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A Review of Reverse Logistics and Depot Level Repairable Tracking in the United States Navy

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June 2005

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A REVIEW OF REVERSE LOGISTICS AND DEPOT LEVEL REPAIRABLE TRACKING IN THE UNITED STATES NAVY

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I. INTRODUCTION

A. OVERVIEW

This project will review the Navy's reverse logistics processes dealing with retrograde Depot Level Repairables (DLRs). *Webster's Dictionary* defines retrograde as "the act of moving, occurring, or performed in a backward direction or opposite to the usual direction." This project will review various aspects of DLR management, current policies, and modes of transportation, cost of transportation, and the costs of current and possible future infrastructure, to include what makes up the applied surcharges. The major entities in the management of the DLR program are identified from a bottom up view. Like most other professions, Navy logisticians have their own jargon. Communication, a common language, is the first hurdle to cross when examining the Navy's retrograde system and trying to compare it with commercial practices.

B. BACKGROUND

Reverse logistics is a fairly new field of study in the world of commercial supply chain management, although the life-cycle management of repairables is a well-established military activity. Reverse logistics focuses on the part of the supply chain after the finished good has reached the end user. Reverse logistics processes include returned merchandise due to damage, seasonal inventory, restock, salvage, recalls, and excess inventory. They also include recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal.

This field of study has been practiced in the military services for more than forty years. DLRs fit into the definition of Reverse Logistics. The commercial processes of restocking, salvaging, recycling, and asset recovery all closely mirror the purpose and intent of the Military Services' DLR programs. In the case of the Navy, the general procedure is for the end user to return the broken asset to a collection hub or point. From the hub, the asset would be screened for nameplate data verification, packaged properly, and shipped on to a predetermined repair facility. Once repaired, the asset would reenter the supply stock inventory system as a Ready for Issues (RFI) asset.

There are many rules and instructions that govern the processing of retrograde DLRs. The return of a DLR back to the supply chain, as the result of Not Ready for Issue (NRFI) exchange, excess turn-ins or Intermediate Maintenance Activity (IMA), requires the same strict attention to detail as purchasing new items because DLRs are normally very expensive and usually considered critical items. Delays in the turn-in of carcasses (unserviceable items) adversely affect readiness due to the decrease in asset availability. Loss of a turn-in will result in a charge to the Type Commander or activity's Operating Target (OPTAR) budget, for the difference between the Net Price (the price paid with carcass turn-in), and the Standard Price (the price paid without carcass turn-in). This difference is also referred to as the Carcass Value. Additionally, this loss may require the Inventory Control Point or item manager to spend Navy Working Capital Fund (NWCF) monies to put a new item back into the inventory supply chain. Determining of which account is credited with the loss depends on where in the retrograde process the loss was discovered.

C. CURRENT ISSUES

Even though the DoD has maintained a reasonably constant spending level with respect to the National GDP, future DoD budget are not likely to keep pace with current and future military requirements. The Navy wants to optimize its spending to address present and perceived future budget short falls. Reducing costs associated with DLR items is an area of concern. Naval Inventory Control Point (NAVICP) manages the recovery and re-distribution of unserviceable retrogrades. There are more than 470,000 parts valued at $31B in inventory. In 2003, more than $1.8B was spent to repair DLRs. NAVICP conducts more than 380,000 repair action annually. For FY03, the cost of DLR recovery totaled $3.08B. Reducing the operating cost associated with this needed value recovery system without reducing availability of spare parts is the issue.

D. PROJECT OBJECTIVE

This project focuses primarily on the processes by which the Navy maintains asset or inventory visibility and how it affects the overall costs related to this portion of the supply chain. Total Asset Visibility (TAV) continues to be a goal of the Navy and the military in general. Knowing where assets or inventories are, and the condition they are in, provides enormous value to the operational war-fighter as well as the behind the scenes logistician. The project purpose is to document and review the processes involved in tracking retrograde inventory from the end user, to the processing agent and back to an issuing point. The importance of these processes lies in the enormous amounts of Navy dollars expensed on them, and the often critical nature of the repairable items to operational effectiveness. The project will examine how these processes affect readiness, inventories levels and operation and maintenance cost. Due to time and travel constraints, the models and functional descriptions contained within are limited to ATAC facilities located in San Diego, CA.

E. METHODLOGY

To obtain firsthand information, the authors conducted a site visit at San Diego, CA area facilities. Visiting ATAC San Diego was the cornerstone of the three day fact finding mission. Research data was collected by means of observation, interviews and interaction with supervisors and individuals in the receiving facility. The freedom to move about the facility unimpeded allowed for an unbiased view of how retrograde material flow through an ATAC Hub. Afloat Training Group, Defense Distribution Depot and Naval Aviation Depot North Island were the other sites visited while conducting research. Additionally, information was gathered by, reviewing of navy publications, procedures and instructions along with commercial reverse logistics practices.

F. OUTLINE

Chapter II will define the term Reverse Logistics and compare and contrast its use in commercial industry with its use in the military. Chapter II also address and defines frequently used acronyms. It will also describe the retrograde process from a macro point of view. One of the key contributors to the success of this reverse logistics process is the Advanced Traceability and Control (ATAC) organization. Chapter III will introduce and review key facts about the ATAC organization, to include general operations, customers, Performance Work Schedules (PWS) and problem areas. Chapter IV examines the Electronic Retrograde Management System (ERMS). This system is designed to improve decision support efficiency; information sharing while reducing administrative cost. Chapter V includes conclusions and recommendations and address areas that may need follow-on research.

II. REVERSE LOGISTICS

A. DIFFERENCES BETWEEN FORWARD AND REVERSE LOGISTICS

Demand is the key driver for forward logistics. Getting the product or service to the customer or end user is paramount for commercial and military logistics alike. With primary emphasis on quick, accurate, and efficient fulfillment of demand, many firms have found reverse logistics just as challenging as getting the product or service to the customer. Key differences between forward and reverse logistics are displayed in Table 1.

1. Forecasting

Forecasting for the forward supply chain is a challenge, but there have been many models developed to aid with this endeavor. As mentioned earlier, demand is the key driver. Every effort is used to estimate demand, so that proper levels of inventory are created and managed to meet demand. Demand is influenced by many things, such as price, cost of raw materials, operational tempo, and the restrictions imposed by war. Demand for the reverse supply chain, however, is generated in a random manner, and thus, can be difficult to forecast. The forecasting of returns is linked to and compounded by the uncertainties in the forecasts on the forward flows, typically encountered or seen as time lags in what happens in the forward chain.[1]

2. Transportation

The phrase "Last Mile" is commonly used in the field of logistics and refers to the final step in delivering the product or service to the desired customer or end-user. For commercial industries, forward transportation of products typically is from one or a few sources to many retail destinations, while return are typically the opposite.[2]

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[1] David Diener, Eric Peltz, Art Lackey, Darlene J. Blake, Karthik Vaidyanathan, Value Recovery from the Reverse Logistics Pipeline, (RAND Corporation 2004), 12

[2] Ibid, 12

Table 1.1 Difference Between Forward and Reverse Logistics.

Forward	Reverse
Forecasting relatively straightforward	Forecasting more difficult
One-to-many transportation	Many-to-one transportation
Product quality uniform	Product quality not uniform
Product packaging uniform	Product packaging often damaged
Destination/routing clear	Destination/routing unclear
Standardized channel	Exception driven
Disposition options clear	Disposition not clear
Pricing relatively uniform	Pricing dependent on many factors
Importance of speed recognized	Speed often not considered a priority
Forward distribution costs closely monitored by accounting systems	Reverse costs less directly visible
Inventory management consistent	Inventory management not consistent
Product life cycle manageable	Product life cycle issues more complex
Negotiation between parties straightforward	Negotiation complicated by additional considerations
Marketing methods well known	Marketing complicated by several factors
Real-time information readily available to track product	Visibility of process less transparent

SOURCE: R.S. Tibben-Lembke and D.S. Rogers, "Differences Between Forward and Reverse Logistics in a Retail Environment," *Supply Chain Management: An International Journal,* Vol. 7, No.5, 2002, p. 276

3. Quality, Routing, Disposition

The forward chain has relatively standard channels for distribution that use standard modes of transportation, both the distribution channel and the mode of transportation are designed from the start, with pricing, speed, cost, and packaging in mind. Another factor to consider is that it is very intuitive what the next step is in the forward chain. The military, as well as industry, often struggle with these same aspects with respect to reverse logistics. For the military, packaging has been a long-standing issue. The Navy and other services have a wide assortment of returning repairables.

They vary in size and weight, and are sometimes dirty or bulky. Some items are so large that they require hand made crates; others are small, like circuit cards, and need protection against breakage and electromagnetic damage. Often, the activity returning the repairable does not have adequate or appropriate packing and crating materials; many personnel also have not been properly trained in packing and crating procedures.[3]

4. Speed

On time delivery is important in any business; in the forward chain much emphasis is placed on making and managing delivery schedule. This level of importance also applies to the military, where the effectiveness of the forward chain is directly related to unit combat readiness. The reverse chain pipeline is not as big and is only indirectly related in the minds of most frontline war fighters. There is an apparent general lack of concern for moving unserviceable items to the location where they can be repaired or disposed of.[4]

5. Costs

Reverse logistics has many impacts that may not be readily apparent, for example storage, handling, and inventory cost (especially if unserviceable items are allowed to stop flowing and accumulate "midstream" without reaching endpoint).[5] Table 1.2 summarizes a comparison of reverse logistics costs and forward logistics costs.

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3 David Diener, Eric Peltz, Art Lackey, Darlene J. Blake, Karthik Vaidyanathan, Value Recovery from the Reverse Logistics Pipeline pp 14

4 Ibid

5 Ibid, 16

Table 1.2 Comparison of Reverse Logistics Costs to Forward Logistics Costs

Cost	Comparison to Forward Logistics
Transportation	Greater: lower-value channels
Inventory holding cost	Lower: lower-value items
Shrinkage (theft) Obsolescence	Much lower: limited use without repair
Collection	May be higher: depends on delays
Sorting, quality diagnosis	Much higher: less standardized
Handling	Much greater: item-by-item
Refurbishment/repackaging	Significant for RL, nonexistent for forward
Change from book value	Significant for RL, nonexistent for forward

SOURCE: R.S. Tibben-Lembke and D.S. Rogers, "Differences Between Forward and Reverse Logistics in a Retail Environment," *Supply Chain Management: An International Journal,* Vol. 7, No.5, p. 278.

B. NAVY REVERSE LOGISTICS PIPELINE

The reverse logistics pipeline starts at the ship or station. Step one, a repairable fails at the activity. The repairable, now classified as a Not-Ready for Issue (NRFI) is packaged for transport along with an accompanying turn-in document, normally form DD 1348-1. Step two, the NRFI items travel to one of two ATAC hubs, located in San Diego, CA., or Norfolk, VA. These hubs receive and process NRFI items. The processing includes screening the item for proper identification, packaging and condition. The hubs also create Transaction Item Reports (TIRs), which electronically transfer the custody of the repairable from the end-user activity to NAVICP. The ship or station returning the repairable will not be charged a carcass charge (the different between the net price and the standard or full price) after the TIR is created. The net price normally varies 25-75 percent less than the standard price. At NAVCIP an Item Manage (IM), tracks the repairable as Stock in Transit (SIT) until it is repaired and return to inventory as a RFI item. The Navy's reverse logistics pipeline is essentially two separate pipelines, an electronic documentation pipeline and a physical material pipeline, which only crosses at designated points. The first real intersecting point is when the ATAC creates the TIR, which is the starting point where a repairable physically entered the reverse logistics pipeline. Step three, the ATAC batches and ships the repairable to an item specific, Designated Overhaul Point (DOP) or a Designated Support Point (DSP) were they are later repaired and returned to the forward logistics supply chain as an "A" condition, Ready for Issue item (RFI). The depot repair facility is known as the DOP authorized to perform depot level repair for the DLR being shipped. Failed items are sent, however, to DSP which serve as a "collection point" or "holding activity" pending subsequent NAVICP directed inductions to a DOP. The material condition of the repairable determines if the item will be disposed or sent to the next physical point in the pipeline. Figure 2.1 depicts a simplified Navy reverse logistics pipeline material flow.

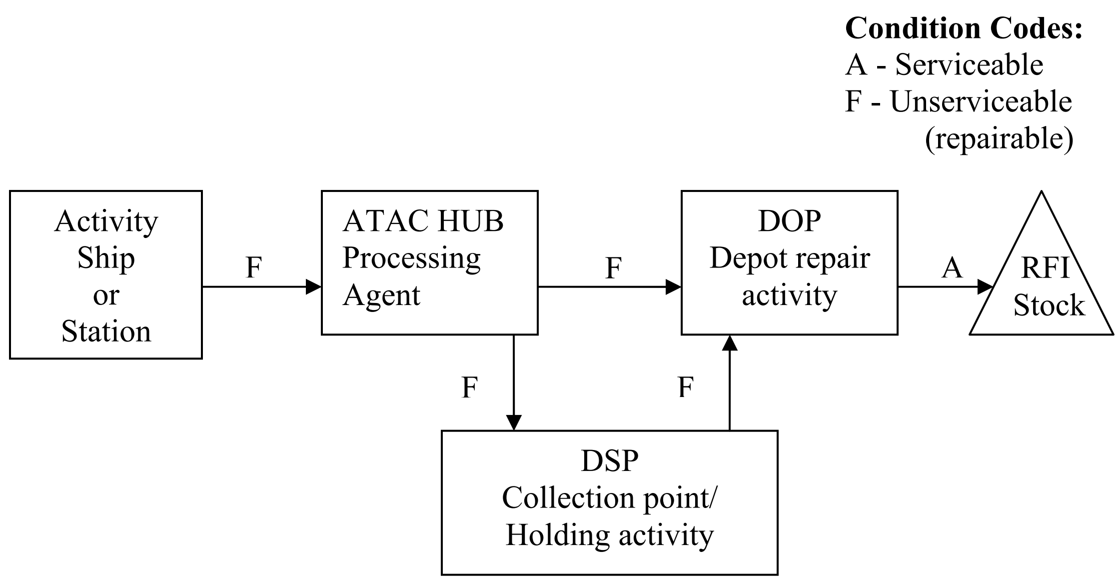

Figure 2.1 Simplified Navy reverse logistics Pipeline

C. REVERSE LOGISTICS FUNDING

Some industries such as automotive parts take full advantage of the reverse logistics supply chain. There is a high demand for re-manufactured auto parts. Automobile starters, alternators and other assorted engine parts are returned to the supply chain by the end-user, who receives some sort of incentive reward in the form of a refunded core charge. This individual incentive to save money, by purchasing a re-manufactured part verses a new a part, helps create the demand for remanufactured items. For the military, the incentive process is less appealing because there is no individual ownership or financial connection to a carcass. As mentioned earlier, some costs associated with reverse logistics are not apparent. The Navy uses a stock fund called Navy Working Capital Fund (NWCF) to support the overhead cost of the retrograde system.

NWCF is an account initially funded by Congress to be self supporting. In other words, the NWCF must make enough money to meet its costs on a yearly bases. The cost of transportation, administration, storage, facilities, manpower, and computer systems are all passed on to the customer in the form of a surcharge added to the cost of a RFI item. The NWCF is not used to fund initial new items. The Program Manager (PM) normally funds initial procurements, with appropriated funds.

III. ADVANCED TRACEABILITY AND CONTROL

A. BACKGROUND

In 1986, the United States Navy implemented the Advanced Traceability and Control (ATAC) system to manage the repairable return process. Under the ATAC system, failed Depot Level Repairable (DLRs) are processed through ATAC hubs before being shipped to the Designated Overhaul Point (DOP) for repair, or stored at the Designated Support Points (DSPs). The ATAC hubs receive, identify, package, and transship or stow these retrograde DLRs. (NAVSUP P-485, Para 8322) The purpose of the current process is to improve accountability and visibility of the carcasses in the repair pipeline, to reduce the number of units of an item in the pipeline and to reduce the length of the pipeline. Additional benefits provided by the ATAC system include transportation savings through the consolidation of shipments from the hubs, labor and processing cost savings gained through computerization and bar-code processing and by consolidating resources at the hubs.

B. THE ATAC SYSTEM

In the ATAC system, the Navy provides a centralized DLR technical screening process and utilizes the functions of a commercial freight agent to increase the traceability and movement of repairable carcasses from the point of failure to the repair DOP or DSP.

Repairable carcasses flow through the system in two ways. Both methods start when an item fails at a Naval activity and the activity determines it cannot repair the part locally. The first option for returning failed components is to send them directly to the nearest hub. This can be done by delivering the component to the hub, if it is located in the vicinity of the activity, or by sending it to the hub by certified mail. Once the item is received at the hub, the hub verifies the material, determines its disposition, and ships it to a DOP for repair or to a DSP for storage.

The second option is for the Naval activity experiencing the failure to transfer the component to the local supply activity that acts as a node. The node serves as a transportation consolidation point, forwarding shipments of failed components to the closest hub for screening and disposition.

The ATAC system works on a first-in, first-out basis and all items receive the same treatment. The Navy's Issue Priority Group system, the urgency of need, and the cost of the item are not used to create a priority system for handling returned carcasses. As a result, there are inherent advantages and disadvantages to this approach. One advantage is that it allows personnel to focus on just one carcass at a time without having to worry excessively about trying to prioritize them as new ones come in. Another advantage is that it saves time at the ATAC hub as consistent reorganization is not required because items with higher urgency arrive.

Conversely, there are disadvantages in that there are parts that need to be re-entered into the Ready-for-Issue (RFI) pool due to increased usage from current exercises, operational commitments, etc. Another disadvantage is that with no research to determine urgency, repairables that have inaccurate system inventories initially are now out of the system, further creating logistical backlogs and ultimately reducing operational availability of key carcasses. Figure 3.2 is a flowchart highlighting the ATAC system from the time a depot level repairable enters and exits the ATAC network.

The following subsections provide details on the various steps a failed component is processed through in the ATAC system, including the information processing completed at each step.

1. Nodes

Unless failed components are delivered directly to a hub, nodes are the first point of receipt for material into the ATAC system. Nodes consolidate failed components and ship them to the nearest hub for processing.

Being the point of entry into the ATAC system, the node is the first place where management information gets recorded into the ATAC database. The initial data entered into the database by node personnel are the document number and national stock number (NSN) for the failed component. This information is also printed on bar-code labels and attached to each item. Contractor-operated nodes are funded by NAVSUP at the following high volume sites: Jacksonville, FL; Yokosuka, Japan; Pearl Harbor, HI; Sigonella, Sicily, Italy.

2. Hubs

There are two hubs: Norfolk, VA and San Diego, CA. When material arrives at a hub, it passes through the following steps:

- Receiving
- Screening
- Processing
- Packing
- Shipping

Failed DLRs are received by an ATAC contractor freight agent, turned over to the Navy hub personnel for screening, processed through the Master Repairable Item List (MRIL), and packed, and returned to the ATAC freight agent for consolidation before shipment by a contractor carrier. See Figure 3.1 for Hub and Node geographic locations.

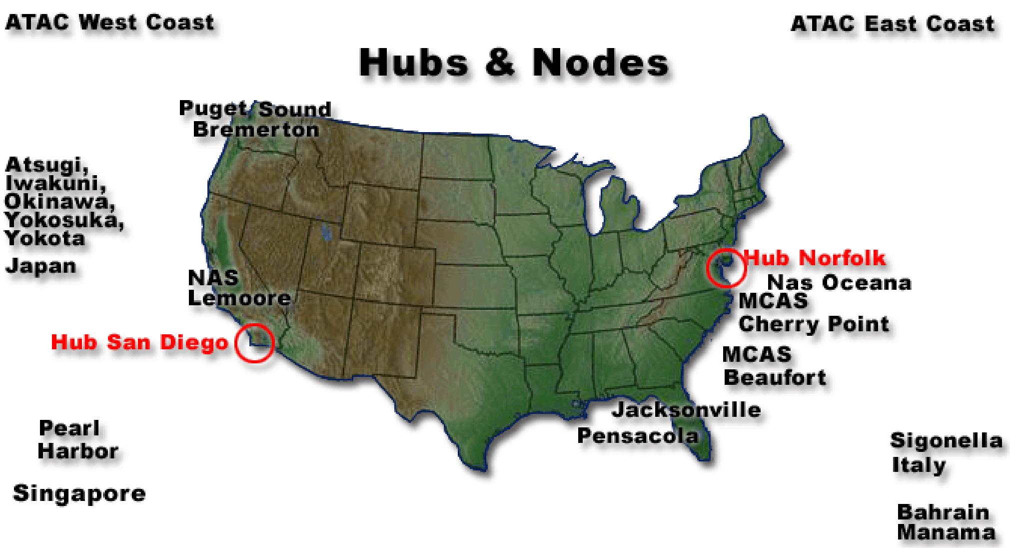

Figure 3.1 ATAC Hubs and Nodes

3. Receiving

The hub process starts when the hub contractor receives a shipment from a node through the mail or locally delivered by the originating activity. The first step is a visual screen of the material to determine if it is really a DLR and if it is hazardous material, but not labeled hazardous. The documentation is also reviewed at this time to check for ATAC excluded material. Material may be excluded from the ATAC system for economic (the item is usually very expensive and not worth the expenditure to repair given its condition), security, or safety reasons. Excluded items received at the hubs are immediately turned over to Navy personnel for handling outside of the ATAC system.

At the hub, the document number and NSN (National Stock Number) of each ATAC eligible carcass is entered into the database. This provides management with the capability to determine if any carcasses processed through a node failed to arrive at the hub, and creates a record for items being delivered directly to the hub via mail or local delivery. Additionally, it provides a starting point for hub processing time measurements and allows for the calculation of transportation times from nodes to the hub.

The ATAC contractor reviews each item to determine if the required bar code label is still attached. For direct delivery items or items with missing labels, new ones are created and applied to the items.

In the next step, the material is separated onto pallets or into portable bins, and a manifest of each container is created. Each manifest lists multiple carcasses. The material and the manifests are then turned over to Navy representatives for screening and the transfer date is recorded in the ATAC database.

4. Screening

After receiving the material from the ATAC contractor, the Navy personnel's first step is to process it through the Parts Master work station. The NSN is scanned into the Parts Master database, which provides important data and management information pertaining to each item, such as part number and manufacturer. This information is attached to the item to assist the screeners in the next step. One of the primary purposes of screening is to ensure that the item received is identified correctly. The part number provided by the Parts Master printout is compared to the part number on the DLR. If there is no part number on the item or the numbers don't match, further research is required to continue processing the item. The additional research includes a search of various microfiche and related technical publications. If the part is identified but the documentation is incorrect, or the part cannot be identified, a Report of Discrepancy (ROD) is created and sent to the originating activity for identification and to the ICP for carcass tracking purposes. This process is done to correct mistakes and avoid additional discrepancies with future items.

5. Processing

After screening, the next step is determining the disposition for the item. Once disposition is determined, a shipping or stowage document must be created. A mechanized MRIL is used to accomplish this. The MRIL contains disposition information for each DLR, such as Material Control Code, Movement Priority Designator, special shipping and handling requirements and, most importantly, the "where-ship-to" address. The MRIL is updated monthly by the Fleet Material Support Office (FMSO), based on information provided by item managers from the ICPs.

The MRIL operator scans each part's bar coded NSN into the MRIL program. A shipping document (DD Form 1348-1) or a local stowage/disposal document is then automatically produced for most items. Items destined for transfer to activities participating in the Advanced Shipping Program are handled somewhat differently.

6. Packing

The next step in the process is to prepare the item for shipment or local stowage. The material is moved to the packing station and separated into categories. Items requiring transshipment are appropriately packaged and the shipping label is attached. Material not requiring shipment is sent directly to local stowage or disposal.

7. Shipping

Material requiring shipment to a DOP/DSP is returned to the ATAC contractor for consolidation and shipment. The steps in this process are:

- The transfer of custody from the Navy to the contractor is recorded in the ATAC database
- Material is consolidated for each shipment destination
- A bar-code shipping label containing the lead Transportation Control Number (TCN), number of pieces, weight and destination is produced and attached to the shipping container.
- The ATAC contractor turns the material over to the Guaranteed Traffic Award (GTA) carrier for the shipment
- The GTA carrier delivers the material to the DOP's central receiving area

ATAC FLOWCHART

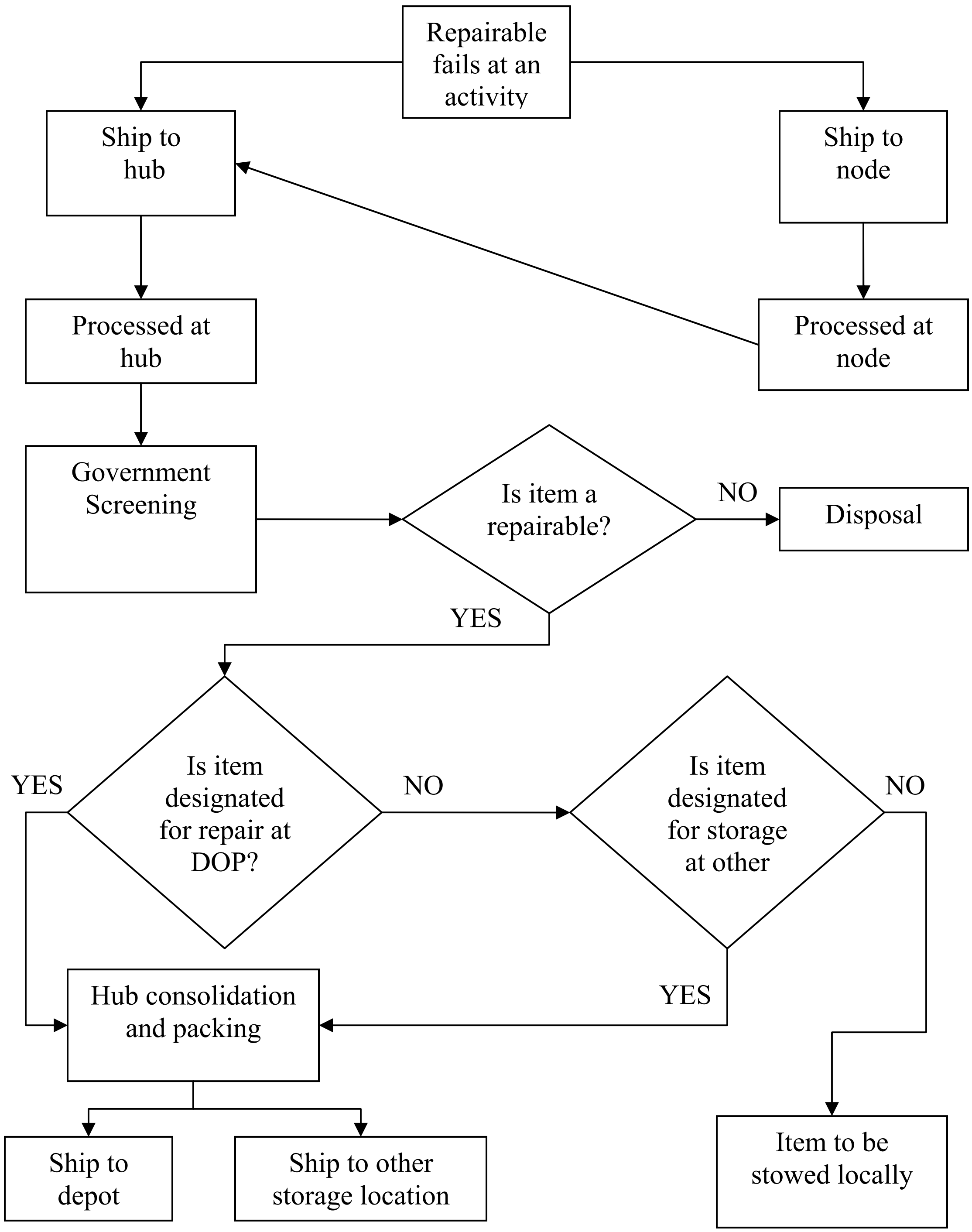

Figure 3.2 ATAC Process flowchart.

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IV. ELECTRONIC RETROGRADE MANAGEMENT SYSTEM

A. INTRODUCTION

The Electronic Retrograde Management System (ERMS) was developed to meet the demand for reduced material identification errors, improved accuracy and timeliness in the routing and return of repairable carcasses, and increased In-Transit Visibility (ITV) necessitated by Operation Iraqi Freedom. The redesign and improvement of different systems will allow users to access a system that was once limited to ATAC logistics centers. The ERMS allows users to accurately identify carcasses, obtain correct depot mailing addresses automatically, prepare digital and bar coded versions of correct shipping labels (including serial number tracking) and allow tracking capability of shipped items. The ERMS provides rapid turn-in credit, reduces carcass tracking, and provides shore installations with instant visibility when a carcass is en-route.

B. PURPOSE

The purpose of the ERMS is to provide quality control for customers and management of transportation systems. The ERMS is a Web-based program that is as easy to use as Hotmail or Yahoo. It provides the customer with one stop shopping for DLR transactions. The system helps reduce carcass charges by providing data directly to the ATAC hub. Requisitions and carcass tracking data are preloaded nightly from the Uniform Inventory Control Program (UICP) to provide the user with updated information. The main screen shows the nearest ATAC to transport DLR parts, and displays the shipping document and manual DD 1348. The user can point and click on the screen to track and verify all of the DD 1348 data. The item information is loaded live from the ICP and Master Data File (MDF). The system allows the user to have direct access to the Master Repairable Item List (MRIL) and ATAC. The system produces two-dimensional barcodes that also displays the part number, date, tracking number, and classification code. The system's functions include RFI offload tracking through Technical Assistance for Repairable Processing (TARP) and ATAC, which allows the fleet to choose "repair and return" instead of Beyond Capability Maintenance (BCM) for retrograde. The system's enhanced capabilities allow for robust ground Marine capability

Navy-Marine Corps Logistics Integration (NLI) and visibility of all retrograde carried by Combat Logistics Force (CLF) ships. The ERMS supports contingency operations by tailoring solutions to each site, depending on capabilities and need for repair parts. ERMS was also implemented to improve the retrograde process and help the customer to improve screening, and documenting repair parts.

C. MAJOR BENEFITS

The major benefits of having the ERMS is reduction of the DLR cycle time and retrograde system. The customer has better In-Transit Visibility (ITV) due to better tracking methods and lower cost for transporting repairable items. The system enables the customer to access the MRIL and ATAC via the Internet. The ERMS delivers real process improvement, reduces carcass bills and shortens the pipeline. The system drives the customer towards best practices with no lost carcasses. This method results in better business while attacking cost. The ERMS can be set-up in a matter of a day on a ship or at an expeditionary node. The system allows for better planning and innovative transportation decision which result in flexible solutions for daily operations. There are short term benefits of using the ERMS. The customer uses the same tools as ATAC, defines metrics highlight expected performance, gives customers incentives by precluding problems and carcass bills, and facilitates transportation of assets into the system sooner. The drawbacks to using the short-term process are accessibility to the ERMS, not everyone can pack, and customers still need a place to offload. Also, most tasks are still being done by ATAC. The long-term benefits of using the ERMS are that Unique Item Identification (UID) greatly reduces the screening problem, Radio Frequency Identification (RFID) solves the ITV problem, and outstanding issues are addressed, whereas items still need to be packaged properly. The ERMS program supports the Department of Navy (DON) goal that encompasses the Naval Enterprise, merged Enterprise Resource Planning (ERP), RFID deployment, Navy Enterprise Portal, and NLI. Also, the system supports the NAVSUP goal that encompasses contingency and expeditionary operations, the NAVSUP strategic plan, and reduction in carcass and Stock in Transit (SIT) charges, as well as preventing mistakes due to the design of the system. The ERMS results in an inexpensive efficient retrograde system, takes part in many phases of the DLR cycle and yields a reliable error resistant process.

D. EFFECTIVENESS

The effectiveness of in-transit visibility can be measured by the percentage of carcass returns for which NAVICP is able to ascertain positive proof of delivery (ATAC receipt). Figure 4.1 compares the percentage of carcass receipts at destination of the USS Lincoln prior to and subsequent to implementation of ERMS aboard ship. Fleet return rate was increased from 85.71 % to 99.56%. This mean less than one percent of returns are subject to carcass charges.

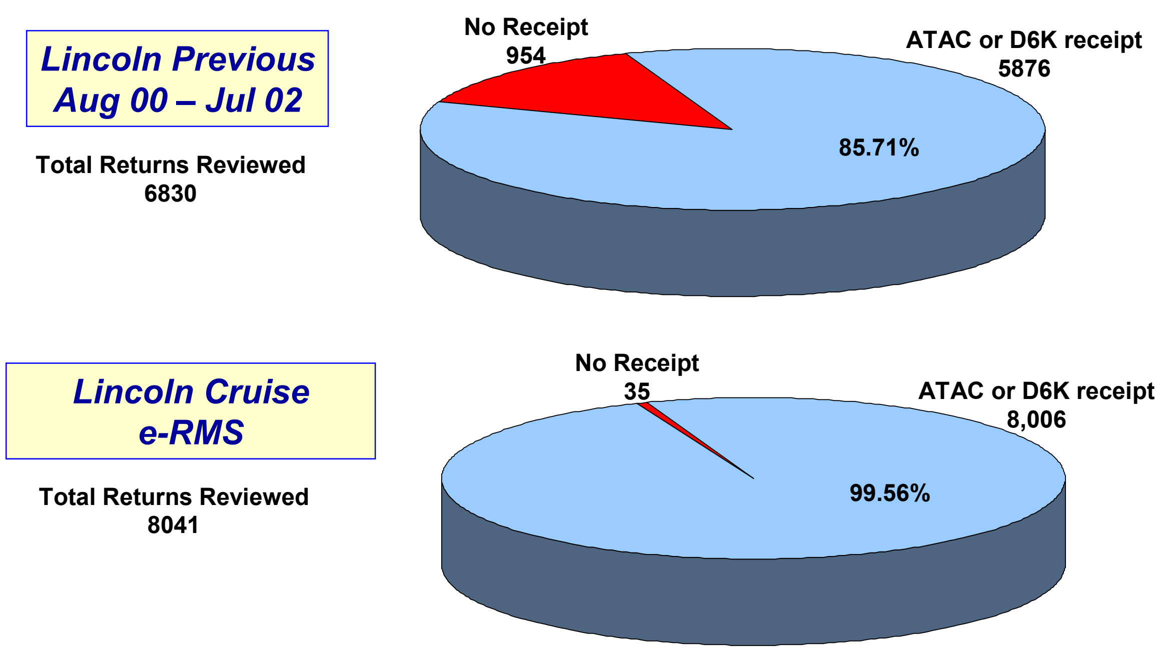
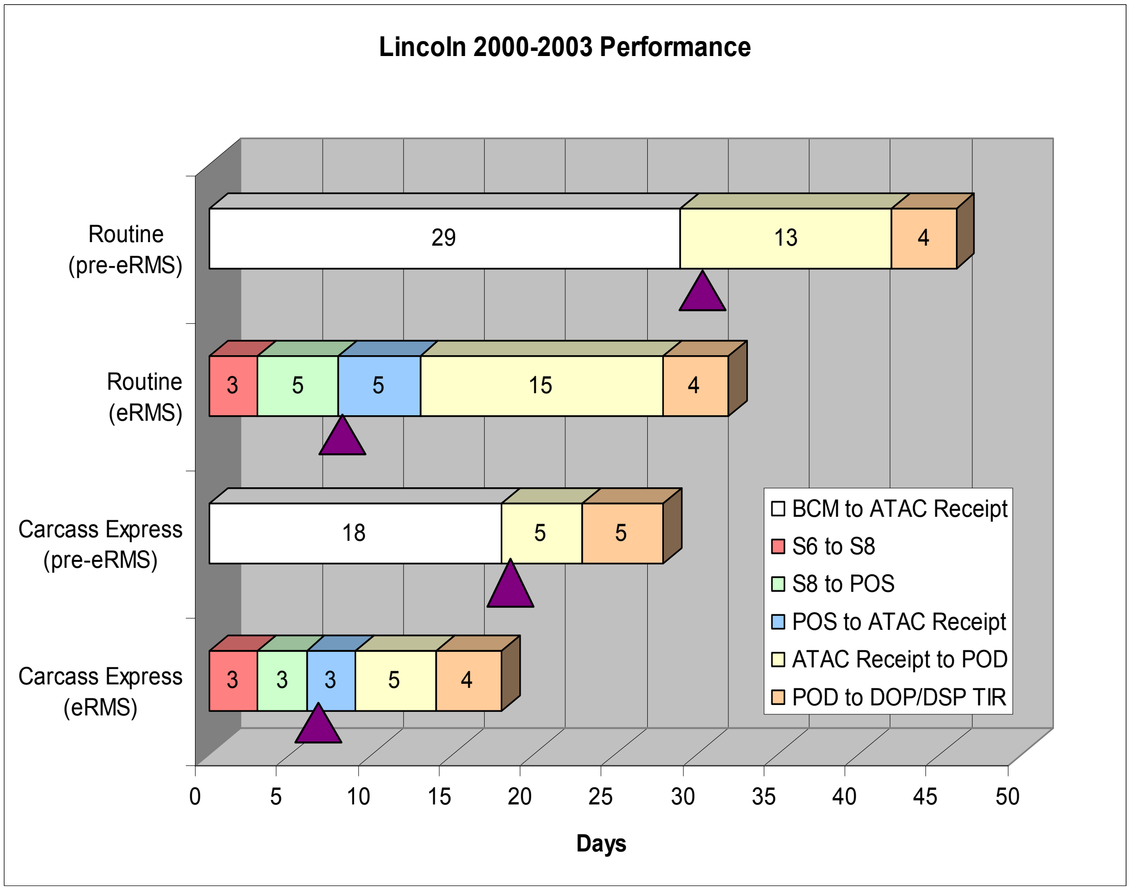


Figure 4.1 USS Lincoln ERMS Analysis: Carcass Return Rate



 - End of Carcass Tracking, start of SIT

Figure 4.2 USS Lincoln ERMS Analysis: Pipeline Time

Figure 4.2 displays the pipeline time measured in days. The BCM to ATAC Receipt measures the time between repairable fails and the time ATAC gets the repairable. The difference between Routine and Carcass Express classifications is urgency. Repairables that meet the Carcass Express criteria are transported to their DOP via the fastest available means. ERMS is only on large deck combat and Combat Logistics Force (CLF) ships. On Carriers, there are two Supply Department Divisions that handle retrograde, Aviation Support (S6) and Material Support (S8). ERMS also monitors internal tracking before the repairable leaves the ship. The largest impact on total cycle time reduction occurred on the ship, not at the ATAC. The triangle indicates when custody of the repairable changes from the ship to NAVICP.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATION

A. SUMMARY

This report reviews the Navy's DLR retrograde system and its material handing agent (ATAC). When compared with industry reverse logistics supply chains, many similarities were noted. Many companies find it difficult to manage and profit from the reverse logistics pipeline. Reverse logistics flows impose additional challenges on the inventory management due to an increased level of uncertainty with respect to profitability, effectiveness or outcome. Enhanced information systems on future product returns, e.g., by means of improved forecasting or monitoring may therefore help to reduce inventory and transportation cost. Although the Navy's retrograde system is not focused on profit, it is concerned with financial stewardship. Greater Return on Investment is the Navy's goal; with DoD's shrinking budget, value recovery, in the form of the return and repair of reparable spare parts is very important.

The Navy's DLR reverse logistics supply chain involves a sizable investment of time and inventory. This report suggests that the Navy's retrograde processes are not unlike those of industry. To this end the Navy and the military in general should maintain an intense awareness of industry best practices in this important area.

B. CONCLUSIONS

This report has provided an overview of how the ERMS will benefit carcass tracking and reduce DLR cycle time for repairable items. Additionally, ERMS is a single integrated data system that has expected benefits for cost reduction and for reducing the time it takes to process repairable items from NRFI to RFI status. However, there are still factors to consider when evaluating the performance of ATAC in terms of the system's ability to help the end-user fully implement the tracking process and benefit from increased ITV for reparable assets.

The data analyzed during this research evaluates the effectiveness of the ERMS in reducing the total DLR cycle time, increasing ITV and tracking carcasses. The graph displayed in this report came from the pilot program onboard the USS Lincoln and, showed vast improvements in NRFI to RFI when the ERMS was implemented. Also, the graph displayed the new method for tracking vs. the traditional tracking method. Though the information was from one test pilot program, which makes it hard to assess the overall reliability and effectiveness of the ERMS, the ability to track DLRs from BCM to the ATAC raises the level of importance for carcass tracking. This increased awareness encourages organizations to keep DLRs moving to the next step in the pipeline. Keeping the DLRs moving shortens the cycle time and reduces the chance of damage and loss. When a carcass is lost, the ship does not receive a carcass charge if they created a TIR in ERMS.

The overall intent of ERMS was to reduce routing time to repair facilities by eliminating the need for identification and routing at ATAC. Also, ITV was expected to be increased through ERMS because of ERMS' capability to track shipments from the turn-in site to repair or storage destinations. Additionally, the capabilities built in the ERMS have lowered IT costs associated with returns management. ERMS affords the opportunity for mobile turn-in sites to use commercial transportation best practices by allowing direct shipment from the user to the repair site.

Last, the ERMS will be the single integrated system of the future for carcass and DLR tracking because it lessens the retrograde process and provides a cost-effective way of reducing equipment losses. As a result, the cost-per item, prevention of damage en-route to the repair site, and repair costs are significantly reduced. However, there are challenges associated with implementing the system onboard naval vessels as well as ashore. Most new Navy information systems are born web-based, for these systems to exchange information effectively broadband connections are needed. The other problems with implementing ERMS include the ability for ATAC to coordinate data among diverse organizations worldwide.

There are a few areas that ERMS does not fully address. Having ITV seems to have little merit when you go to physically get an item, that's not there, or the wrong item is in its place. Lost carcasses still need more attention. In most cases, carcasses are not completely lost. They are misrouted, mislabeled or in the case of electronic circuit cards, have more than one card packaged in a single card protective "crown jewel" container.

Crown jewel containers come in many different sizes. They are reusable shipping containers with shock mounted platforms or cushioning material designed to hold one item, which is defined as very fragile or having a dollar value greater than $20,000. These types of problems are mostly related to personnel training issues.

In this report, reference is made to proper packing and packaging of retrograde DLRs. The Naval Supply Systems Command Publication 700, commonly called NAVSUP P-700, provides preservation and packaging requirements for specific repairable components. ERMS has a built-in interface with the P-700. The user enters the item's National Item Identification Number (NIIN) into the query block and the proper specific packaging information is provided. Proper packaging is a skill that few Navy and Marine Corps personnel possess. To help mitigate and provide training in this area, NAVICP started the Technical Assistance Repairables Protection (TARP) program. The TARP program provides support and training at the field level or other sites that might turn in retrograde DLRs. When specified packing, handling, storage and transportation requirements are not carried out correctly, assets throughout the entire retrograde pipeline, end-user to repair site, can be exposed to damage that is often preventable.

In the forward supply chain, misrouting is an inevitable occurrence with current processes for tracking end-users' current locations. The deployed end-user usually moves faster than the transportation system can update their shipping address. In the reverse logistic pipeline, the DOPs/DOS are for the most part fixed shore locations. Again, misrouted repairables seemingly are personnel training related issues, vice a problem with the transportation system.

The impact of mislabeled, misrouted, and improperly packaged retrograde is counterproductive. These types of errors illustrate the problematic issues that occur when information and physical material flows are disjointed. In the forward supply chain receiving is the most vulnerable phase, whereas shipping is the most vulnerable phase for reverse logistics. If the error-rate is reduced to a zero fault mentality so that the aforementioned problems are not allowed to enter the pipeline, the Navy would move toward reaping the ROI it seeks.

C. RECOMMENDATIONS

The Depot Level Repairable Retrograde system in recent years has been drawing comparable visibility and importance compared to the forward logistics phase of the repairable management process. To that end, the following conclusions/ recommendations are provided:

- Continued emphasis on investigating carcass losses. Supply Officers need to continue investigating carcass losses despite the write-off provided by the current system. One of the pillars of the ERMS is the assumption that the users are investigating the losses and not just writing off their losses to save time and effort.
- Screening of retrograde items is still a significant issue. To take full advantage of the ERMS tool, NAVICP should mandate the use of serial numbers on all surface DLRs as intended by the UID initiative. This may help resolve the problem of misdirected items and incomplete documentation. Further research is needed on this subject.
- The ERMS should be continued, as it has demonstrated significant potential to reduce overall repair turnaround time due to the visibility ERMS provides to returns in transit.

This report was intended to be an overview of the Navy's retrograde processes. There are many areas dealing with retrograde processes not covered in this report. The modes and costs of transportation, along with the composition of applied surcharges are prime areas where further research may bring new opportunities for savings. Other supporting systems may prove fruitful for further research. The Navy's use of organic and commercial transportation is a key area that needs more exploration. Expansion of the TRAP to CLF ships is another area of possible retrograde cost reduction. Weighing the benefits of using RFID technology at the item or package level is another opportunity for research. Any research addressing system cycle time or traceability has the potential to make the DLR retrograde process more efficient by maximizing the value recovery of reparable spare parts.

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