Supply Chain Management for Generic and Military Applications using RFID

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Abstract

This paper explains two main aspects of RFID supply chain management – the generic supply chain management and the specific military application for the purpose of asset viability. The generic supply chain management is studied by examining how to improve supply chain management through accurately determining inventory levels in real time without human interaction. For the military application, the current legacy systems used by the military for Supply Chain Management and Asset Visibility are analyzed and suggestions are made for improvements in the form of Total Asset Visibility through Radio Frequency Identification tags, and Geographic Information Systems.

Keywords: *RFID, JIT, SCM, TAV, PIM, Military Logistics, RFID tags*

1. Introduction

This paper explains two main aspects of RFID supply chain management – the generic supply chain management and the specific military application for the purpose of asset viability. The generic supply chain management is studied by examining how to improve supply chain management through accurately determining inventory levels in real time without human interaction. For the military application, the current legacy systems used by the military for Supply Chain Management and Asset Visibility are analyzed and suggestions are made for improvements in the form of Total Asset Visibility through Radio Frequency Identification tags, and Geographic Information Systems.

1.1. What Is RFID?

RFID is defined as a wireless automatic identification and data capture technology [2]. This technology is composed of three parts: an identification tag, a reader and a computer. The identification tag can take one of three forms, active passive, semi-passive; though the two major forms are active and passive.

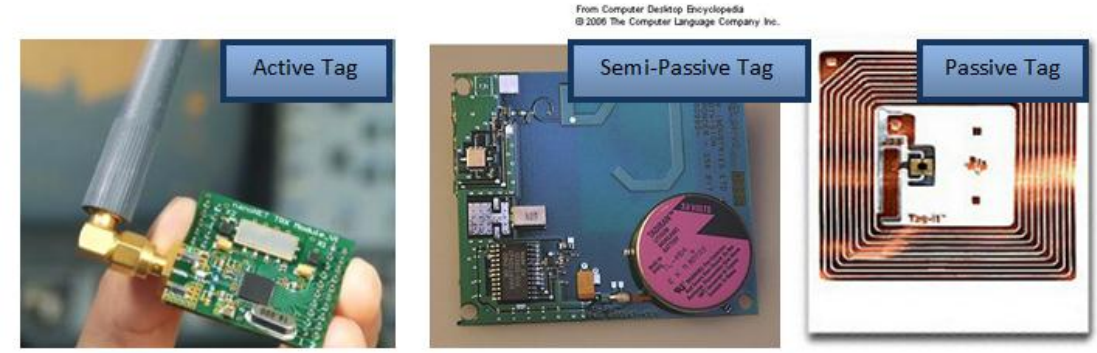
With Active RFID, extremely low-level RF signals can be received by the tag (since the reader/interrogator does not power the tag), and the tag (powered by its internal source) can

generate high-level signals back to the reader/interrogator. Active RFID tags are continuously powered, which enables to be used when longer tag read distance is desired. [2]

Passive RFID tags reflect energy from the reader/interrogator or receiver and temporarily store a small amount of energy from the reader/interrogator signal in order to generate the tag response. Passive RFID requires strong RF signals from the reader/interrogator, and the RF signal strength returned from the tag is constrained to very low levels by the limited energy [2].

Semi Passive tags are similar to active tags, but the battery is used to run the microchip's circuitry but not to broadcast a signal to the reader. Some of these tags conserve battery life by sleeping until they are woken up by the reader's signal. Semi-Passive tags may also be referred to as battery-assisted tags [24].

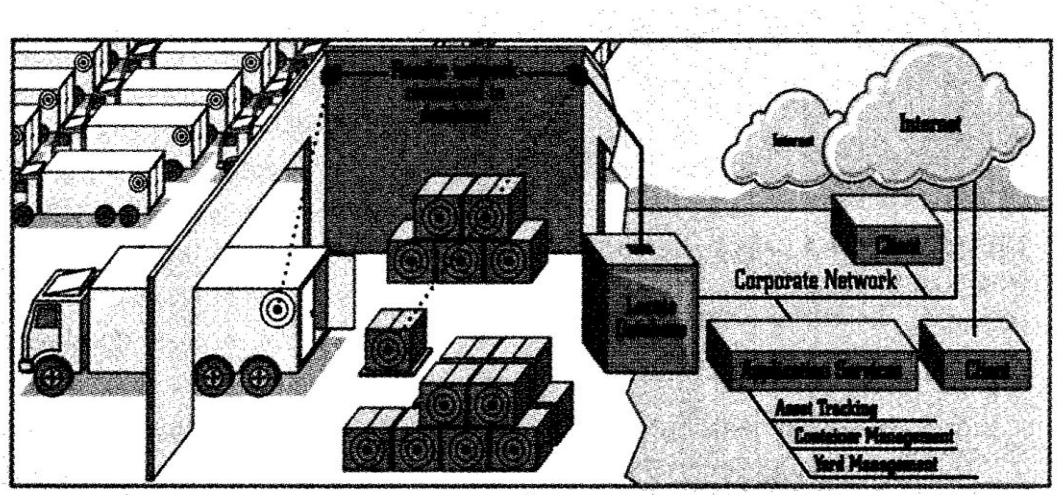
Active tags are more expensive than passive tags because they send information using an internal battery source and store more data, while passive tags rely on the reader. Additionally, tags have a discrete memory capacity that varies from a small license plate to thousands of records. Data within a tag can provide any level of identification for an item during manufacture, in-transit, in storage, or in use [4].



In addition to tags, an RFID system also needs a method for reading or interpreting the tags to obtain the stored data, and also a way of communicating this tag [4]. Attached to readers are antennas which transmit data read from a passive or active tag to the computer. This information can be used to track the asset through the supply chain. Using RFID technology can potentially allow supply chain members to automate manual tasks, reduce human errors, and improve the traceability and availability of items (products, boxes, pallets, etc.), generating savings for all the supply chain members [2]. This is possible because RFID is a totally non-intrusive methodology for data capture [4]. A non-intrusive methodology is a process that does not require human intervention. This is done by using automatic readers which gather information from the RFID tag attached to the item. It is also known to be a non-line-of-sight technology, and can possess both read and write options within the same equipment item [4]. Radio waves are used to make this process capable of non-line-of-sight technology, which means the tags can be read even if they are not visible to the reader.

RFID tags have also proven to be incredibly durable. They have been subjected to physical, environmental and real world tests. The physical tests included stacking, dropping, and vibration. Even after being subjected to these rugged tests an overwhelming majority of the tags were still functionally operational. Tests concerning variations and extremes in temperature and humidity were used during the environmental testing. It was found that some degradation to the read rates did occur when tested at the extremes. It is also interesting

to note that using sensor enhanced RFID devices enable them to monitor their physical context (awareness) such as temperature or moisture [9]. Real world tests included damage to a few tags such as scratches and depressions. These defects did not have a significant reduction in tag performance [3].



MILITARY APPLICATIONS of WhereNet's RTLS technology are adapted from the basic commercial model (above). RTLS uses active RFID tags and multiple antennas for long-range tracking indoors and outdoors. Graphic courtesy of WhereNet Corp.

Figure 1. A Potential Setup of the Distribution and Network Constituting a RFID SCM System [11]

The government requires that in the coming years the military will need to have total asset visibility. To achieve this goal RFID technology will need to be used, along with effective databases.

1.2. What Is Supply Chain Management?

Supply chain management (SCM) has always been one of the most essential elements in business. In the past, the focus has been more so on improving the distribution process and refining inventory models instead of technological components. However, it still lacks great efficiency. That being said, how can we improve supply chain management using technology? While it will never be perfect, utilizing advancements in technology, such as RFID can drastically improve the system. Systems that implement automated processes to collect, maintain, organize, and analyze information in real-time empower businesses to exponentially increase efficiency, resulting in increased profits. By looking at the current problems and limitations facing supply chain management, this paper examines RFID's potential in the supply chain and provides solutions to some of these problems.

2. History of SCM

2.1. Supply Chain Management

Supply chain management (SCM) is a broadened management focus that considers the combined impact of all the companies involved in the production of goods and services, from suppliers to manufacturers to wholesalers to retailers to final consumers and beyond to disposal and recycling.

The goal of SCM is to seamlessly link all of the activities responsible for bringing goods and services to the market and efficiently manage the flow from start to finish. Basically, no matter how many companies are involved, this process should take place as though there were only one, very well managed company performing the activities. All companies in the supply chain can benefit from sharing information and working closely with the other companies that are within their supply chain.

2.2. SCM in the Military

Currently, it is evident that the military has not adopted a very efficient Supply Chain Management (SCM) system. Previous errors in package handling, frivolous spending on legacy systems and dirty data that is used in decision making are all reasons that the military needs to adopt a more efficient SCM system that has as its vision is of Total Asset Visibility (TAV). With the end of the cold war there has been a shift in paradigm from a large heavy force to a light, reactionary mobile force [5]. This effectively means that the equipment needs to be as responsive and mobile as the soldiers. The equipment is only as good as the soldiers that use it, and the soldiers are only as good if they have the proper equipment to do their jobs. To achieve the goal of a mobile logistic system good asset management should be used on the supply chain. This would include:

- manage assets individually,
- allow locating the right assets,
- provide information about the current physical status (quality) of an asset, and
- keep an information history of an asset. [9]

The major need for an integrated supply chain management network arose from the problems the soldiers in the field experienced during the first Gulf War. United States Air Force Gen. Walter Kross explains concisely that "during the Gulf War, we simply did not have good information on anything. We did not have good tracking; we had no real asset visibility. Materiel would enter the logistics pipeline based on murky requirements, and then it could not really be tracked in the system.... We lacked the necessary priority flows to understand where and when things were moving. It was all done on the fly, on a daily basis... It truly was brute force...We had too much, and, worse yet, we did not know what was where" [10].

These problems led to wasted equipment and ill-equipped soldiers. It was also not cost efficient; because of the way the military had set up its shipping and receiving, many of the pallets sent over to the theater went to waste. The Department of Defense's (DOD) logistics strategy was scattered and running on out of date technology. In the 1991 Gulf War, one of the DOD's biggest logistic nightmare were huge shipping containers sitting unopened in the desert, full of unidentified equipment and supplies. As a result, additional equipment and supplies had to be shipped, resulting in costly duplication and waste[11]. When a shipment

was received its arrival was not put into a database or any form of computer system; instead carbon copies were used. This method further increased the number of duplicated shipments and also the confusion of what exactly was in each container. It became clear that the military needed to create an organized supply chain in which not only would the data be easily accessible but that the equipment would also be able to be quickly located and allocated; the military needed total asset visibility (TAV).

Effectively, there is a need to have actionable information available to them at all times about the location, quantity and state of their material assets and personnel [3]. This system would help to solve General Kross' problem of not knowing what was what or where it was. Eric Wagner believes that this can be done with radio frequency identification (RFID) tags. It [RFID technology] integrates the digital and the physical world by seamlessly connecting objects in the physical world with their representations in information systems [9]. Wagner says that by using these tags, it was possible to track soldier's movements, their actions and their interactions with each other [12]. If these tags can be used to accurately collect and store data on the complexities of human movement it can also be applied to the objects in the supply chain. This new technology has the power to completely restructure the militaries supply chain in a way that is cost effective and reliable.

2.3. Problems and Limitations with SCM

SCM affects all aspects of business. Accounting, inventory control, marketing and ultimately a company's revenues are all intimately linked to and dependent upon efficient management of their supply chain. Supply chains are systems with a flow of goods from supplier to consumer, made up of many facilities where communication and intensive coordination are a necessity. As with any system, one malfunctioning node can have major effects on all congruent and subsequent actions along the chain. This being said, supply chain management is perhaps the one area of business where creativity and flexibility are most necessary. Improved processes in a company's supply chain can yield a plethora of cost cutting opportunities. Digital technologies and growing trend toward globalization are influencing supply chain management in very profound ways.

Inefficient supply chains can hinder businesses in a number of ways. Faulty distribution strategies can put the right product in the wrong place or the wrong amount of product in places where they do not sell well. Companies lose revenue from missed sales opportunities and likely have to pay to correct the malfunction. Inefficient management of cash flow between departments can disrupt accounting processes and affect the bottom line. Inventory control has been one of the most visible problems facing supply chain management. Inventory management affects the way companies handle their manufacturing overhead. Companies lose money by storing inventory items that are not selling. Whether to rely on mathematic equations, computer inventory records or a mixture of the two to determine the optimal inventory level is an issue facing companies today. Recently there has been a shift in the way businesses think about their inventory needs. Businesses are moving away from the industrial age model of "Iron Mountains of just-in-case inventory" into the 21st century information age model of "demand driven… just-in- time inventory" [26]. Efficient supply chain processes that abide by just-in-time inventory principles can greatly reduce their inventory holding costs.

By not buying and or producing, and ultimately not warehousing products that are not in high demand and not selling companies can save money.

Figure 2. The Integrated Operating Activities of a Typical Supply Chain [9]

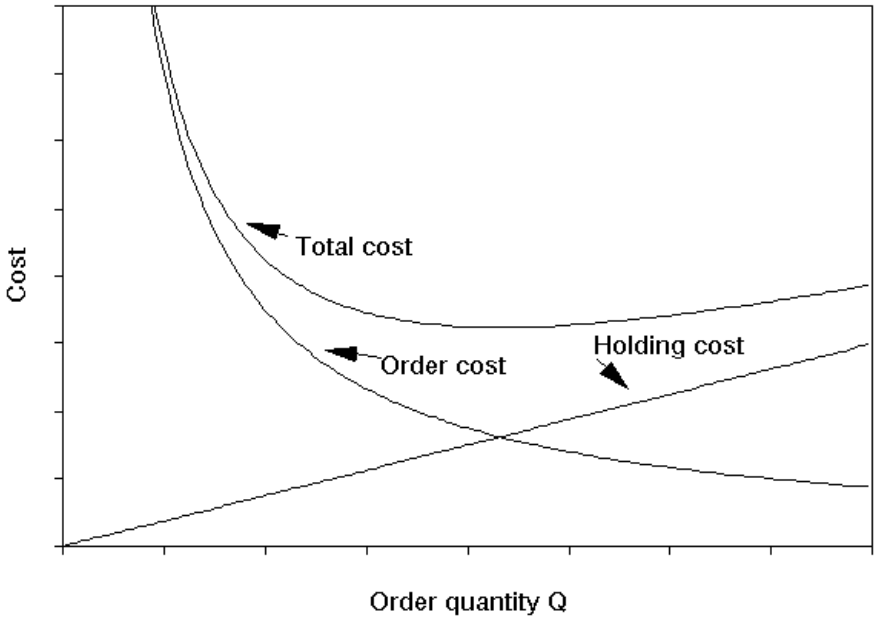


Figure 3. Cost V Order Quantity [9]

While Just-in-time inventory has the potential to solve many of the inventory problems facing current companies supply chains, just-in-time inventory practices are not without their limitations. The principles of just-in-time inventory may seem obvious; companies only hold as much as they can sell. Actually implementing just-in-time principles and achieving them in practice can prove to be extremely difficult. Unforeseen fluctuations in customer demand can create a situation where stock outs force customers to shop elsewhere, costing the company in

lost revenue and more importantly; customer good will. Controlling inventory in real-time should be the goal of any supply chain.

Traditionally, companies relied on large advertising departments to develop and maintain marketing plans to provide potential customers with information about their products. These processes are exhaustive and require extensive financial and human resources to wage an effective campaign to attract customers. The emerging demands caused by globalization, and changing consumer trends require a more efficient system for gathering, maintaining and utilizing the information to effectively market products to intended customers. Product information Management or PIM is a emerging as a solution to these issues. PIM is the processes and technologies corporations use to gather and manage information about products with the aim of improving its marketing and increasing its overall selling power.

Changing of traditional business processes and experimentation with new technologies is the key to survival in today's competitive business environment. New technologies are providing answers to questions that most never thought to ask. The danger many businesses face is becoming comfortable with processes they have implemented, today's business culture is fast paced and ever changing. Alexander Drobik and Jeff Woods in their article *Development of Chaos-Tolerant Processes Is Key to Supply Chain Optimization* say "the next generation of supply chain excellence will not come from lean-influenced or demand-driven-only planning". This comes only decades removed from the renaissance of just-in-time centric thinking. Due to these types of realizations businesses are increasingly embracing the idea of Chaos Tolerant processes. The theory behind this thinking is that elimination of complexity and uncertainty solely through fail-safe process design is improbable. Many argue that implementing rigid policies of supply chain principles across an unstable, performance-based network cannot provide coherent management span of control and doing so can lead to diminishing returns. Designing such fault-tolerant rather than fail-safe processes [20] will become increasingly necessary in the future.

Businesses, managers and executives must be flexible and open to embracing new ideas in order to remain relevant in the ever changing technology driven global market place. Information is power; therefore it follows that Information Technology is power. Nearly all business problems can be solved by proper manipulation and implementation of information. Alexander Drobik notes that current supply chain operations [today] continue to accept a level of inefficiency… to overcome this, further redesign of the supply chain and leverage of new enabling IT is necessary [20]. New technologies are always evolving tackle problems with the hopes of increasing productivity, lowering waste and increasing profit margins. Radio Frequency Identification is a new technology whose applications are limited only by one's imagination. RFID will change the way companies conduct business and revolutionize all aspects of supply chain management systems.

3. Solutions

3.1. Hardware

In order to successfully implement RFID applications in the supply chain, there will need to be several components installed both within items and in the store. The first aspect is the electronic product code, or EPC. [17] states that the:

"EPC consists of an eight-bit header and three sets of data: EPC Manager (28 bits), object class (24 bits), and a serial number (36bits). The header identifies the EPC version number. The EPC Manager identifies the manufacturer of the product in question. The object class

refers to the exact type of product or stock-keeping unit. The serial number is the unique code that identifies the specific product item."

The EPC itself will be embedded into the RFID tag in order to be transmitted. To successfully translate the tag, a tag reader must be used. The tag reader must be able to handle readings both fast and effectively, allowing for greater increase in speed through the supply chain.

3.2. Software

Enterprise software must be created that performs a number of major tasks supporting the network of readers, namely, data smoothing, reader coordination, data forwarding, data storage, and task management. The software must be efficient in that it can accurately read and record product information at high speeds and can remove duplicates in real time. In addition, the software must realize what information can be terminated at a certain point and what information must be forwarded up and down the supply chain. The resulting databases must be designed to store mass amounts of information as well as the ability to quickly retrieve information of a specific item. Along with enterprise software, companies will need to utilize an object name service, or ONS. An ONS is similar to a DNS in that it will be used to associate bits of information together. The ONS must take the EPC from the enterprise software and quickly find the location of the detailed information of the product associated with the code.

3.3. Language

In addition to the necessary hardware and software arises the need for a new programming language called physical markup language, or PML, which is derived from XML. It is said that PML is intended as the global standard to be used across industries for describing physical objects, processes, and environments using a hierarchical basis of taxonomy [17].

3.4 The 7 Step Implementation

According to the Technology Development Centre, implementing RFID into the supply chain can be summarized into a 7 step process.

Step 1: Embed into every item an RFID tag that includes the EPC. Along with individual items, pallets and cases can also be tagged with their own unique identifier.

Step 2: The products can be automatically and cost-effectively identified, counted, and tracked by implementing a reader's non-line of sight technology.

Step 3: s the product leaves the manufacturer a RFID can send a beam of radio waves that activate the tags allowing them to be read by specific readers.

Step 4a: Tags broadcast their EPCs to the reader, which rapidly switches them on and off in sequence, until all are read.

Step 4b: The reader sends the EPC to a computer running enterprise software that sends the EPC over the internet to an ONS database which produces an address. The ONS matches the EPC to another server where comprehensive information about the product is stored.

Step 4c: The server with the extensive information uses PML, to store data about manufacturers' products. The server knows the location of the reader sending the

query resulting in the knowledge of where the product was made. In case of defects or tampering, the source of the problem can be tracked and the products can be recalled.

Step 5: The unloading dock contains a RFID reader that can read the items without opening packages to examine their contents and can be quickly routed to the appropriate truck.

Step 6: As the inventory arrives at stores, a reader scans the items updating the retail systems to include every item. This allows to stores to locate their entire inventory automatically and at low cost.

Step 7: Reader enabled shelves can automatically order more product from the backroom or the manufacturer. This system eliminates the necessity for local warehouses that hold safety inventory.

In addition to these seven steps, readers can also be enabled at check-out counters and exits. The counters can quickly scan items without the need for UPC and can automatically update inventory. At the same time, the tags can be turned off when an item is purchased in order to control theft. At all exits, readers will scan items leaving to make sure they have been purchased which will reduce shrinkage.

4. Achieving TAV

A combination of RFID technology and a well maintained supply chain management system can result in TAV system. It is important to the military to be able to track equipment, vehicles, ammunition, soldiers, and even military civilians in and out of theaters (war-zone). The information will be stored in a database environment, and allow access to military personnel to query the information for logistical purposes. The query will return all the relevant information that was held on the RFID. Things such as the Item Code, Status, Location, and other information will be stored on the tag, and then transferred to the database. It is expected that RFID will provide better inventory management and control. This can also translate into better released support for the troops in the battlefield [8]. When the military is able to closely track these items operations will run more smoothly due to the fact of less variability and more reliable information of the localities of equipment and personal necessary for the war effort. Having the power to know where all supplies, and personnel are in a hazardous and fast paced environment allows planners to make good well informed decisions, which leads to a more powerful and responsive military.

In addition, when integrated with a wireless network, an RFID system allows access to continuous real-time information on smart items, anytime, anywhere in the supply chain, thereby enabling end-to-end supply chain visibility [2]. Moreover, if there is a crucial requirement to locate a specific item at any of the nodes, the logistics operator can query the TAV system, [database], to find all the locations where the item is current[ly] located" [10]. Since active tags are more expensive than passive ones the Department of Defense has decided to use passive tags for a high-volume rollout [16]. This means that a majority of the equipment that the military uses will already have the RFID tags on them, allowing a TAV system to be easily established.

While a TAV system is a step in the right direction, it is not exactly what is needed for the military to have complete visibility of their assets. All the information will be obtained but it will be stored into a database. Only trained soldiers will be able to access the data and even if the data is retrieved it takes a long time processing all the information retrieved. The next

ultimate maneuver is to integrate the TAV system to a Geographic Information System (GIS). This adds a visual perspective of the data that a TAV system cannot provide. A GIS system can be used to show the location of assets using global positioning system (GPS) technology, as well as show the terrain that the military has to encounter. It is important to integrate RFID with a "geolocation sensor since a RFID tag cannot provide x-y coordinates, but can only indicate its location within the field of its reader, or provide environmental observations" [8].

When an RFID tag is joined with a geolocation sensor they will together supply simple identifying information, including location coordinates. When a query is processed, the RFID tag will return such location information as latitude and longitude; effectively serving as a digital survey stake [6].

5. Improvements

While the above section discusses in detail about how the solutions can be incorporated with RFID, there is still room for achieving more. Although the solutions by themselves are sufficient to make big changes to supply chain management, it is possible to push the boundaries and get more in the process. In the sections below, we will look at some of the ways in which improvements can be included in order to ensure that the RFID solution will be an effective one that is capable of expansion and can provide more than just basic supply chain management.

6. Introduction to GIS

Internet-based geographic information systems (GISs) are tremendous tools in providing constituent access to government information. The ability of a GIS to aggregate and easily display layered themes of data on maps can greatly enhance constituent access and streamline operations by avoiding requests for printed map production. GIS's can, and are, playing a supportive role in improving government's homeland security posture. [1] GISs can be used for:

1. Visually locating and mapping critical infrastructure
2. Help locating public-safety facilities based on population and proximity to at-risk critical infrastructure
3. Identifying the best evacuation routes based on population, traffic patterns and road capacities
4. Routing emergency vehicles efficiently in real time, using Global Positioning System and Automatic Vehicle Location
5. Supporting field workers who collect data and report status in real-time (for example, reporting on the spread of fire or performing triage in multiple affected areas to help prioritize rescue and recovery operations) [1]

Military application of the above uses:

1. Allows for a more detailed perspective of the battlefield that can be disseminated to the troops so that they can be better prepared for possible conflict.

2. This could be used so that the military will always know where safe spots and potential medic tents can be set up.
3. With the increasing danger of roadside bombs and RPG attacks finding an appropriate convoy route can be created.
4. If a "hot spot" (a place where conflict has broken out) has occurred then the other vehicles can be routed to this location to provide support, or if the vehicle is not capable of fighting, it can be immediately re-routed around this conflict zone. "Spatially oriented information systems can improve road safety engineering by more accurately representing roads and intersections, as well as by providing more in-depth analysis of the factors that contribute to traffic accidents" [15].
5. This point will help the infantry soldier, if they are in trouble, the logistical information officer will be able to tell on the map, and send help to the location requested.

All this information is provided on the map, which could be a lot of data to take in at one time, but because it is done visually the information is able to be seen and understood in less time than if it were done with text. "Information visualization techniques amplify understanding by increasing human mental resources, reducing search times, improving recognition of patterns, increasing inference making, and increasing monitoring scope" [13].

This GIS is a great tool for military strategic planners. It gives them the information in a form that is easy to understand and process. "The inclusion of these types of technologies provide more accurate, up-to-date situational awareness and help make both training and tactical missions successful while improving force protection" [5].

6.1. Expanding TAV to Include GIS

To improve on the GIS capability would be to include the usage of RFID tags with the TAV system. Since the RFID tags would be set up with specific information to store such as their unique code, location, and timestamp, the GIS map system can be set up to include time as a third coordinate. Outdated mapping technology is only able to map in 2D, this dimension being space called "tracks, which were used by the Air Force and Navy command and control systems to show on a map surface the trails of moving entities" [13].

This only allows information to be plotted on x, y coordinates. This means that looking at the data the user does not know how long a piece of equipment or personnel have been at the same location, or where they are supposed to be going. The maps if you would are just snap shots in time and do not incorporate the past or present into the picture. Time can extend above the map in the third dimension proving time does not need to be a hidden dimension [13].

There are two major ways that this could be done. First, from the point where the object is located a line can go either up to indicate in the future, or below the graph to indicate in the past. Second, from the objects location on the x, y coordinate a line will go upwards to a time scale, where the scale will determine whether it will be in the past, present, or future. Examples of these two ways of mapping time onto the third dimension are shown in Figures 4 and 5.

Figure 4. Line Extension and Passage through Terrain to Indicate Time [13]

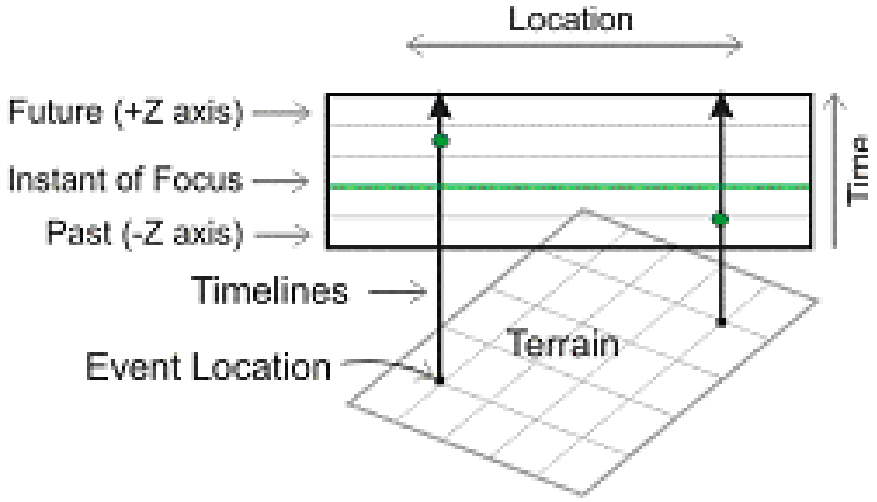


Figure 5. Time-Chart Timelines Depicting Terrain Location Connections on the Map [13]

The good thing that the map offers is the visualization that a command and control officer wants to process information quickly when it is needed, but the GIS allows for even more detail through the use of drill-down options. Mouse over drill down, allows additional information, such as text or images, can be displayed in the visualization [14]. The GIS system will be in sync with the database that holds all the RFID tags information, and because "the memory of smart assets can be used to store history information that can be requested later [9] when the option to drill-down on a specific object on the map the GIS will run a query to populate information in a pop-up window. Information will be presented to the user in a textual format. Status, Unique Code, Name, Location, and Timestamp are all possibilities of what data will be returned to the user.

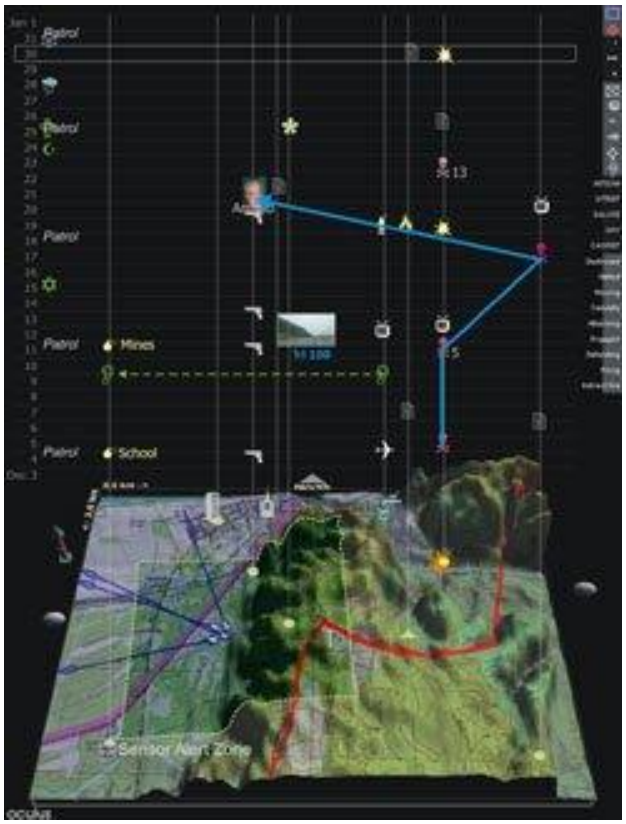


Figure 5. GIS' Capability to Produce 3D Maps of the Terrain, which would be a Valued Attribute for the Military [13]

6.2. Improvement to JIT

The main problem with JIT inventory is that stock levels are determined by historic demand and do not account for sudden spikes in demand resulting in unhappy customers. The ability of RFID enabled systems to maintain an accurate count of inventory both on hand and in the warehouse can resolve this issue. As demand rises the system can automatically order new stock resulting in increase profits for the firm. In addition to the increased profits, the firm will see an increase in customer morale as the products they wish to buy will always be available.

6.3. Improvement to PIM

PIM's biggest goal is to place more detailed product information out to customers and promote the development of e-commerce. Currently, in order to get information into a PIM system, there must be constant processing of products and data resulting in high labor cost. RFID will be able to streamline the process and provide the PIM with extensive information. Increasing product information will give more power to the consumers and will drive sales. Since the process will be automated and the tags will contain all the information, labor costs of PIM will decrease again resulting in increased profit.

7. Benefits

The benefits from implementing RFID in supply chain management are limitless. The main benefit is the improvement in inventory tracking from when the product is manufactured all the way until the product leaves the store. RFID technology provides companies the ability to control inventory levels at precise levels and automates the process. This will save the time, cost, and energy of workers who will no longer need to physically scan and log every item. An additional benefit is the ability to manage returns and recalls effectively. Products can be tracked to exactly where they came from which allows items that are inferior or dangerous to be quickly removed from the supply chain. Other benefits include: increased speed throughout the supply chain, enhanced inventory throughput, improved inventory management, reduced labor costs, reduced shrinkage, advance shipping notices, and anti-theft and aid in recall and returns.

8. Conclusion

Upon examining the problems associated with supply chain management and also indentifying some of the solutions RFID technology can offer, it is clear that the integration of RFID technology into SCM will have a positive impact. While the technology is still relatively new and the initial investment associated with the transition to RFID based systems is substantial, it is clear that the benefits of RFID technology far outweigh the costs in the long run. As more companies adopt the usage of this technology, its cost will continue to decline and will lead toward standardization within the industry – much like the barcode system. Companies who use this technology will see several positive improvements, such as: reduced inventory shrinkage, increased efficiency maintaining inventory levels leading to reduced holding costs, decreased labor costs associated with inventory management, increased speed and information sharing throughout the supply chain, and increased proficiency in recalls and returns. These are just examples of some of the tangible benefits that can be seen right now. In time, numerous intangible benefits will be realized.

If the military wants to stay ahead of the swords, it needs to adopt a RFID embedded SCM system. With this system in place the military will be able to easily track all of their assets and be able to manage the data in an organized fashion. This fusion of an RFID and SCM system would also lead to the opportunities to incorporate a GIS mapping function that would allow the military's command and control officers to enjoy the benefits of easy to understand information in real time. This visual representation of data speeds cognitive understanding and will also be useful in emergency situations as well as day to day work. Together the two technologies, RFID and GIS, will offer the military total asset visibility. Not only would these benefits improve asset visibility, the system would also end up saving the military large sums of money that could be used across the board for various programs.

The military needs to update its legacy systems. Its current systems are dangerous not only the military's budget but also to the soldiers in the field who are being denied expedient delivery of equipment. Conversely it is also dangerous to the Military's inventory in that soldiers or military personnel can easily walk off with an item of equipment and have it not be accounted missing for days or even weeks. The research indicates that the most efficient and effective way of updating the legacy systems would be to implement an RFID embedded SCM system that integrates GIS mapping technology.

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