EXPLORING THE HEART OF LOGISTICS

Interim Global Logistics Support Center Supply Chain Management Capabilities

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It's not good enough to be capable of fighting big armies and big navies and big air forces on a slow, ponderous basis. We have to be able to move quickly and have to be agile and have to have a smaller footprint. And we have to be able to deal with the so-called asymmetrical threats, the kind of threats that we're facing with terrorists and terrorist networks.[1]

—Former Defense Secretary Donald Rumsfeld

The Logistics Transformation Requirement

The Air Force is undergoing a significant transformation with the ultimate objective of restructuring the force to address the threats of the 21st century. The transformation effort is enormous, affecting all aspects of Air Force warfighting capabilities.

The Air Force Research Laboratory has identified six long term challenges that will be the keys to successfully transforming the Air Force. One of those six is the need to develop "…solutions that will improve or enhance the Service's ability to provide agile combat support (ACS) to the warfighter, such as reducing the deployment footprint, improving asset visibility, and improving logistics command and control."[2] In fact, the Defense Science Board Task Force on Logistics Transformation concluded that:

> For the US military to maintain its position of global leadership, it must transform its logistics system. Failure to do so imperils our ability to deploy and sustain our military forces to meet the new threats we will face in the future.[3]

The Logistics Transformation Plan

Air Force logisticians have been hard at work in recent years to transform logistics support concepts, processes, and data systems to ensure that the structure and management of the Air Force supply chain supports overall Air Force transformation objectives. The primary Air Force logistics transformation effort is called Expeditionary Logistics for the 21st Century, or *eLog21*. The mission of eLog21 is to develop and implement transformational concepts, processes, systems, and policies to deliver dependable, effective, and efficient ACS to the 21st century aerospace expeditionary force.[4] In 2006, the eLog21 effort resulted in a recommendation to the Air Staff stating that the Air Force logistics transformation objectives can be best delivered via the acquisition and implementation of a commercial off-the-shelf (COTS), enterprise resource planning (ERP) system. The recommendation has been accepted, and the Air Force is now preparing to document the future Air Force logistics functional requirements for implementation in an ERP software suite. The future Air Force logistics enterprise system, called the Expeditionary Combat Support System (ECSS) will implement four key design elements.

- The system will be managed as a single enterprise focused on meeting warfighter requirements timely and affordably. Process integration will eliminate the vertical functional and organizational stovepipes of the past. Enterprise-wide logistics resources will be managed in a shared data environment for more responsive and accurate decisionmaking.
- The system will focus on customer support and drive execution based on enterprise operational goals.
- The Air Force logistics structure will be redefined to become network centric with dynamic command, control, communication, information, and instant feedback permitting rapid supply chain reconfiguration.
- Legacy functions, organizations, or processes that do not support Air Force core competencies will be eliminated or outsourced.

The current ECSS procurement, development, and implementation schedule indicates the future enterprise logistics system will be rolled out across the Air Force in 2012. However, a recent Air Staff briefing[5] suggests an immediate need to maximize our efforts to implement enterprise supply chain management processes as soon as possible.

- Personnel costs have risen by 50 percent in the last 10 years, despite manpower reductions.
- Aircraft fleet operations and maintenance costs have increased by 87 percent in the last decade.
- The aircraft fleet is aging.
- Air Force investment budgets have declined significantly since 1986, and the future budget picture is not bright.

In terms of the need for enterprise Air Force supply chain management capabilities, the future is now. In fact, the Air Staff has already established a new organization called the Global Logistics Support Center (GLSC) to manage the Air Force supply chain. The GLSC is responsible for conducting enterprise supply chain planning, providing global command and control of the Air Force supply chain, and acting as a single focal point for supply chain support for the full range of Air Force operations. Even though the GLSC is responsible for the management of the entire Air Force supply chain, it has very few enterprise supply chain management tools. The GLSC needs integrated, near real-time, actionable supply chain data to ensure logistics managers have complete visibility of enterprise logistics requirements and resources, and the tools to centrally manage those resources to optimize logistics support and maximize mission capabilities.

Developing Interim Supply Chain Management Tools

The 754th ELSG has been commissioned by the Air Staff to develop interim enterprise supply chain management tools to maximize GLSC capabilities pending the delivery of ECSS. To deliver those capabilities, the 754th is developing rule-based applications within the GCSS-AF integrated framework (IF). The GCSS-AF IF service-oriented architecture (SOA) enables loosely coupled data exchange services between existing (legacy) software systems to support the functional requirements of the software users.[6] GCSS-AF SOA web-based applications can be accessed with reduced sign-on from anywhere access to the Internet is available. These web-based applications can communicate with legacy systems to make a collection of applications look seamless. Figure 1 provides an example of how SOA enables rule-based applications that are being used to bring Air Force logistics legacy system data together to provide enterprise supply chain management capabilities to the GLSC.

By using the GCSS-AF SOA approach, enterprise supply chain data from disparate legacy data systems can be passed between legacy data systems, merged into comprehensive enterprise data views, and even used to initiate legacy system transactions to update and reconcile data across the legacy systems—all without making any major changes to legacy data systems. This is a key point. Once the Air Force decided to develop ECSS as the future enterprise logistics management system, funding for modifying and enhancing logistics legacy systems was redirected to support ECSS costs.

Figure 2 provides a summary of the interim enterprise supply chain management capabilities that the 754th ELSG has already developed, is currently developing, and those capabilities that are being evaluated for future development.

The capabilities summarized in Figure 2 represent a significant step forward in providing the GLSC with interim enterprise supply chain management tools. It is also important to note another contribution made by these developments. In developing the functional requirements underlying these GLSC supply chain management capabilities, we consulted with, and sought the advice from, leading Air Force logistics experts. Further, when we tested these tools, we enlisted the direct assistance of the GLSC managers that will be implementing the new capabilities to manage the Air Force enterprise supply chain. We used the feedback from the GLSC managers to refine the tools during the testing process. Since we obtained the initial requirements for these tools from GLSC managers, and then updated the tools based on their feedback, the collective capabilities provided by the GLSC tools provide a solid baseline for the blueprinting of ECSS functional requirements. In other words, the GLSC supply chain management tool set (development, implementation, and refinement) over the next 5 years will provide the ECSS developers with a set of *road tested* enterprise supply chain management capabilities. In addition, these capabilities will make our legacy systems more accessible to modern messaging and transaction formats, which will ease the implementation of ECSS components, and better facilitate legacy system interfaces to other modern logistics systems.

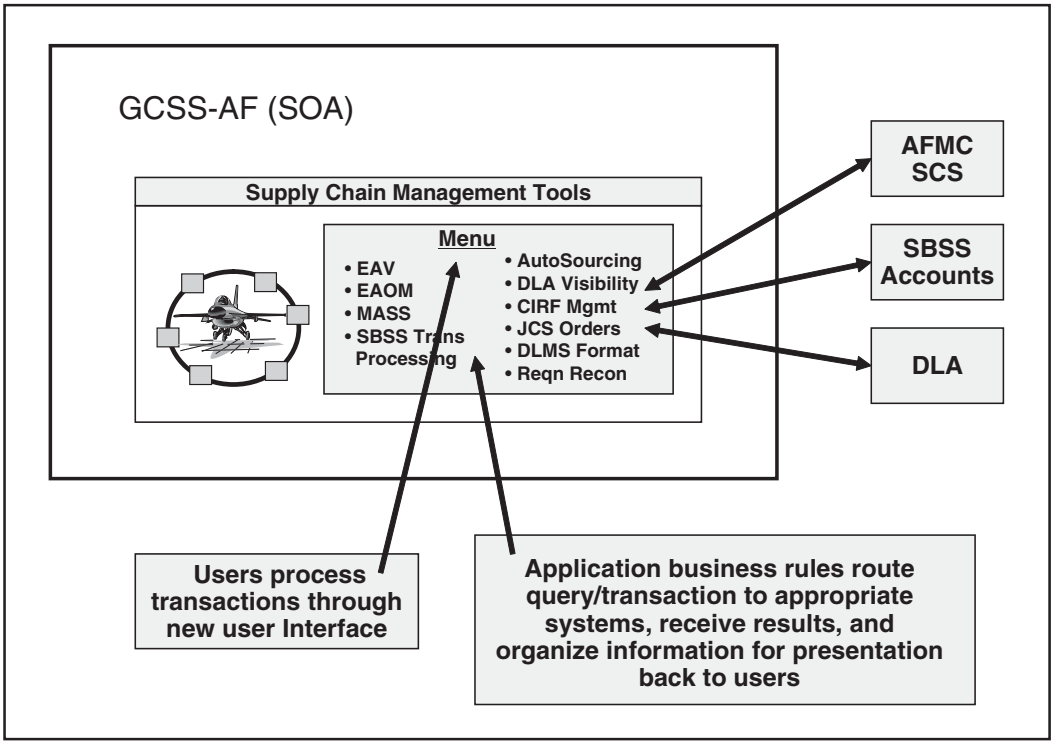

Figure 1. Illustration of a Rule-Based Application on the GCSS-AF SOA

Application Development Summaries

The following paragraphs summarize the interim GLSC supply chain management capabilities the 754th ELSG is providing. This collection of applications provides the GLSC with the enterprise asset visibility and supply chain management tools needed to manage Air Force logistics resources until ECSS is fielded.

- **Initial Enterprise Solution—Supply (ES-S) Developments.** The 754th ELSG first began to explore how SOA tools could be used to integrate data across disparate legacy logistics systems in 2004 through a proof of technology effort funded by AF/ILI.
  - **Enterprise Asset Visibility (EAV).** Our initial ES-S development, called EAV, had the objective of creating a near real-time unified view of the Stock Control System (SCS) and the Standard Base Supply System (SBSS) asset data. Prior to the development of EAV, logistics managers would have had to query more than 300 separate SBSS accounts and 3 SCS accounts, and then manually collate those query results to obtain a global view of on-hand inventory across all locations. Through the use of SOA tools like enterprise application integration, we were able to develop a near real-time global view of assets across all SBSS and SCS locations that users can access within a few seconds.
  - **Enterprise Asset Order Management (EAOM).** The EAOM component provides similar query capabilities for customer orders. The details and status of orders can be obtained directly from the back order source and displayed side by side to provide a complete picture of the order. While this capability provides obvious benefits to supply customers, it also provides important information to suppliers. For example, prior to EAOM development, wholesale item managers did not know the intended customer use of spares because the requisition data alone does not provide end use application data. By combining information from base level systems with wholesale systems, managers are able to link the requisition to the end use customer requirement. The EAOM component also proved that with the push of a button within the ES-S application, SBSS, and SCS legacy system transactions can be simultaneously initiated to move assets to satisfy priority needs at other bases.
  - **SBSS Web-Based Transaction Processing.** The SBSS web-based transaction processing project provides logistics support center managers with expanded capabilities to process over 170 different SBSS legacy transactions using simple web-based graphical user interfaces (GUI). This tool also allows enterprise managers to process transactions against one or more SBSS accounts without having to sign on to each SBSS instance separately (only Air Force Portal user ID and portal role required). Also, an entry point (web service) for other systems to send SBSS transactions directly to specific SBSS accounts has been developed. Finally, this ES-S web service sets the stage for improved interfaces and connectivity to ECSS.
- **Mission Capable Asset Sourcing System.** The Mission Capable Asset Sourcing System (MASS) is a fundamental capability required by the GLSC. In fact, as you will see, a number of the GLSC tools described in this article will be implemented as expansions of the MASS function. Initially, a new version of MASS was hosted on the GCSS-AF integration framework and made accessible via the ES-S Homepage on the Air Force Portal. This version of MASS replaces the MASS application hosted on the SBSS mainframes and some client-side software on individual PCs. The MASS component utilizes data in a web-enabled, shared, single-entry, near real-time environment to support the management and sourcing of mission capable (MICAP) and awaiting parts (AWP) back orders. This provides a more accurate picture of the actual position of assets for sourcing decisions, and the creation of global historical views for analysis. This new MASS capability also replaces the MICAP reports builder created by the Combat Air Forces Logistics Support Center. The following list provides a high-level summary of MASS capabilities.
  - Provides a single point of access via the Air Force Portal (no need for separate user ID and password for each separate SBSS account).
  - Provides the first consolidated (global) view of active MICAP and AWP back orders in a single database.
  - Allows near real-time management and sourcing of MICAP and AWP back orders across all SBSS accounts. The MASS database is synchronized with SBSS using a new Logistics Event Notification Service that reports new or changed orders to MASS. Also, MASS now utilizes ES-S *query asset* type capability to locate assets across the enterprise in near real-time.
  - A tailorable workflow approach to managing MICAPs. In other words, GLSC managers (and other users) will be able to choose which MICAPs to manage using urgency justification codes (UJC), standard reporting designators

Article Acronyms

AFDS – Air Force Data Services
ACS - Agile Combat Support
AFMC - Air Force Materiel Command
AWP - Awaiting Parts
BTA - Business Transformation Agency
CIRF - Centralized Intermediate Repair Facility
DLA - Defense Logistics Agency
DLMS - Defense Logistics Management System
EAOM - Enterprise Asset Order Management
ERP - Enterprise Resource Planning
ECSS - Expeditionary Combat Support System
ES-S - Enterprise Solution-Supply
EXPRESS - Execution and Prioritization of Repair Support System
EWT - EXPRESS Web Toolkit
GCSS-AF - Global Combat Support System–Air Force
GLSC - Global Logistics Support Center
GUI - Graphical User Interfaces
IF - Integrated Framework
JCS - Joint Chiefs of Staff
MASS - Mission Capable Asset Sourcing System
MICAP - Mission Capable
MILS - Military Standard
PDM - Programmed Depot Maintenance
SOA - Service Oriented Architecture
SCS - Stock Control System
SBSS - Standard Base Supply System

(SRD), federal supply class (FSC), and so forth. MICAPs are then categorized in *buckets* based on their status. For example, new MICAPs will show up in a *new* bucket that indicates that action must be taken to satisfy the requirement. As the MICAP is worked (requisitioned, shipped, and so forth), it will be recategorized. This approach allows managers to quickly see how many MICAPs are in each category and what action is necessary to ensure the needs are satisfied on a timely basis.

- Global history data to all authorized users.

- **GLSC Tool Set.** In the fall of 2006, the Air Staff tasked the 754th ELSG to develop additional SOA-based supply chain management capabilities in support of GLSC capability requirements. These capabilities will be fielded in September 2007.
  - Requisition Reconciliation. Numerous analyses have documented that significant problems exist between Air Force wholesale supply systems and retail (or base level) supply systems in accurately communicating and reconciling base materiel orders and order status. One study indicated 42 percent of in-transit and 29 percent of back-order data for Air Force Materiel Command (AFMC)-managed items were inconsistent. A subsequent study of Defense Logistics Agency (DLA) back-order data indicated DLA had over 28K requisitions that did not match SBSS requisition records, and the SBSS had over 24K requisitions that did not match DLA requisition files. It is critically important for suppliers to have accurate base requisition data. Failure to quickly identify and reconcile mismatched base and supplier requisition data for all sources of supply results in logistics support delays, reduced mission capability, and misallocation of repair and distribution resources. To ensure the timely and accurate communication of warfighter needs to supply sources, the 754th ELSG is developing a component to implement business rules for reconciling base and supplier requisition data. The component will use daily wholesale supplier (AFMC and DLA) and base (SBSS) requisition data feeds from GCSS-AF Data Services (AFDS) to identify and reconcile mismatched requisitions between the retail supply and wholesale supplier data systems.
  - Automatic Sourcing. This GLSC capability development will use near real-time asset and requirements data from source systems (SBSS, SCS, and DLA) to automatically determine the best enterprise source for fulfillment of selected priority (MICAP, AWP, and Joint Chiefs of Staff [JCS] project-coded) requisitions and create the appropriate legacy system transactions to effect the movement of the assets from the selected source. The capability will include a new direct transaction interface to the Defense Automatic Addressing System for the routing of orders for non-AFMC-managed items that are not automatically sourced from alternate locations. The capability will also allow GLSC supply chain managers to suspend or start automatic sourcing as needed (for a specific requisition, stock number, base), and to tailor the sequence in which sourcing business rules are applied (requisition to wholesale source of supply, use lateral support first, or alter the prioritized sequence of competing enterprise needs). This capability also provides an automated *reverse sourcing* feature that reacts to the introduction of assets into the enterprise. Whenever assets become available, the reverse sourcing feature scans existing enterprise needs to determine whether the assets should be redirected to satisfy high priority needs. The reverse sourcing feature uses the daily Execution and Prioritization of Repair Support System (EXPRESS) distribution prioritization list to determine which enterprise back orders should be fulfilled in cases where there are competing requirements for available assets. The implementation of these automatic sourcing features provides two important benefits. First, the embedded business rules ensure that enterprise objectives are rationally considered in sourcing decisions. Second, by automating the sourcing process, GLSC managers are relieved of a very time consuming process and are freed to focus on other supply chain management duties.
  - DLA Asset and Order Status Visibility. This initiative requires the development of a direct communications interface between Air Force and DLA systems to provide GLSC managers with near real-time DLA asset and order status data.

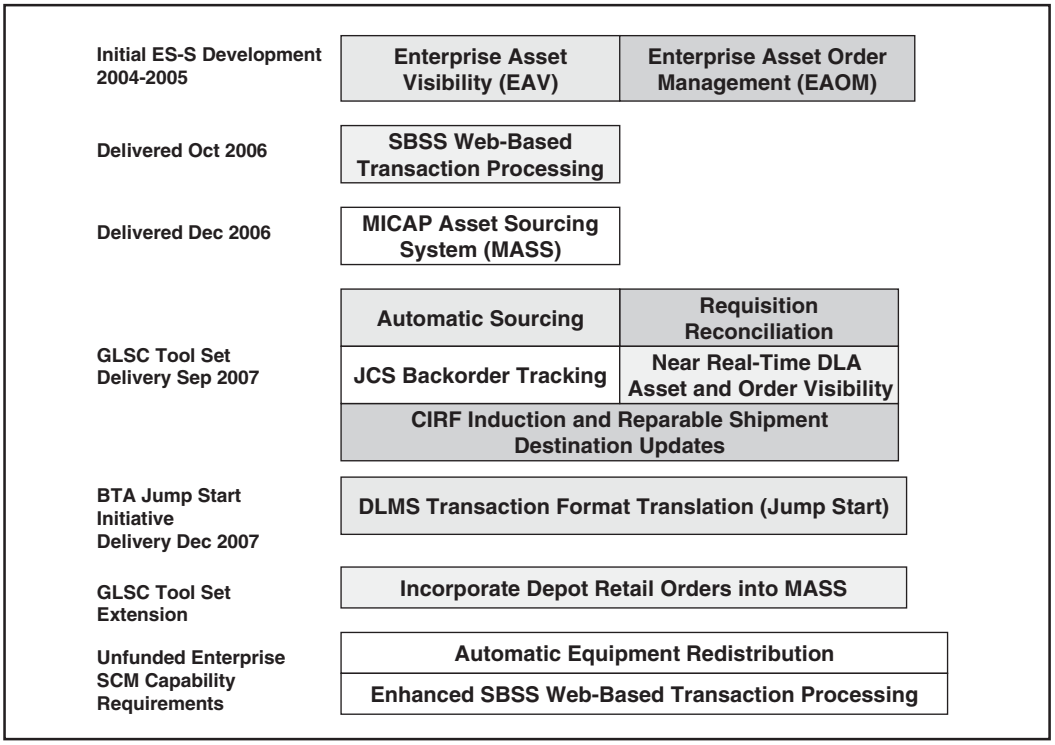

Figure 2. Interim Enterprise Supply Chain Management Capability Development

- Near Real-Time Asset Visibility. Near real-time asset visibility information will enable the GLSC to smartly source consumable weapon system items that cause more than half of all MICAP conditions. The GLSC currently has near real-time access to only Air Force base asset data. As a result, GLSC enterprise logistics managers may source priority customer needs for DLA-managed items from another retail account when, in fact, given the DLA asset position, the optimal enterprise decision might be to order the item from DLA instead. GLSC access to near real-time asset data will enable logistics managers to look across the enterprise to optimally source high priority customer orders.
- Near Real-Time Order Status Information Capability. The direct communications interface developed for the asset query capability will provide GLSC managers with the ability to query existing Air Force orders to determine, in near real-time, the status of requisitions. The development of a near real-time order status query capability will enhance GLSC asset sourcing and cannibalization decisions, thus enabling logistics managers to better meet enterprise logistics support objectives.

- JCS Project Coded Order Management. The Air Force Spares Priority Release Sequence dictates that JCS-project coded requirements be given precedence over non-JCS-coded MICAP and AWP orders. To provide the GLSC the capability to effectively manage JCS Project-coded orders, SBSS JCS order data will be presented in the MASS application, and made available to the automatic sourcing logic. The inclusion of these orders within MASS will ensure JCS orders are visible to GLSC managers and are managed or sourced commensurate with the priority of need.
- Centralized Intermediate Repair Facility Management**.** HQ AFMC is currently extending the execution and prioritization of the repair support system (EXPRESS) to manage all enterprise repair actions, including centralized intermediate repair facility (CIRF) inductions. We are complementing that effort by developing two new GLSC capabilities.
  - Induction Management. The first of these two requirements is to obtain the data for implementing the daily EXPRESS enterprise repair induction list for CIRFs. The system will automatically induct unserviceable reparables (using SBSS legacy transactions) into the CIRF for repair. That process is illustrated in Figure 3.
  - Reparable Shipment Destination Management. The GLSC CIRF managers update a table within EXPRESS via the EXPRESS web toolkit (EWT) to indicate which forward bases are served by which CIRF, for what items. It is vital that whenever base-to-item-to-CIRF mappings are changed in EXPRESS, those changes are also updated in SBSS reparable shipment records. If those updates are not correctly reflected in the SBSS, bases will ship their reparable carcasses to the wrong enterprise repair locations. We are developing a capability that will use a daily EXPRESS data file to synchronize SBSS reparable shipment destinations with the EWT tables. The process is illustrated in Figure 4.
- **DLMS Transaction Format Translation.** The DLA business system modernization process and other modern logistics data systems are designed to communicate via variable length defense logistics management system (DLMS) American National Standards Institute (ANSI) Accredited Standard Committee (ASC) X12-compliant transactions. However, legacy Air Force logistics systems communicate via fixed length military standard (MILS) transaction formats. The ability to convert legacy system MILS formatted transactions to the DLMS standards would benefit the customer order and status transaction flow between the Air Force supply system and DLA systems, and would set the stage for enabling communication between (and eventual transition from) the Air Force's legacy supply systems and other COTS enterprise resource planning (ERP) systems. The Business Transformation Agency (BTA) has endorsed and promoted the DLMS migration initiative and is encouraging the components to accelerate DLMS conversion through the DLMS Jump Start Program. The DLMS Jump Start Program is designed to incentivize Department of Defense Components to migrate legacy systems from MILS to DLMS. The BTA has funded the 754th ELSG to develop the capability to transform selected inbound and outbound transactions as a first step in developing the capability for directly interfacing to data systems that use DLMS ASC X12 transactions. The development of this new transaction transformation capability will eventually provide the GLSC the ability to more directly communicate with suppliers in placing orders and obtaining order status. The variable length nature and new data elements supported in the DLMS formats will also support the eventual introduction of new business processes such as the tracking of unit identifications and online part number (DD Form 1348-6) requisitioning. Further, because the development of this DLMS conversion function will be accomplished using the GCSS-AF SOA, the capability will be useable for transforming legacy transactions for other GCSS-AF-hosted legacy systems.
- **Depot Retail Order Management in MASS.** Air Force warfighter retail supply support consists of two vital parts. The first part consists of the operational unit supply activities that directly support warfighter spare parts and component needs—essentially, the SBSS accounts around the world. The second vital component of warfighter supply support is comprised of *depot retail* activities. As shown in Figure 5, depot retail activities support two primary customers—programmed depot maintenance (PDM) and depot component repair.

The previously described MASS and automatic sourcing features do not currently include visibility of depot retail supply (D035K) requisitions that support PDM activities and depot component repair. The lack of an integrated GLSC view of visibility into D035K requisition data creates an enterprise blind spot. In fact, depot retail supply needs can often compete with operational activity supply support activity needs for the same assets. Therefore, the lack of near real-time visibility of all enterprise asset requirements could result in erroneous GLSC asset distribution decisions. The GLSC would clearly benefit from the incorporation of D035K requisition visibility into the GLSC supply chain management tool set; therefore, we are working with depot retail supply experts to pursue the development of the following capabilities.

- Extend MASS to manage MICAP, AWP, and JCS project coded requisitions at depot retail (D035K) accounts
- Extend automatic sourcing capabilities to include D035K requisition sourcing

- **Automatic Equipment Redistribution.** Air Force Logistics Management Agency studies have documented that there are hundreds of enterprise opportunities to redistribute millions of dollars worth of excess base-held serviceable equipment items to satisfy unfilled authorizations at other bases. The GLSC could benefit from an automated capability that uses SBSS, the Air Force Equipment Management System, or AFDS data to identify opportunities for redistributing equipment items among bases when appropriate to improve global mission support. Although this initiative is not funded for development at this time, there is clear interest in fielding an automated equipment distribution capability. As a result, the 754th ELSG was tasked by the 79th Air Force Materiel Management Board to develop a rough order of magnitude cost and schedule estimate for developing that capability.
- **Expand SBSS Web-Based Transaction Processing.** The SBSS web-based transaction processing feature could provide additional benefit to the Global Logistics Support Center (GLSC) via the incorporation of all the remaining (beyond the 170 already provided) SBSS transactions and screens into the GCSS-AF SOA. When completed, access to the SBSS green screens and the use of terminal emulation software on the client computer will no longer be needed by any SBSS user. This would enable specialized users like SBSS computer operators, warehouse personnel, and finance personnel to process all of their legacy system transactions via a web-based GUI.

Summary and Conclusions

Five years from now, the ECSS will be the Air Force system for managing the enterprise supply chain. However, the GLSC has an immediate requirement for integrated, near real-time, actionable enterprise supply chain data, and the ability to centrally manage logistics resources to optimize support and maximize mission capabilities. The 754th ELSG is exploiting the service-oriented architecture to develop rule-based applications on the GCSS-AF framework to provide the GLSC with interim enterprise supply chain tools pending the delivery of ECSS. The interim supply chain management capabilities provided by these rule-based applications will provide the GLSC with vital, fundamental enterprise management capabilities and establish a solid baseline for the blueprinting of ECSS functional requirements.

Notes

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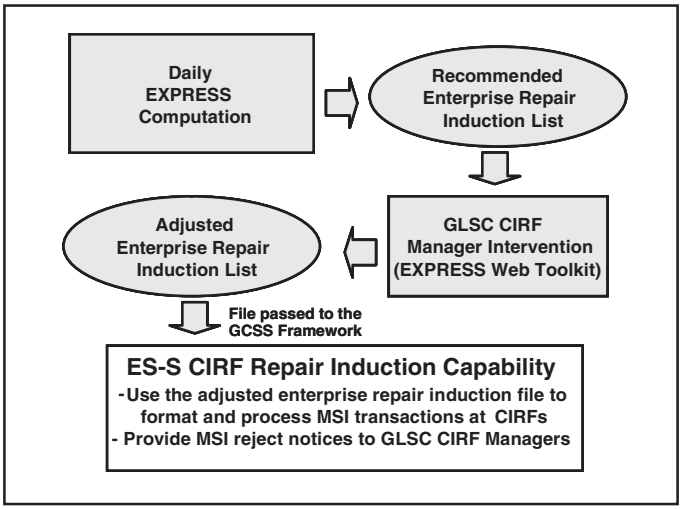

Figure 3. Implementation of the EXPRESS Enterprise Repair Induction list

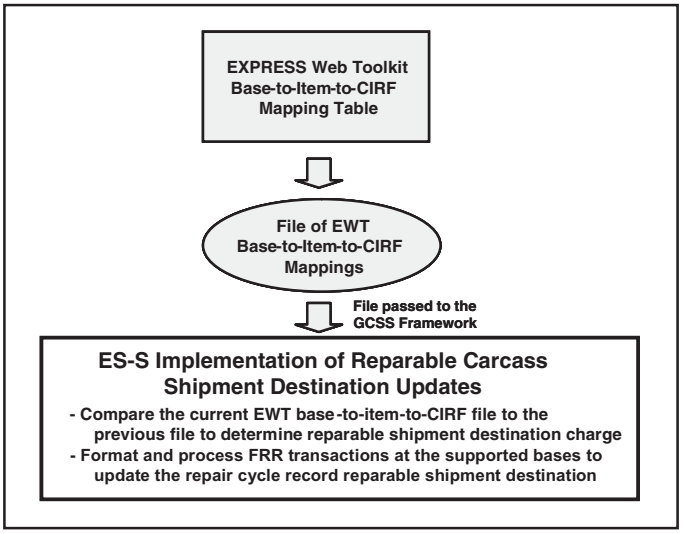

Figure 4. Implementation of Reparable Carcass Shipment Destination Updates

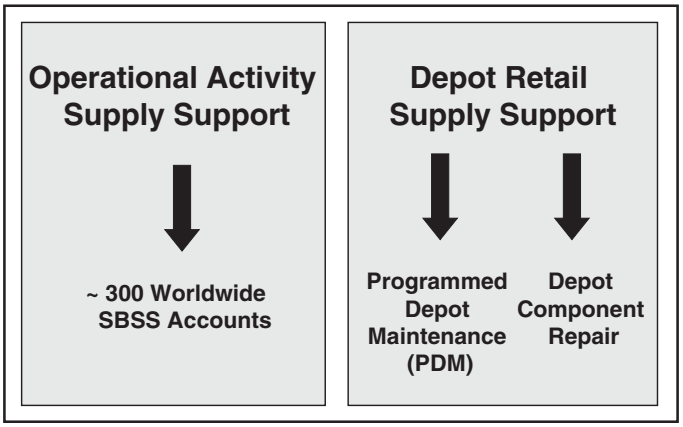

Figure 5. Warfighter Retail Supply Support Activities

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Logistics Analysis

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Introduction

The current focus in logistics analysis relies heavily on the use of averages. There are instances where predictive modeling is used; however, data requirements for predictive modeling to be accurate are often not being met by the logistics community.

Predictive modeling, probability management, and stochastics provide a backbone for data analysis requirements in tomorrow's Air Force logistics community. In order for these techniques to provide real benefit, data integrity must be maintained. The implementation of an Enterprise Resource Planning (ERP) system in the logistics enterprise allows for an integrated common database, alleviating errors and wait time in transferring data between logistics systems. In the logistics community of the Air Force, the ERP system, along with the demand planning and repair scheduling programs is called the Expeditionary Combat Support System (ECSS). As the logistics community moves to install ECSS, new analysis techniques can be used to more accurately predict future requirements for manpower, transportation, supply, maintenance, and other areas of agile combat support throughout the logistics enterprise.

Article Acronyms

ECSS - Expeditionary Combat Support System
ERP - Enterprise Resource Planning
LCOM - Logistics Composite Model
SEP - Shell Exploration and Production

Current State of Logistics Analysis

Throughout the logistics world, the Air Force uses averages in metrics and decision support. Examples include determining stock purchases by averaging pipeline transportation and repair times in conjunction with average demands, determining schedules of transportation assets based on average required capacity, and buying jet fuel at an average rate per year. The dangers associated with averages can be put into categories:[1]

- **The Family with 1.5 Children**. The average data does not take into consideration the actual population. When transportation times for items are entered into Air Force computer systems, such as the D200 Requirements Management System, average times are used. These averages do not often capture the reality of transportation times, as illustrated by the fact that they are used less than 35 percent of the time. These transportation times are used to determine pipeline length, and subsequently, purchase requirements. The danger of errors and poor data management results in significant back orders.[2]
- **Ignoring Restrictions.** When preparing for average demand, a certain amount of capacity is allocated to meet that demand. If demand exceeds capacity, demand is limited by capacity. If capacity exceeds demand, overcapacity exists. Using the average required capacity to schedule transportation assets for Air Mobility Command to be used by United States Transportation Command presents this danger. If the demand for assets is lower than the capacity, assets will be underutilized. Conversely, if demand is higher than the required capacity, throughput will be limited by the capacity of transportation assets. This problem becomes more evident when combining the weight, cube, and palletization of assets.[3]