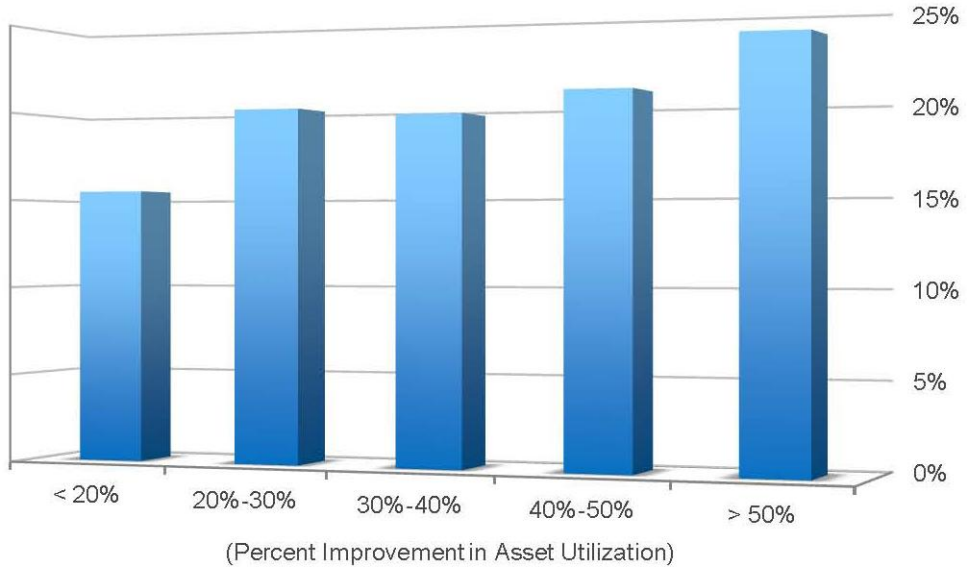
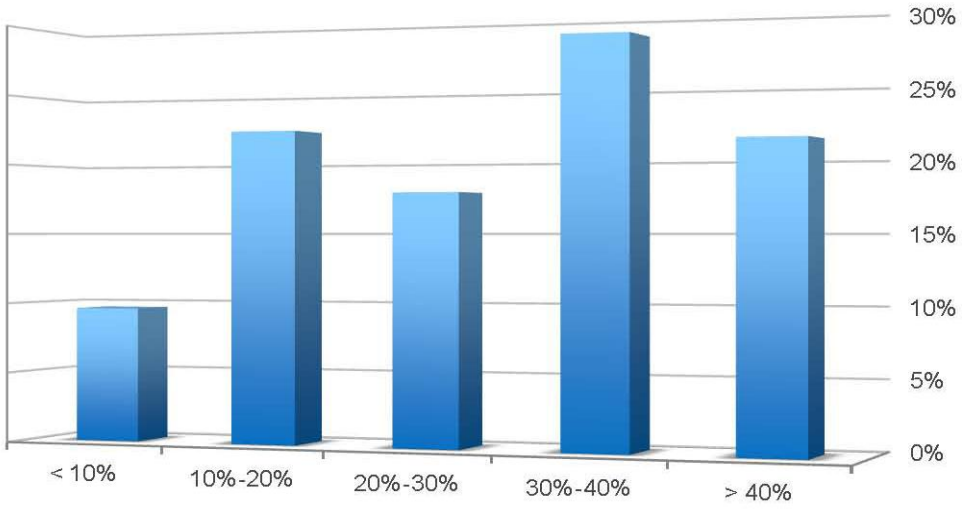


Exhibit 5

Enterprise Respondent's Percent Reduction in Operating Costs Associated with RTLS

(N=286)



(Includes decreases in time-on-task, labor and non-labor expenses and shrinkage/loss)

WHO'S USING RTLS?

RTLS solutions are increasingly being used in virtually all primary regions and vertical markets and across Tier I, II and III communities (i.e., companies with annual revenue >$200 Million). The following table provides an overview of the typical RTLS deployments as cited by the respondents to VDC's enterprise end user survey.

Exhibit 6

RTLS DEPLOYMENTS BY VERTICAL MARKET

	TRANSPORTATION	HEALTH CARE	GOVERNMENT	RETAIL	INDUSTRIAL	PROFESSIONAL SERVICES
RTLS Applications	• Vehicle Tracking • Asset Tracking • Employee Tracking • MRO • Sensing/Monitoring	• Asset Tracking • Employee Tracking • Supply Chain Management • Compliance • Safety • MRO	• Vehicle Tracking • Asset Tracking • Employee Tracking • MRO • Supply Chain Management • Safety/Security • Animal Tracking	• Employee Tracking • Asset Tracking • Supply Chain Management	• Employee Tracking • Asset Tracking • Supply Chain Management • Safety • MRO • Compliance • WIP • Tool Tracking	• Employee Tracking • Asset Tracking • Safety/Security • Vehicle Tracking • MRO • Tool Tracking
Installation Environments	• Depot/Hub • Warehouse/DC • Yard/Lot • Port Facility	• Hospital • Health Care Facility • Warehouse/DC	• In-Field • Warehouse/DC • Data Center • Yard/Lot • Port Facility • Depot/Hub • Health Care Facility • Large Facilities	• In-Store • Warehouse/DC	• Shop Floor • Warehouse/DC	• In-Field/On-site • Data Center • Warehouse/DC • Campus • Large Facilities
Technologies Used	• GPS/A-GPS • Out-of-Band • Active RFID • Wi-Fi • Passive RFID	• Wi-Fi • Out-of-Band • Active RFID • GPS/A-GPS	• GPS/A-GPS • Out-of-Band • Wi-Fi • Active RFID • Passive RFID	• Wi-Fi • GPS/A-GPS • Active RFID • Passive RFID	• Out-of-Band • Active RFID • Wi-Fi • Passive RFID • GPS/A-GPS	• Out-of-Band • GPS/A-GPS • Wi-Fi • Active RFID

WHAT TO KNOW BEFORE DEPLOYING

Despite the benefits the system can provide, RTLS is not a solution for every company. Companies should consider evaluating or adopting RTLS solutions if they have any of the following business challenges or characteristics:

- There is a large installed base of mission critical and/or mobile assets used in the operation of the business.
- The supply or value chain is complex and is comprised of multiple product sets/types.
- There is a desire to provide more value to the customer and improve their satisfaction.
- A need exists to reduce order to cash cycle time, improve throughput and streamline processes.
- There are significant MRO and/or compliance requirements.
- Current Asset Tracking solutions do not provide the level of visibility required.
- Employee management and safety is critical to the success of the business.
- RTLS is being used in other points of the supply or value chain.

Deploying RTLS does not have to be a complex, timely and expensive process. In fact, most companies VDC spoke with about their RTLS deployments indicated they experienced very little pain associated with adoption, scale and solution expansion. The most pain encountered by these enterprises was associated with identifying and selecting the right vendor.

What's the best adoption strategy?

Start small, but don't lose your vision. Focus your initial efforts on addressing one or two, less complex business issues, all the while keeping your overall vision of how the solution can be used throughout your enterprise and value chain in mind. Starting small offers several advantages for the adopting enterprise, including:

- Less risk and investment associated with proving the concept.
- ROI is more measurable and time to attain ROI will be faster.
- Improves enterprise's level of knowledge based on real world experience.
- Simplifies justification for further investment in the solution (already proven to provide value to your firm).
- Ensures the right choice in RTLS solution provider was made (ability to test the vendor with lower risk).
- Facilitates scale, expansion and further integration (of the established infrastructure).

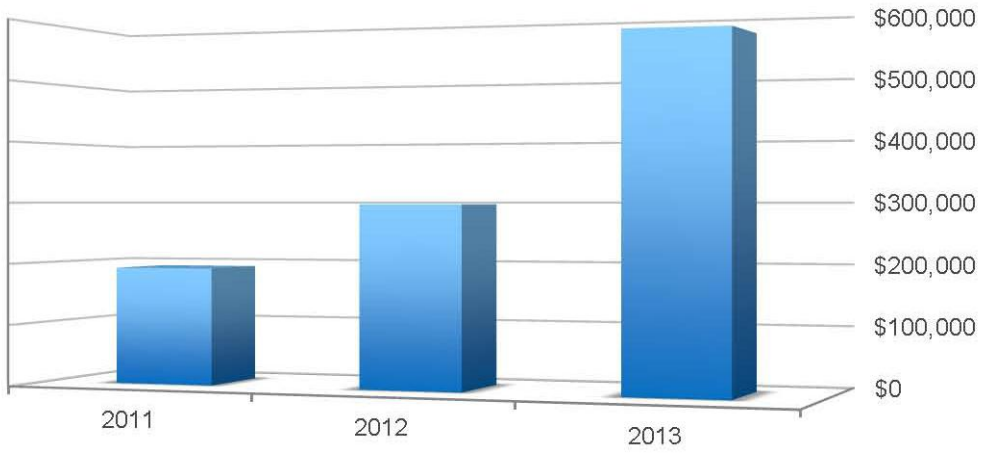
How much does it cost?

The cost of an RTLS solution can vary significantly. On average, the respondents to VDC's survey of RTLS enterprises indicated they were spending, on average, approximately $190,000 on their RTLS systems in 2011, a value that is expected to increase more than 90% within 24 months as these companies rapidly scale, expand and integrate their solutions (see Exhibit 7). It should be stated that these budget values represent the entire population of survey respondents and that in instances where the respondent companies are more experienced with RTLS and/or have already began deploying the solution, the annual budgets reported are typically closer to the 2013 values listed in Exhibit 7 (i.e., >$500,000).

Exhibit 7

Average Enterprise Annual Budget for RTLS Solutions

(N=335)



The primary factors impacting the price of an RTLS solution include:

- **The Type of Technology(ies) Required.** Although the primary consideration for pricing should be on the cost of the system, hardware price can vary considerably by technology and performance requirements. For example:
  - More than one technology may be required to provide the accuracy and precision needed.
  - The price of an active tag can be 100x more than that of a passive one; however, the number of readers required to support a passive solution may be significantly greater.
  - A reader may not be required if the tag is location aware and can communicate directly with the system.
- **Size of the Deployment.** Not only in the number of tags and readers required, but also in the number of locations where the solutions will be used. Hardware economies of scale can have a significant impact on the solution price as well as afford the adopting enterprise greater bargaining power during negotiations. In addition, as a rule of thumb, the more locations in which the solution has to be installed, the greater the integration costs.
- **Solution Complexity and Level of Integration.** The more complex the solution and the deeper the system needs to be integrated into the enterprise, the greater the systems integration costs. Highly complex, deeply integrated RTLS solutions (e.g., temperature monitoring of produce while being shipped directly linked to a distribution center's inventory and sales management system to maximize shelf-life and quality) can add more value than more basic systems, but they will require more upfront time and resources.
- **Level of Customization.** As mentioned previously, no two deployments are identical and it's a well known fact that more customization typically means more expensive. There will be some level of customization required in order to implement RTLS, but the real impact on cost lies in how much. Software and hardware customization costs can vary significantly depending on how much development is required.

HOW TO FIND A VENDOR & SOLUTION

RTLS is a solution and needs to be thought of as such. We recommend companies work with total solution providers (e.g., Zebra Technologies) when deploying RTLS, not companies offering only part of the solution (e.g., hardware only). Total solution providers are capable of providing enterprises with a complete and comprehensive solution (all hardware, software and services) and typically are more experienced with real-world deployments and uses (as opposed to limited use cases and design laboratories).

But not all total solution providers are the same. Some are technology focused, placing greater emphasis on pushing their core technologies and not necessarily placing the best in class solution for the application or environment. Others are more focused on a part of the solution (e.g., hardware, software or services) or are highly specialized on a market or application and although they may be offering complete solutions, they might have significant weaknesses in their portfolio that may limit functionality, future scale and expansion.

Do not worry about the technology… as much. Rely on your RTLS solution provider for this, but don't take a completely passive role. As mentioned previously, technology selection is dependent on the application requirements and installation environments. It is wise to understand the different technologies' capabilities and limitations, but the solution provider should be able to recommend the most effective technology(ies) that meet your specific needs. In many instances, it could be more than one technology that needs to be used.

Which leads us to our next vendor selection recommendation…find a technology agnostic solution provider. This can be critical as many RTLS solution providers are strong and experienced in a select number of technologies for a limited number of applications and may not be offering (or capable of offering) the best in class solution for your specific application or deployment. It is important to find a solution provider that can support a broad base of technologies for use in a diversity of installation environments.

Aside from the aforementioned, we also recommend the following when looking for an RTLS solution provider:

- Look for a company that measures its success based on the benefits their customers achieve, not how much product goes out the door. Enterprise should look for a true partner, a company that is interested in a longer-term relationship and is willing to grow with yours.
- Ensure your providers have global scale and reach, particularly if the technology can be leveraged throughout multiple regions and global value chains.
- Make sure they are established and can provide proof of their success, benchmarks and examples of their work.
- Ensure that they can configure and tailor their solutions. No two RTLS deployments are identical and off-the-shelf solutions can be too limiting.

ABOUT VDC

VDC Research Group (VDC) provides exceptionally detailed direct-contact primary market research and consulting services to many of the world's largest technology suppliers, innovative start-ups and leading investors. The firm is organized around six practices, each with its own focused area of coverage. Our clients rely on us for highly segmented research and analysis which is derived from our unwavering commitment to the idea that all markets are collections of smaller market segments and that winning companies must develop and execute strategies that are segment-specific.

For more information about this research product, please contact:

VDC Research Group, Inc. | 679 Worcester Road | Suite 2 | Natick, MA 01760

Dan Doonan – *Account Director*, **508.653.9000** x121, ddoonan@vdcresearch.com

Michael Liard – *Director*, mliard@vdcresearch.