

1 Background Information

1.1 Acknowledgements

The RFID Solutions Center would like to express our thanks to CACI for their help in making this report possible.

1.2 Contract Information

Offering Department:
U.S. Air Force Research Laboratory, Materials and Manufacturing Directorate ("AFRL/MLM")

Recipient:
Wright Brothers Institute

Vehicle:
Memorandum of Understanding / Partnership Intermediary Agreement ("MOU" / "PIA")
FA8650-06-3-9000

Contract:
Collaborative Purchase Order ("CPO") FA8650-06-3-9021

Title:
RFID Rapid Adoption Collaboration Initiative ("RRACI")

The objective of the program is for the recipient to stimulate the rapid transition of radio frequency identification (RFID) technologies by developing an RFID solutions center. The RFID solutions center shall provide an effective way to collaborate with government end users, contractors, and defense industry suppliers. The solutions center shall provide education, training, and application of specific system design capabilities to transition RFID technologies to meet military needs. The RFID solutions center shall provide the capabilities and services that shall assist the government in streamlining both internal and external supply chain challenges to support the war fighter.

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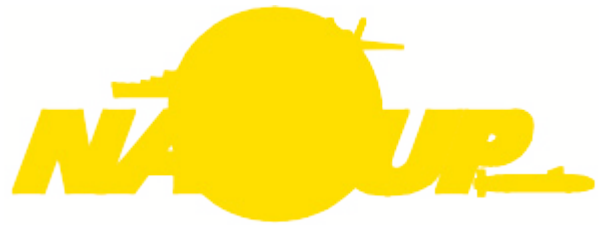




Table of Contents

1.1 Acknowledgements	1
1.2 Contract Information	1
3.1 About Passive RFID	5
3.2 Background	5
3.3 Scope	7
3.4 Project Team	8
3.5 Report Layout	9
4 Methodology	9
5 Conclusions	9
5.1 Findings	9
Table 1: pRFID Solution Elements	10
Figure 1: The Future Vision - Bangor Material Flow Diagram	12
Figure 2: Future Vision — pRFID Expansion High Level Data Flow Diagram	13
Figure 3: ASN/RFID Metrics Report Format	16
Figure 4: ASN/RFID Metrics Definitions	17
Figure 5: ASN/RFID Metrics Definitions	18
Figure 6: Sample Operational Metrics Report	19
Figure 7: Operational Metrics Report Definitions	20
Figure 8: New RFID Printer Location	21
5.2 Recommendations	21



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2 EXECUTIVE SUMMARY

As part of the Navy Enterprise Resource Planning (NERP) Program, the Department of the Navy has selected SAP as their Enterprise Solution and SAP's Warehouse Management System (WMS) to manage their warehouse operations. The Navy desires that this single ERP and RFID system converge logistics business processes for the entire Navy. The role of the converged system will be to normalize the Navy's Passive Radio Frequency Identification (pRFID) and warehousing business processes on a global basis.

The Naval Supply Systems Command (NAVSUP) would like to finalize its Bangor RFID Evaluation (BRE) Project implementation, develop "Exportable" enhancements, certify all hardware and software to NMCI standards, sustain BRE through the end of FY06, apply "Lessons Learned", and use the information garnered to implement an additional RFID/Warehouse Management System (WMS) (hereinafter RFID +) at the TRIDENT Refit Facility (TRIREFFAC) Kings Bay, GA. This will pave the way for an early shutdown of legacy applications supporting warehouse management functions and ensure that cutting edge RFID and AIT technology is implemented in accordance with OSD mandates.

Today, Navy Partner sites perform their warehouse management functions for material using several UADPS subsystems/applications (running on both IBM Mainframe and Tandem). These systems collectively communicate warehouse information to and from the Inventory Management (IM) system. Since these sites are not currently part of the initial rollout of NERP, the Navy would like to replace the legacy warehouse management applications (residing on Tandem) with AIT / SAP including pRFID. The SAP IM and WM modules will initially interface with legacy systems, which will continue to perform the IM function. Eventually, RFID will interface with the SAP Enterprise for the performance of the IM function. Having the RFID solution in place prior to the completion of the total converged Navy ERP solution will facilitate and mitigate the risk of implementing the final Navy solution. Early implementation of RFID will provide more efficient and capable warehouse system and enhanced by RFID technology as mandated by DoD. This implementation will offer Navy the opportunity to implement efficiency-enhancing technologies and processes in its warehouses, just as the converged SAP ERP implementation will offer the opportunity to implement them for the logistics community as a whole.

The Headquarters customer for this RFID and Supply Chain Management initiative, the Naval Supply Systems Command (NAVSUP), as well as DoD elements have been extremely complimentary of the results attained by a predecessor RFID installation, the Bangor RFID Evaluation (BRE) Project at the Trident Intermediate Maintenance Facility (IMF) in Bangor, Washington. The objective under this proposal is to further refine the BRE Project achievements at Bangor and export them to meet the warehousing, distribution, and supply chain requirements at the TRIDENT Refit Facility (TRIREFFAC) Kings Bay, Georgia. NAVSUP's goal to provide a "BRE like" logistics package for its customers throughout the Department of the Navy. The initial BRE implementation effected improvements in the following areas:

- › Improved data accuracy with a Passive Radio Frequency Identification (pRFID) and bar-coding solution.
- › Introduced the use of Advance Shipping Notification (ASN).
- › Increase efficiency and inventory accuracy with the automated processes of material receipt, stow, issue, and inventory management.



- › Generated real-time documents; DD1348-1A, Material Movement Document (MMD), Receipt Label, and pRFID Labels.
- › Increased visibility of inventory by location and processing statistics in a real-time environment.
- › Integration to legacy warehouse management applications.
- › Improved visibility of serialized item information through the warehousing lifecycle.

3 Introduction

3.1 About Passive RFID

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. Utilizing radio frequency waves, an RFID tag can be applied to or incorporated into a product for the purpose of location and identification. UHF Passive RFID can be read from several meters away and beyond the line of sight of the reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal and can also be used for other specialized functions. The second is an antenna for receiving and transmitting the signal.

RFID technology is in increasing use in enterprise supply chain management, improving the efficiency of inventory tracking and management. The Department of Defense, along with major commercial companies such as Wal-Mart, is implementing systems to test the ability of this technology to improve asset visibility, product integrity and readiness throughout the supply chain.

The use of RFID in the DoD supply chain has the potential to provide real benefits in inventory management, asset visibility, and interoperability in an end-to-end integrated environment. RFID encapsulates the data accuracy advantages inherent in all types of automatic identification technology (AIT). Additionally, RFID is a totally non-intrusive methodology for data capture (requires no human intervention), is non-line of sight technology, and is a technology that possesses both read and write options within the same equipment item.

RFID addresses a key challenge that has been noted at every node within the DoD supply chain – lack of visibility of item data. As an integral aspect of the overarching suite of AIT capabilities, RFID will become a key technology enabler for the DoD logistics business transformation and will support long-term integration of the Unique Identification (UID) into the DoD end-to-end supply chain. RFID (both active and passive) is required by DoD to:

- › Provide near-real time in-transit visibility for all classes of supplies and materiel
- › Provide “in the box” content level detail for all classes of supplies and materiel
- › Provide quality, non-intrusive identification and data collection that enables enhanced inventory management
- › Provide enhanced item level visibility

3.2 Background

The United States Department of Defense Internal Guide to Passive RFID provides some very specific guidelines on the approach to RFID implementation across the DoD. The highlights of the guidelines are detailed in the following paragraphs.

RFID is a transformational technology performing a vital role in achieving the Department of Defense (DoD) vision



for implementing knowledge-enabled logistic support to the war fighter through fully automated visibility and supply chain management. The goal is to employ mature and emerging supply chain technologies to optimize the supply chain. Utilizing RFID as an integral part of a comprehensive suite of Automatic Identification Technology (AIT) will facilitate accurate, hands-free data capture supporting DoD business processes in an integrated, end-to-end supply chain enterprise.

Typically, RFID benefits can be seen in the areas of inventory management and visibility, operational improvements, shrinkage, and asset tracking. Within each area, there are substantial benefits for the DoD. Highlighted benefits include:

- › Improve inventory management
- › Improve labor productivity
- › Eliminate duplicate orders
- › Replace manual procedures
- › Automate receipt and acceptance
- › Improve inventory and shipment visibility and management
- › Reduce shrinkage
- › Enhance business processes
- › Improve asset tracking

The DoD has developed a Concept of Operations (CONOPS) for passive RFID tagging that delivers the best value to the war fighting customer. This CONOPS provides a roadmap that targets critical distribution functions within the defense distribution depots, depot maintenance operations and strategic aerial ports.

RFID technology will be implemented through a phased approach, applied both to supplier requirements and DoD sites. Shipments of goods and materials will be phased in by procurement methods, classes/commodities, location and layers of packaging for passive RFID.

In order to take advantage of the DoD's new RFID capabilities at certain nodes, internal DoD shipments need to have passive RFID tags. Additionally, a corresponding Advanced Shipping Notification (ASN) needs to be generated for all shipments.

The BRE pRFID implementation at the Subbase Bangor in March of 2006 was a move towards achieving the DoD's goals for pRFID technology. The BRE solution uses SAP for material and warehouse management and brought bin level inventory management to track materials. BRE is interfaced with the U2 legacy system which remains the system of financial record. When Navy ERP reaches maturity, the BRE warehouse solution will be integrated with the overall SAP ERP solution.

BRE uses SAP functionality to process receipts, manage inventory by bin, and process issues from stock. Two automated conveyor lines with stationary pRFID portals were installed in Bangor's building 6403 as part of the BRE solution. These portals are used to read pRFID tagged cartons and trigger goods receipts postings in SAP when the tags are successfully matched with ASNs. The DLA depots in San Joaquin and Susquehanna are currently the only Bangor suppliers shipping pRFID tagged cartons.



3.3 Scope

The BRE RSC project had two major goals, to enhance the functionality and stability of the initial SAP/RFID implementation and to expand the system to the waterfront. The tasks described below were designed to support those goals. Tasks 3.2.1.1 and 3.2.1.2 describe the future vision of pRFID usage for tracking requisitions and a solution and architecture to meet that vision. The portion of the vision described in 3.2.1.1 that deals with reading pRFID tags with a handheld scanning device was developed and implemented at the Bangor SUBSAT staging area. SUBSAT is a waterfront staging area where items received against boat requisitions are stored until the boats are ready for the materials. The remaining tasks address enhancing the functionality of the initial implementation. Task 3.2.1.5 was deleted from the tasking due to changing Navy requirements and plans.

The BRE RSC project identified seven tasks in the Design Plan. Those tasks were as follows:

Task 3.2.1.1 Define requirements to extend RFID tracking from the warehouse to the boat

Task Goal: The goal of this task is to capture the vision of expanding pRFID usage to meet the requirements for tracking requisitions through receiving, warehousing, and delivery to the boat or other end customer. The narrative and diagrams contained in this task describe the future vision.

Task 3.2.1.2 Design an architecture and a solution to meet the extended RFID solution requirements to the “last mile”

Task Goal: The goal of this task is to develop an overall solution, to include the supporting technical architecture, meeting the requirements laid out in Task 3.2.1.1. Components of this solution will be prototyped under Task 3.2.2.1. Implementing this solution will result in better visibility of material movements on base and fewer movements for material destined for on base customers.

Task 3.2.1.3 Develop a plan, including hardware, software, and labor costs, for the installation of the extended RFID tracking solution at Bangor

Task Goal: The goal of this task is to develop a plan to build and test a prototype of the portion of the expanded Bangor pRFID solution identified in task 3.2.1.2 as the first steps in developing the pRFID vision.

Task 3.2.1.4 Design an RFID and operational metrics package to capture the metrics defined in the Deloitte BCA metrics analysis

Task Goal: The goal of this task is design pRFID and SAP operational metrics package to support the management of the BRE implementation and supporting the collection of metrics for the BCA. SAIC is performing the BCA, not Deloitte.

Task 3.2.1.5 Develop a plan for a site survey and assessment at Kings Bay Submarine Base

Task Goal: The goal of the Kings Bay site survey is to gather information about any unique functional, technical, and organizational change requirements at that site for the functions that are in scope for BRE. The data collected during this survey will be the basis of a gap assessment, high-level functional and technical design, and high level cost estimate that will assist in more detailed planning for deployment of BRE to Kings Bay.

Task 3.2.1.6 Develop plan to enhance DTO processing

Task Goal: The goal of this task is to design a solution for improving the rate at which pRFID tag reads for Direct Turnover (DTO) receipts match the corresponding Advanced Shipping Notice (ASN) and the SAP purchase order.



A successful match results in a posted goods receipt in SAP. An unsuccessful match requires manual processing.

Task 3.2.1.7 Develop a plan to enhance the speed of the printing solution

Task Goal: The goal of this task is to design a solution for enhancing the speed of the printing process for pRFID generated receipts. The current print solution sends the receiving documents for all pRFID generated receipts to the same printer. This process requires an extra step to separate the documents as they come off the printer.

The outcome of each task is addressed in the Findings & Conclusion section.

3.4 Project Team

This project was conducted by a team of passive RFID and Academia professionals and supported by CACI. The project team was comprised of CACI, the Wright Brother's Institute, and Alien Technology. The team members are described below.

US Navy AIT Program Office

The Navy AIT Office is the "AIT Clearinghouse" for the Navy. The AIT Office is responsible for certification of AIT equipment for inclusion in the CLIN 0023 catalog which offers enhanced, commercial off the shelf (COTS) software and hardware peripherals.

CACI

CACI International Inc provides the IT and network solutions needed to prevail in today's new era of national security, intelligence, and e-government. From systems integration and managed network solutions to knowledge management, engineering, simulation, and information assurance, CACI delivers the IT applications and infrastructures the federal government uses to improve communications and collaboration, secure the integrity of information systems and networks, enhance data collection and analysis, and increase efficiency and mission effectiveness.

Wright Brothers Institute

The Wright Brothers Institute was the recipient of the grant and is the prime contractor for this contract.

Alien Technology Corporation

Alien Technology Corporation (ATC) was the sole subrecipient of the grant and provided overall program management as well as significant support through the RFID Solution Center (RSC) for training, integration facility support, and RFID solution engineering support. Alien Technology provides UHF Radio Frequency Identification (RFID) products and services to customers in retail, consumer goods, manufacturing, defense, transportation and logistics, pharmaceuticals and other industries. The RFID Solutions Center, a division of ATC, is the most advanced facility devoted entirely to the application of RFID technology. Open to enterprises, government agencies and their partners, the Center comprises 23,000 square feet of educational, R&D and real-world implementation resources designed to enable the global RFID community to tap the potential of RFID technology.



3.5 Report Layout

The remainder of this report describes the study design, experiments, findings, conclusions, and recommendations.

4 Methodology

In executing each of the tasks included in the scope of this project the project team was constrained by the limitations of operating within Navy Marine Corp Intranet (NMCI) network in place at Bangor. The BRE implementation was the first SAP/RFID system implementation within the NMCI network and in many cases needed to find creative solutions for operating within the security restrictions of the network.

The methodology for approaching every task was a straight forward drawn from the standard SAP Accelerated SAP (ASAP) implementation methodology which contains the following basic steps:

1. Plan the project
2. Define the requirements
3. Design the solution
4. Build the solution
5. Test the solution
6. Implement the solution

This project did not have a traditional single point of focus for its scope, but addressed a mixed bag of operational requirements to enhance the initial solution and expand the reach of the solution to the waterfront.

The major value derived from the initial BRE implementation and the subsequent RSC project is the proof of concept for operating an SAP/RFID based warehouse management system in a production NMCI environment.

5 Conclusions

The RSC BRE project did not result in a single large impact easily measured with performance metrics. The combined effect of the successful completion of the individual tasks was a more robust, user acceptable, system. The findings from the results of each of the tasks described in the Scope section are described in the Findings section below.

5.1 Findings

The results of each task are described below.

Task 3.2.1.1 Define requirements to extend RFID tracking from the warehouse to the boat

The project team held requirement gathering workshops with representatives of the NAVSUP AIT Office and the FISC operations personnel at Bangor to discuss future uses of pRFID technology to track requisitions.

What emerged from the requirements workshops is a vision of the future in which users have the ability to track the status of requisitions and the related material movements in one system. The vision also includes using pRFID tag reads to trigger the key receipt, picking confirmation, and proof of delivery transactions.

The vision includes capturing "observations" of material movements for requisitions through the system using pRFID tag reads. These "observation" reads are basically "I am here" messages generated as tagged



requisitions pass through designated observation points. Tracking inbound requisitions from vendors consist of tracking movements from the time materials arrive on site until DTO requisitions are delivered to the end customer or stock requisitions are stowed in the warehouse. Tracking requisitions filled from stock consists of tracking material from the time the requisition is picked until it is delivered to the end customer.

An as yet undesignated system would receive all of the requisition movement observations collected by pRFID tag reads and provide tracking visibility to users. All of the requirements workshop participants agreed that the pRFID observation tag reads should require the least amount of labor possible.

Bangor would also like to use pRFID technology to improve efficiency of requisition fulfillment by receiving at multiple locations and eliminating some of the internal warehouse material movements.

The project team is using the FISC operations at Bangor as a model to demonstrate the future pRFID vision described above. Achieving the pRFID vision requires some specific development activities and process changes, not all of which are part of the BRE system solution. The identified development activities and process changes are described in the following table. Items with "Current Scope" in the Schedule column are included within the scope of the prototype being developed for this statement of work. The items with "Future Vision" in the Schedule column are part of the solution to meet the future vision, but are not being developed as part of this statement of work.

The table below from the RSC Design Plan Deliverable illustrates the vision derived from this task.




Table 1: pRFID Solution Elements

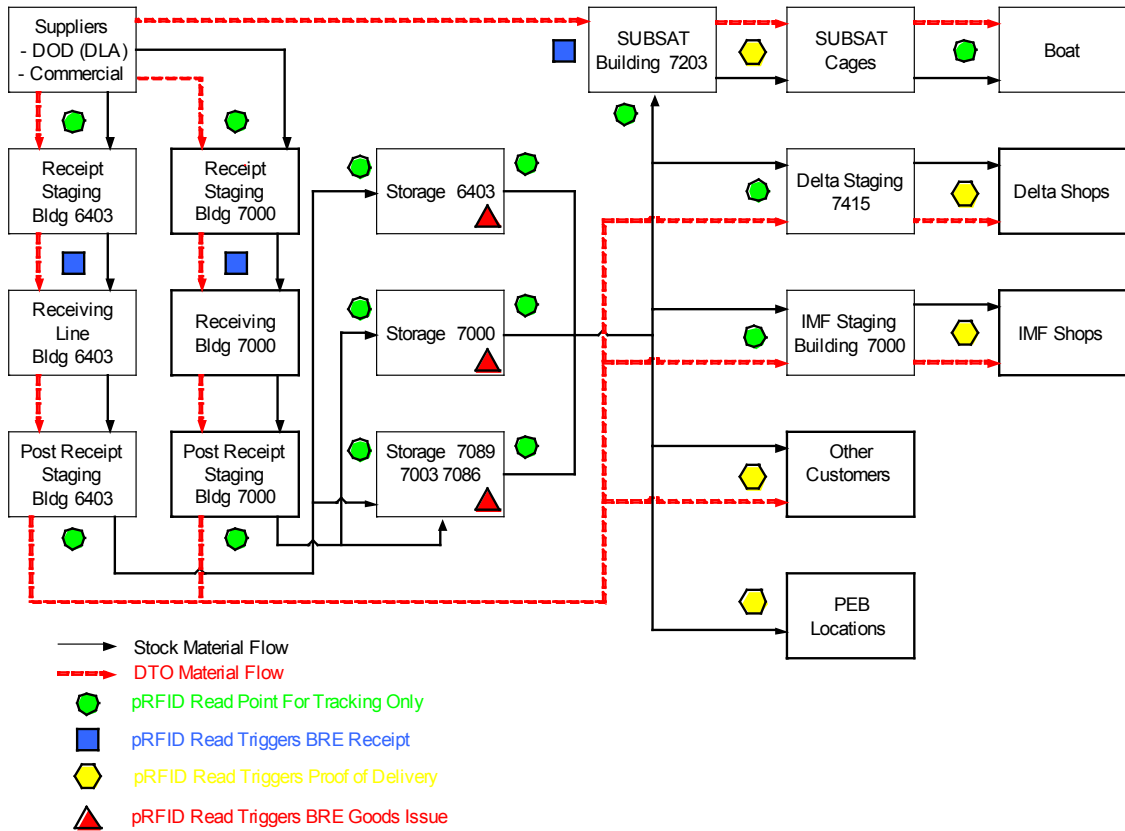
Item	Schedule	Description
1	Current Scope	Develop a solution to trigger receiving transactions from pRFID tag reads using portable pRFID scanning devices. This will improve the efficiency of the receiving process by allowing the receipt of material at locations without a traditional pRFID portal installation.
2	Current Scope	Change vendor shipping practices so deliveries are shipped to the appropriate receiving location.
3	Current Scope	Develop a solution to generate "observation" pRFID tag reads from portable scanning devices. The current scope only includes developing the ability to generate the "observation" read from a portable device. Developing the system to accept the reads and track the requisitions is future development.
4	Future Vision	Develop a solution to generate "observation" pRFID tag reads from pRFID antennas mounted on door frames, door ways, portals, or other fixed locations.
5	Future Vision	Develop a solution to generate and apply pRFID tags to requisitions filled from stock and send a tracking system message when the pick is confirmed.
6	Future Vision	Develop a solution to generate validated proof of delivery messages by reading the pRFID tag and reading a positive form of identification from the customer.



Item	Schedule	Description
7	Future Vision	Develop a new system or enhance an existing system to act as the tracking system for requisition movements captured by pRFID tag reads.
8	Future Vision	Change vendor pRFID tagging practices so tags are applied at the requisition level instead of the carton level.

The Future Vision - Bangor Material Flow diagram in Figure 1 illustrates the pRFID vision of a requisition level tracking system for FISC operations at Bangor. The diagram uses the physical layout of the Bangor operations to indicate where the various types of pRFID reads would take place.

-  Indicates a tag read from a portal or handheld device designed to trigger a goods receipt posting in BRE (Must be 100% accurate)
-  Indicates a tag read from a handheld device designed to confirm the transfer order (pick) and post goods issue in BRE (Must be 100% accurate)
-  Indicates a tag read from a handheld device designed to trigger the proof of delivery message to LDS (Must be 100% accurate)
-  Indicates an observational pRFID tag read as a requisition moves around the site.
-  Dashed red lines indicate the flow of direct turnover (DTO) materials. These materials get delivered to the receiving location closest to the end customer. (Building 6403, Building 7000. or SUBSAT)
-  Solid black lines indicate the flow of stock material into the warehouse facilities and back out to customers



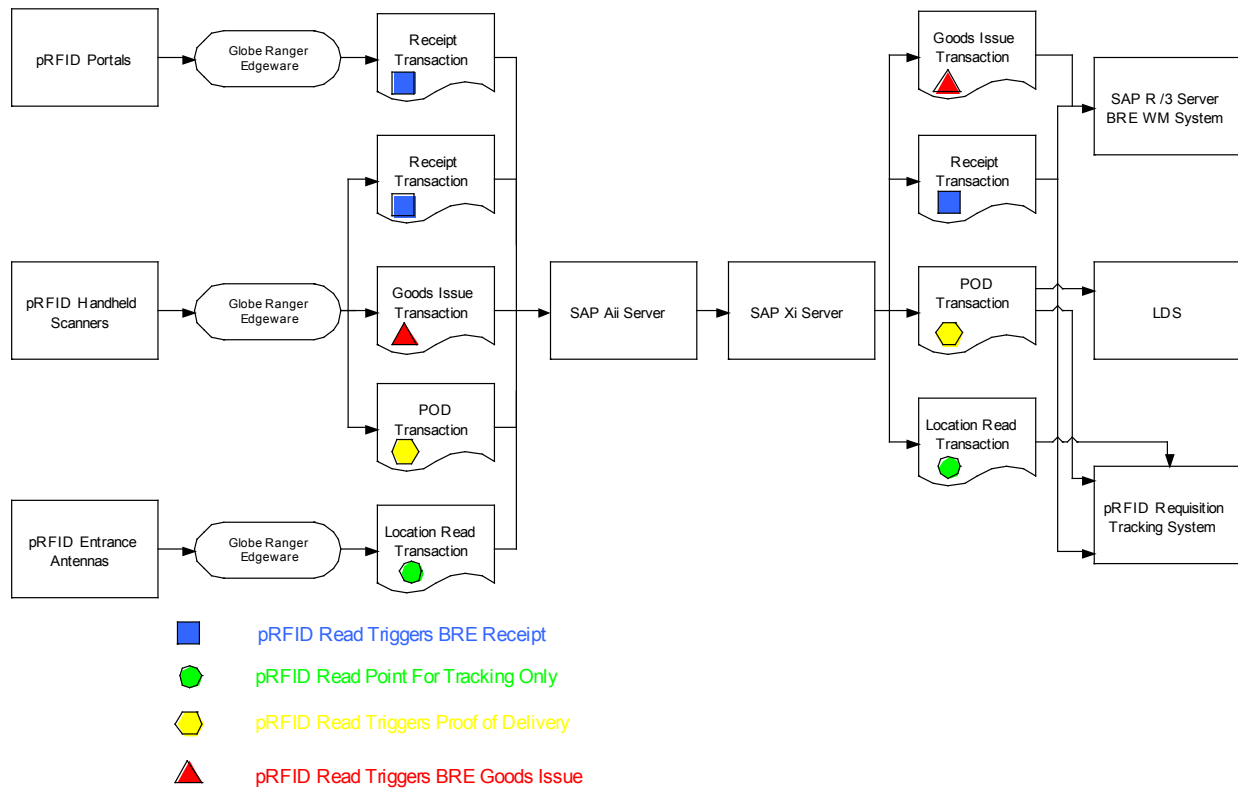
as requisitions filled from stock.

Figure 1: The Future Vision - Bangor Material Flow Diagram

The pRFID Expansion High Level Data Flow diagram that follows in Figure 2 is a high level picture of the data flows resulting from the pRFID reads in the Material Flow diagram.

-
- ▲
- ⬡ Indicates a goods receipt transaction
- Indicates an issue confirmation and goods issue transaction
- Indicates a proof of delivery transaction
- Indicates an observation transaction

Note that the box in the lower right corner of the diagram is labeled pRFID Requisition Tracking System. No decision has been made on whether to use and existing such as LDS or to build a new system for tracking pRFID



tagged requisitions.

Figure 2: Future Vision — pRFID Expansion High Level Data Flow Diagram

Task 3.2.1.2 Design an architecture and a solution to meet the extended RFID solution requirements to the “last mile”

Task 3.2.1.3 Develop a plan, including hardware, software, and labor costs, for the installation of the extended RFID tracking solution at Bangor

The results of designing the solution, developing the implementation plan, and implementing the solution are detailed below.

The project team developed and implemented a solution for executing SAP receipts in BRE with a handheld RFID scanner. The solution was implemented at the Bangor SUBSAT waterfront staging area. The implementation of this solution streamlines the receiving solution for direct shipments to the submarines by eliminating the need to process receipts in Building 6403 and then sending them to SUBSAT. Shipments may now be received directly at SUBSAT.

The details of design and operation of the handheld device are contained in the Installation Report. The details of the architecture are included in the Design Document. All of the following objectives detailed in the Design



Document for the operation of the handheld device were achieved by the implementation of the handheld RFID receiving solution.

1. Move to a more decentralized receiving function. Allowing material to be received closer to its final destination reduces the number of physical moves, reducing the chances of the material getting lost or misplaced.
2. Add the capability to automate RFID receipts at locations other than Bldg 6403. The handheld device permits receiving at SUBSAT and will be implemented in other locations in the future.
3. Develop the capability to generate "observation" tag reads to capture movement of material. The handheld solution has the capability to record "Here I Am" observations of pRFID tags.
4. Change the level at which DLA applies pRFID tags. Currently, DLA applies pRFID tags at the package level. DLA has begun tagging at the MRO level for shipments from the San Joaquin depot.
5. Automate POD processing by reading pRFID tags and positive form of identification. Changes implemented in the legacy systems now post a proof of delivery transaction whenever the receipts are posted in BRE.

Task 3.2.1.4 Design an RFID and operational metrics package to capture the metrics defined in the Deloitte BCA metrics analysis

The deliverables under this task were two Excel based reporting models. One report measures BRE system performance in processing ASN transactions received from DLA and processing RFID tagged receipts. The second report provides operational metrics for Bangor management to support warehouse operations.

The ASN/RFID metric report has evolved from the design included in the RSC Design Plan Deliverable. Based on feedback from management the design of the ASN/RFID Metrics Report evolved into a simpler, more focused report. The revised design measures the effectiveness of the system in processing ASN transactions and RFID



Project Summary Report:

Results of the Bangor RFID Evaluation Using Passive RFID Technology

tags and provides an explanation for failed transactions.

Description	May 2007	Jun 2007	July 2007
ASN Metrics			
Number Of ASNs	2,256	2,247	1,999
Minus Multiple EPC ASNs	42	4	2
ASNs Sent To SAP	2,214	2,243	1,997
Minus Failed FI017 Idocs	246	266	164
Processed	1,968	1,977	1,833
% Processed	88.9%	88.1%	91.8%
Failed Idocs By Reason			
Carter & Other Points of Entry Requisitions	132	136	68
COSAL Requisitions	86	101	71
Suffix Mismatch Requisitions	16	15	3
Purchase Order Deleted in SAP	9	3	21
Purchase Order in SAP After ASN	2	4	-
Other	1	7	1
	246	266	164
RFID Tag Metrics			
Tags Read	903	1,514	1,369
Minus Not Matched	140	182	215
Matched	763	1,332	1,154
Match Rate	84.5%	88.0%	84.3%
Deliveries Matched	1,225	1,336	1,512
Minus Not Posted	207	154	176
Posted	1,018	1,182	1,336
Post Rate	83.1%	88.5%	88.4%
Tags Not Matched By Reason			
No ASNs Received	57	93	120
COSAL Requisitions	34	23	31
Other Point of Entry Requisitions		35	53
Multiple Tag Reads	5	18	
Communications Errors	5	9	
Multiple EPCs In ASN	26	3	
Unit of Measure Errors	3	1	1
Other	10		10
	140	182	215
Receipts Not Posted By Reason			
Batch Controlled Material	132	143	166
Purchase Order Deleted	73		
Other	2	11	10
	207	154	176
RFID Receipts As Percent Of SAP Receipts			
RFID Receipts	1,018	1,182	1,336
Total SAP Receipts	3,790	3,551	2,981
RFID Receipt Rate	26.9%	33.3%	44.8%



The ASN/RFID Metrics Report format is displayed below.

ASN & RFID Metrics Definitions			
Description		Definition	Source
ASN Metrics			
Number Of ASNs	A	Number of ASN messages received from DAAS for the month that contained at least one EPC number.	WebMethods Transaction Log for interface FI017
Minus Multiple EPC ASNs	B	Number of ASN messages containing multiple EPC numbers. The ASN does not contain separate quantities for each EPC, so the ASN cannot be processed.	WebMethods Transaction Log for interface FI017
ASNs Sent To SAP	C	Number of ASN messages sent to SAP for processing. Each ASN creates an FI017 Idoc.	A Minus B
Minus Failed FI017 Idocs	D	Number of FI017 Idocs in SAP that failed to process successfully.	SAP Transaction WE02 for logical messages ZZ_FI017
Processed	E	Number of FI017 Idocs in SAP that processed successfully.	C Minus D
% Processed	F	Percentage of ASN messages sent to SAP that processed successfully.	E Divided By C
Failed Idocs By Reason			
Carter & Other Points of Entry Requisitions		Number of FI017 Idocs that failed because the requisitions were not entered through the Bangor U2 point of entry. Therefore there is not a purchase order in SAP to process the ASN against.	Analysis of report from SAP transaction ZIDOCFAILED.
COSAL Requisitions		Number of FI017 Idocs that failed because the requisitions were created through the COSAL process. Therefore there is not a purchase order in SAP to process the ASN against. COSAL requisitions are captured in SAP beginning mid June 2007.	Analysis of report from SAP transaction ZIDOCFAILED.
Suffix Mismatch Requisitions		Number of FI017 Idocs that failed because the suffix in the ASN is different from the suffix on the purchase order in SAP.	Analysis of report from SAP transaction ZIDOCFAILED.
No Purchase Order in SAP		Number of FI017 Idocs that failed because the purchase order was not in SAP and the reason isn't covered by any of the other failure categories.	Analysis of report from SAP transaction ZIDOCFAILED.
Purchase Order in SAP After ASN		Number of FI017 Idocs that failed because the ASN was processed before the purchase order was created in SAP.	Analysis of report from SAP transaction ZIDOCFAILED.
Other		Number of FI017 Idocs that failed for any other reason.	Analysis of report from SAP transaction ZIDOCFAILED.

Figure 3: ASN/RFID Metrics Report Format

The definitions of the items in the ASN/RFID Metrics Report are displayed on the following two figures.



Results of the Bangor RFID Evaluation Using Passive RFID Technology

RFID Tag Metrics			
Tags Read	G	Number of RFID tag read messages sent to the Aii	Analysis of Aii log custom report.
Minus Not Matched	H	Number of RFID tag read messages without a matching ASN and delivery.	Analysis of Aii log custom report.
Matched	I	Number of RFID tag read messages with a matching ASN and delivery.	G Minus H
Match Rate	J	Percentage of RFID tag reads with a matching ASN and delivery.	I Divided By G
Deliveries Matched	K	Number of Deliveries matched from successful tag reads. Deliveries are created against purchase orders in SAP for each successfully processed ASN. Total is greater than the number of "Matched" tags because of the impact of multipacks from Susquehanna.	Analysis of table ZZMATDOC using SAP transaction SE16.
Minus Not Posted	L	Number of Deliveries matched from successful tag reads that failed to post a goods receipt in SAP.	Analysis of table ZZMATDOC using SAP transaction SE16.
Posted	M	Number of Deliveries matched from successful tag reads that did post a goods receipt in SAP.	K Minus L
Post Rate	N	Percentage of matched Deliveries that posted a goods receipt in SAP.	M Divided By K
Tags Not Matched By Reason			
No ASNs Received		Number of RFID tags that failed to match because the ASN was never received from DAAS.	Analysis of WebMethods archive of DAAS transactions.
COSAL Requisitions		Number of RFID tags that failed to match because the requisition was generated through COSAL process.	Analysis of WebMethods archive of DAAS transactions.
Other Point of Entry Requisitions		Number of RFID tags that failed to match because the requisition was not entered through Bangor's U2 site.	Analysis of WebMethods archive of DAAS transactions.
Multiple Tag Reads		Number of RFID tags that failed to match because the tag read was included in an Aii log with another tag read.	Analysis of Aii log custom report.
Communications Errors		Number of RFID tags that failed to match because of a failure in communications between ECC 5.0 and Aii.	Analysis of AIDOPMSG Idocs using SAP transaction WE02.
Multiple EPCs In ASN		Number of RFID tags that failed to match because the ASN contained multiple EPC numbers without separate quantities for each EPC.	Analysis of WebMethods archive of DAAS transactions.
Unit of Measure Errors		Number of RFID tags that failed to match because of a problem with unit of measure synchronization.	Analysis of AIDOPMSG Idocs using SAP transaction WE02.
Other		Number of RFID tags that failed to match for any other reason.	Process of elimination.
Receipts Not Posted By Reason			
Batch Controlled Material		Number of receipts that did not post because the material is batch managed.	Analysis of table ZZMATDOC using SAP transaction SE16 and the purchase orders using SAP transaction ME2N.
DTO No Material Number		Number of receipts that did not post because the requisition is DTO without a material number.	Analysis of table ZZMATDOC using SAP transaction SE16 and the purchase orders using SAP transaction ME2N.
Other		Number of receipts that did not post because of any other reason.	Analysis of table ZZMATDOC using SAP transaction SE16 and the purchase orders using SAP transaction ME2N.
RFID Receipts As Percent Of SAP Receipts			
RFID Receipts	O	Total SAP purchase order receipts posted by the RFID user ID.	Operational Metrics Report
Total SAP Receipts	P	Total SAP purchase order receipts.	Operational Metrics Report
RFID Receipt Rate	Q	Percentage of SAP receipts posted by the RFID user ID.	O Divided By P

Results of the Bangor RFID Evaluation Using Passive RFID Technology

Figure 5: ASN/RFID Metrics Definitions

The design of the Operational Metrics Report has not changed from the design included in the RSC Design Plan

	Month					
	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
Inbound Processing Metrics						
Total Receipts	3,233	4,817	3,777	5,085	1,569	2,082
Stock Receipts	1,866	3,134	3,486	4,951	1,543	2,063
DTO Receipts	1,367	1,683	291	134	26	19
DTO Receipt Detail						
DTO Open Purchase Receipts	8	11	0	1	0	0
DTO Credit Card Receipts	3	5	1	2	0	0
Receipts By Entry Type						
Manual Goods Receipts	3,048	3,558	2,415	3,416	1,419	1,751
RFID Goods Receipts	185	1,259	1,362	1,669	150	331
Total MTIS Receipts	1,008	927	844	684	704	658
Customer Returns	209	149	165	76	160	99
Returns From Repair	52	29	64	38	25	28
Turn Ins	747	749	615	570	519	531
Putaway Transfer Orders Confirmed	1,759	3,058	3,902	4,873	1,619	1,972
Receipt to Stow Time - Days	5.18	2.99	8.19	3.12	2.32	2.03
Outbound Processing Metrics						
Deliveries Created	12,868	8,237	6,055	9,343	6,573	6,698
Pick Transfer Orders Created	10,470	11,017	6,502	9,447	6,796	9,364
Pick Transfer Orders Confirmed	8,235	9,698	7,856	11,464	7,326	6,347
Total Goods Issues	8,209	9,453	8,239	11,113	7,392	6,695
Goods Issues - Priority Group 1	1,065	1,093	1,539	1,287	1,000	1,067
Goods Issues - Priority Groups 2 & 3	7,144	8,360	6,700	9,826	6,392	5,628
Walk Throughs - All Priorities	1,030	1,196	980	1,212	924	1,118
Storage Activity Processing Time (Days)	6.99	9.66	20.54	20.60	3.45	4.46
Delivery to Transfer Order - Days	1.93	2.77	9.51	5.70	1.57	1.21
Transfer Order to Confirmation - Days	3.72	5.56	7.29	14.36	1.13	1.39
Confirmation to Post Goods Issue - Days	1.35	1.33	3.74	0.54	0.75	1.86
Warehouse Metrics						
Bin To Bin Transfers	777	1,189	1,195	1,160	1,242	1,045
Bin Utilization Rate				56.8%	56.8%	56.8%
Total Bins	0	0	0	140,134	140,096	140,171
Total Empty Bins	0	0	0	60,482	60,510	60,564
Physical Inventory Counts	287	243	381	513	183	1,588

Deliverable. A sample report is displayed below.



Figure 6: Sample Operational Metrics Report

SAP Operational Metrics Definitions				
Metric	Unit of Measure	Definitions	Source	Formula
Total Receipts	Transaction Count	Total number of goods receipts documents posted in the month	Calculated	Sum of "Stock Receipts" and "DTO Receipts"
Stock Receipts	Transaction Count	Total number of goods receipts documents posted in the month for stock items	PO_RCPTS Query	PO receipt material documents posted in current month where the Sloc field is not blank
DTO Receipts	Transaction Count	Total number of goods receipts documents posted in the month for DTO items	Calculated	Sum of Manual Goods Receipts and RFID Goods Receipts minus Stock Receipts
DTO Open Purchase Receipts	Transaction Count	Total number of goods receipts documents posted in the month for DTO open purchases	PO_RCPTS Query	PO receipt material documents posted in the current month with the Material Group equal to OPEN (Subset of DTO Receipts)
DTO Credit Card Receipts	Transaction Count	Total number of goods receipts documents posted in the month for DTO items purchased with credit cards	PO_RCPTS Query	PO receipt material documents posted in the current month with X in the ninth position of the PIIN (Subset of DTO Receipts)
Manual Goods Receipts	Transaction Count	Total number of goods receipts documents posted in the month not processed by the RFID portals	PO_RCPTS Query	PO receipt material documents posted in the current month with user name not equal to XIRWBUSER
RFID Goods Receipts	Transaction Count	Total number of goods receipts documents posted in the month processed by the RFID portals	PO_RCPTS Query	PO receipt material documents posted in the current month with user name equal to XIRWBUSER
Total MTIS Receipts	Transaction Count	Total number of MTIS receipt documents posted in the month	Calculated	Sum of "Customer Returns", "Returns From Repair", and "Turn Ins"
Customer Returns	Transaction Count	Total number of MTIS receipt documents posted in the month for customer returns	MTIS_RCPTS Query	Material documents posted in the current month with a movement type of 961, 963, or 965 and a docid equal to ZWC
Returns From Repair	Transaction Count	Total number of MTIS receipt documents posted in the month for returns from repairs	MTIS_RCPTS Query	Material documents posted in the current month with a movement type of 961, 963, or 965 and a docid equal to ZVE
Turn Ins	Transaction Count	Total number of MTIS receipt documents posted in the month for turn ins	MTIS_RCPTS Query	Material documents posted in the current month with a movement type of 961, 963, or 965 and a docid equal to D6A or N6A
Putaway Transfer Orders Confirmed	Transaction Count	Total number of putaway transfer orders confirmed in the month	TO_LIST Confirmed Query	Transfer Orders with a movement type of 101 with a final confirmation date in the current month
Receipt to Stow Time	Days	Average elapsed time from the posting of the goods receipt document to transfer order confirmation for transfer orders confirmed in the month	TO_LIST Confirmed Query	Elapsed time between date and time of creation and the date and time of final confirmation for movement type 101 transfer orders with a final confirmation date in the current month
Deliveries Created	Transaction Count	Total number of deliveries created in the month	DEL_LIST Query	Deliveries with delivery type of ZDU or ZLO with a creation date in the current month
Pick Transfer Orders Created	Transaction Count	Total number of pick transfer orders created in the month	TO_LIST Created Query	Transfer Orders for movement types 601 & 951 with a creation date in the current month
Pick Transfer Orders Confirmed	Transaction Count	Total number of pick transfer orders confirmed in the month	TO_LIST Confirmed Query	Transfer Orders for movement types 601 and 951 with a final confirmation date in the current month
Total Issues	Transaction Count	Total number of goods issues posted in the month	Calculated	Sum of "Issues Posted - Priority Group 1" and "Issues Posted - Priority Group 2 & 3"
Issues Posted - Priority Group 1	Transaction Count	Total number of goods issues posted in the month for priorities 1 - 3	GI_DOCS Query	Material documents for movement types 601 and 951 with priority equal to 1, 2, & 3 with a posting date in the current month
Issues Posted - Priority Group 2 & 3	Transaction Count	Total number of goods issues posted in the month for priorities 4 - 15	GI_DOCS Query	Material documents for movement types 601 and 951 with priority greater than 3 with a posting date in the current month
Walkthroughs	Transaction Count	Total number of goods issues posted in the month, with any priority, that were handled as walkthroughs	GI_DOCS Query	Material documents for movement types 601 and 951 with route equal to WT with a posting date in the current month (All Priorities)



The definitions of the items in the Operational Metrics Report are displayed below.

Figure 7: Operational Metrics Report Definitions

Task 3.2.1.6 Develop plan to enhance DTO processing

Detailed research into the DTO receipt process disclosed several opportunities to improve the automatic goods receipt posting rate. The following changes were implemented to enhance the DTO receipt matching process:

1. Revised U2 to include COSAL requisitions. COSAL requisitions were previously processed entirely outside of the U2 system. Since U2 did not know about the COSAL requisitions it could not send a due message to BRE. Therefore, when the receipts for COSAL requisitions were processed in BRE there was no SAP purchase order and inbound delivery to receive against and the tag match failed. Legacy code changes were implemented to capture COSAL requisitions in U2 and the corresponding due records are now being sent to BRE and creating purchase orders.
2. Changed the SAP configuration to automatically create or update material master records in the Aii system when material masters are created or updated in SAP R/3. The Aii system is the system that processes the pRFID tag reads in the SAP RFID solution. Currently, if a pRFID tag read is processed for a material that does not exist in the Aii system the tag match will fail.
3. Revised the interface program that creates the SAP to Aii ASN idoc messages (AIDOPMSG outbound) for DTO requisitions to include "DTO" in the material field for requisitions of material not maintained in BRE. Incorrect values in this field will cause the tag match to fail.
4. TRIDENT system was changed to send Service Code N to U2 instead of Service Code X.

Task 3.2.1.7 Develop a plan to enhance the speed of the printing solution

The previous BRE print solution directed the documents generated by the posting of a goods receipt in SAP to the default printer assigned to the user id of the user posting the receipt. Each user has default settings in SAP for their user id and a default printer is one of the settings. Stock receipts generate a put away document and a material label. Direct turnover receipts (DTO) generate a goods receipt slip. Print output configuration in SAP links label printers to each regular laser printer. Therefore if a user posts a stock receipt the put away document goes to their default laser printer and the material label goes to the associated label printer.

All goods receipts posted as the result of a successful pRFID tag read and ASN match are processed under an RFID system user id. The same system user id is used for transactions from all RFID devices. Since all of the transactions are under the same user id they could only be sent to the default printer assigned to the RFID system user id.

In the building 6403 conveyor line schematic in Figure 8 below, the existing RFID output printer and the proposed new output printer are indicated as follows:

- A** Existing laser printer used to print receiving documents for both receiving lines

