Supply Chain Council Awards for Excellence in Supply Chain Operation and Management

HQ AFMC/LGI
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U.S. Air Force Headquarters Air Force Materiel Command,
Logistics Directorate
Supply Management Division, Supply Chain Initiative:

Purchasing Aircraft Availability for Pennies on the Dollar

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EXECUTIVE SUMMARY

Enterprise management of consumable items has truly come to the forefront of supply chain solutions that offer the greatest return on our most important products—Aircraft Availability (AA) and readiness. In tandem, the Defense Logistics Agency (DLA) and the AF manage more than one million consumable aviation investment items that result in sales exceeding $3.8B per year. During FY02 and FY03, DLA consumable items accounted for 53-58% of the total AF non-Mission Capable (MICAP) hours; concurrently, AF managed consumables outpaced similarly priced reparable item MICAP hours by a ratio of 2:1.

Our current policies, processes, and systems result in relatively inexpensive consumable items contributing an inordinate amount toward the AF Total Not Mission Capable Supply (TNMCS) rates. DLA items costing less than $100 accounted for 35-40% of AF MICAP hours during FY02 and FY03. Similarly, AF managed consumable items costing $500 generated twice as many MICAP hours as reparable items costing the same amount. Presented with this, Air Force Materiel Command (AFMC) integrated several initiatives to improve the supportability of consumable items.

In late FY01, AFMC developed and implemented the Customer Oriented Leveling Technique (COLT). This model set the stage for many follow-on initiatives. COLT used marginal analysis algorithms and leveraged collaborative data sharing to reduce Customer Wait Times (CWTs) at the AF depots by 65% during the first year of implementation. Spurred on by this monumental success, we sought to implement COLT at the retail echelon of the supply chain—which we began doing in CY03. However, while COLT addresses a significant portion of the total population of consumable items, it is not applied to AF-managed consumable items. The AF initiated analyses to seek similar improvements in AF-managed consumable items achieved with DLA consumable items. Key to the management of consumable items, AFMC sought to continue developing collaborative enterprise supply chain solutions with DLA. Internally, we began developing models that sought to optimize the distribution of funds across our depot enterprise—ensuring we've optimized the allocation of dollars to repair, vs. the bits 'n pieces needed for those repairs. Last, complying with mandates to remove the Contract Depot Maintenance Activity Group from the Working Capital Fund, we focused on the management of consumables to contract sources. In particular, we sought to divest ourselves of the risk and cost of continually providing consumable items to contractors as Government Furnished Materiel (GFM).

The results of these efforts during CY03 have been phenomenal. By maintaining COLT during FY03, we avoided spending $50M for exchangeable inventories—a return on investment of 2000 to 1! Early COLT implementation results at Seymour Johnson AFB and Travis AFB have seen MICAP hours reduced 53% and CWT reduced 21%—with no additional inventory investment. As we export COLT to other AF bases, we anticipate our current ROI of 25 to 1 remaining relatively constant, but the return on AA will grow with each implementation. Focused on improving our support to AF-managed consumable items, we anticipate a 25% reduction in MICAP hours for these parts with no increase in cost—an anticipated ROI of 40 to 1. Our initiative to eliminate DLA managed items as GFM is projected to reduce our GFM inventories from $500M today—to less than $100M in the next couple of years. Furthermore, we anticipate passing on the 3% reduction in contract costs for these GFM contracts to our customer, the warfighting operational units. Last, our initiatives to collaborate with DLA on enterprise solutions, and develop our own internal funding trade-off models, offer significant promise as we continually seek to achieve AATs at reduced costs—this remains our true focus.

The relatively inexpensive nature of consumable items, their pervasiveness in supply chain processes, and the colossal potential gains from reducing TNMCS through improved enterprise consumable item supply chain solutions all add up to increased AA for pennies on the dollar.

SECTION 1: GENERAL INFORMATION AND PROJECT COMPLEXITY (15 POINTS)

1.1. NAME OF THE SUBMITTING ORGANIZATION (CORPORATION, SERVICE, ETC).

Headquarters Air Force Materiel Command, Logistics Directorate, Supply Management Division
Headquarters Air Force Materiel Command, Plans & Programs Directorate, Studies & Analysis Division

1.2. RESPONDING ORGANIZATIONAL UNIT (SITE, FUNCTION, ETC.).

Headquarters Air Force Materiel Command, Logistics Directorate, Supply Management Division

1.3. BRIEF MISSION DESCRIPTION OF THE OVERALL BUSINESS OBJECTIVES, PRODUCT LINES, AND MISSION OF THE ORGANIZATION.

The mission of the Logistics Directorate within Headquarters Air Force Materiel Command is as follows:

> *Our mission is to provide policy, guidance and resources to fulfill United States Air Force Logistics' needs in war and peace.*
>
> http://www.afmc.wpafb.af.mil/HQ-AFMC/LG/

More directly stated, the overall business objective of the organization is to maximize the availability of weapon systems—at the least possible cost, as stipulated in DoDR 4140.1. The Supply Management Division (AFMC/LGI) supports this mission through the development of policy, processes and systems that program for, budget, and distribute financial resources that facilitate the optimal buying, inducting, and distribution of materiel needed to support weapon system readiness. How is this accomplished? Figure 1.1 depicts the process. As reflected in node one of the figure, the Air Staff provides AFMC with readiness objectives that are expressed in targets—Aircraft Availability Targets (AATs). Figure 1.2 contains a list of notional AATs that span a three-year fiscal requirement—for future discussion, note that these AATs are less than 100%. These AATs represent the warfighters' statement of required operational readiness for each weapon system. As depicted in node 2 of Figure 1.1, the Secondary Item Requirements System—otherwise referred to as "D200"—converts this statement of required readiness into a statement of spares that will need to be purchased or repaired in order for each weapon system to achieve its AAT. The Supply Management Division complies with the mandate to minimize inventory investments to achieve readiness objectives through the use of complex, multi-echelon, multi-indenture algorithms that consider cost trade-offs throughout its supply chain in developing minimized investment requirements that yield targeted aircraft availability requirements—as stipulated by the Air Staff. The computation of requirements serve two main purposes: 1) they become the basis of a budget submission for future-year resources, 2) they become the basis for determining how requirements will be distributed throughout the supply chain in such a manner that allows each operational location (base) to achieve the AATs for their given weapon systems.

Figure 1.1. AATs: The Alpha & Omega of the Materiel Management Process

As depicted in node three of Figure 1.1, the Readiness Based Leveling (RBL) system converts the statement of requirement into stock levels that are pushed to bases on a quarterly basis. These levels consider the unique characteristics of each item—and each operating location. For example, what are the demand rates for the items—by location, and how often does each location repair an item, how long does the repair generally take, and so forth? Consistent with the AATs being less than 100%, RBL distributes the requirement in such a manner that optimizes each location's probability of achieving the AAT set forth by Air Staff. Furthermore—consistent with the AATs being less than 100%, this distribution of requirement becomes a statement of expected supply system failure. Simply put, the RBLs not only represent the requirement for assets to achieve a given readiness target—***but also the amount of time weapon systems will be incapacitated for lack of an asset.*** This is commonly referred to as the "Total Not Mission Capable Supply" rate—or TNMCS. At this point, note that one minus the AAT is equal to TNMCS.

Figure 1.2. Notional AATs

AATs			
MDS	**FY02**	**FY03**	**FY04**
A-10	95%	92%	95%
B-1	94%	92%	95%
B-52	94%	91%	90%
C-5	90%	92%	94%
KC-10	95%	95%	91%
C-17	89%	91%	90%
C-130	91%	94%	93%
C-141	94%	91%	91%
E-3	90%	91%	89%
F-15A-D	93%	89%	94%
F-15E	95%	91%	91%
F-16	91%	89%	90%
F117	81%	93%	91%
H-53	89%	90%	91%
H-60	91%	95%	92%
KC-135	93%	91%	95%
SOF C-130	95%	95%	95%
T-37	92%	94%	93%
T-38	94%	93%	93%

$$\mathbf{TNMCS = 1 - AAT}$$

This relationship allows our complex models and systems to mathematically derive the ***required availability of assets*** to achieve readiness objectives. Alternatively stated, this relationship allows our complex models and systems to mathematically derive the ***non-availability of assets*** to achieve readiness objectives! These instances of non-availability are referred to as "Expected Backorders"—or EBOs. This commercial term refers to the expected average number of instances when a customer will come to the supply window—and not have has his or her request immediately satisfied from shelf stock, and the item will have to be backordered. This "average number of instances" is composed of two factors—1) the daily demand rate of an item, and 2) the amount of time a customer waits for a backordered part, or CWT (customer wait time). Simplistically expressed, EBOs are:

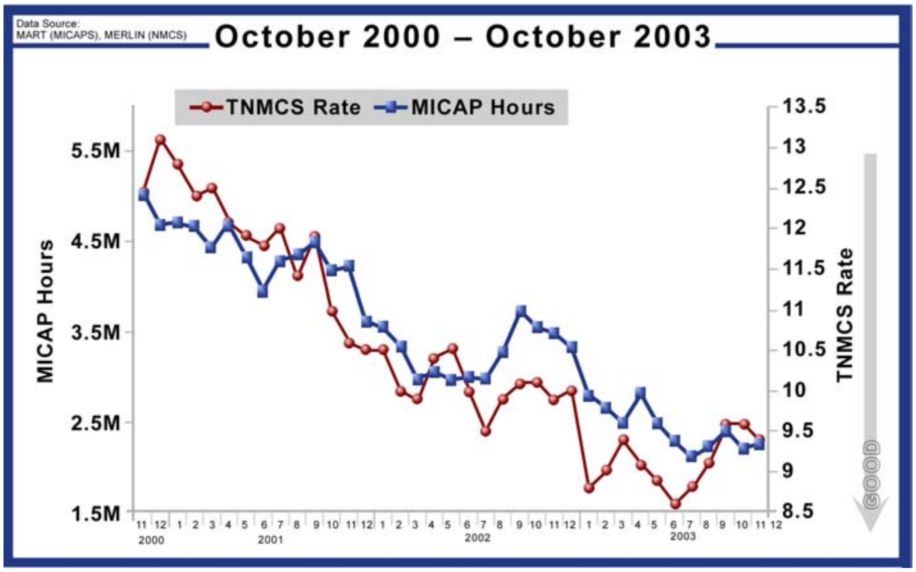
$$EBO = DailyDemandRate * CustomerWaitTime$$

EBOs may also be thought of as the average number of unfilled customer requests per day for a given item. For this paper, we'll call the actual instance that a customer is not able to have his or her order filled from on-hand stocks an "Actual Due Out", or ADO. At this point, EBOs may be compared to ADOs to determine the greatest sources of variance in supply system performance—and aircraft availability! The objective function of the RBL system is to minimize the time-weighted EBOs across the supply chain in such a manner that allows each base to achieve the AATs that initiate the spares requirements process.

As node four of Figure 1.1 depicts, real world execution can differ from expected performance parameters. Flying hour programs (most reparable items break by flying hour) may vary from those we budgeted for, an operational contingency may arise and generate unanticipated requirements, the supply chain may incur unanticipated difficulties with repair, etc. When this happens, the base customer may be driven to alternative measures to compensate for the lack of performance by the supply system—cannibalization of parts, pulling items from their wartime spares packages, or laterally shipping an asset from another base. In total, these actions will mask the true performance of the supply system.

As node 5 of Figure 1.1 depicts, 30"1-AAT" becomes the meaningful output of the system, otherwise measured as TNMCS. Those instances where non-availability of a spare incapacitates a weapon system, or some sub-system of the weapon system, are generally referred to as MICAPs (or Mission Capable). MICAP incidents accrue "time"—ie, hours and days. Figure 1.3, which depicts the aggregate TNMCS rate for the AF against aggregate MICAP hours (for spares that are managed by the Materiel Support Division (MSD), a division of the Air Force Working Capital Fund), illustrates that MICAP and TNMCS are closely correlated—.92 to be more precise, during the period Oct 00- Oct 03! This extremely close statistical relationship allows us to use MICAPs as a surrogate for TNMCS, and to more readily identify those items that contribute the greatest amount of variance to TNMCS.

Figure 1.3. Correlation of TNMCS to MSD MICAP Hours



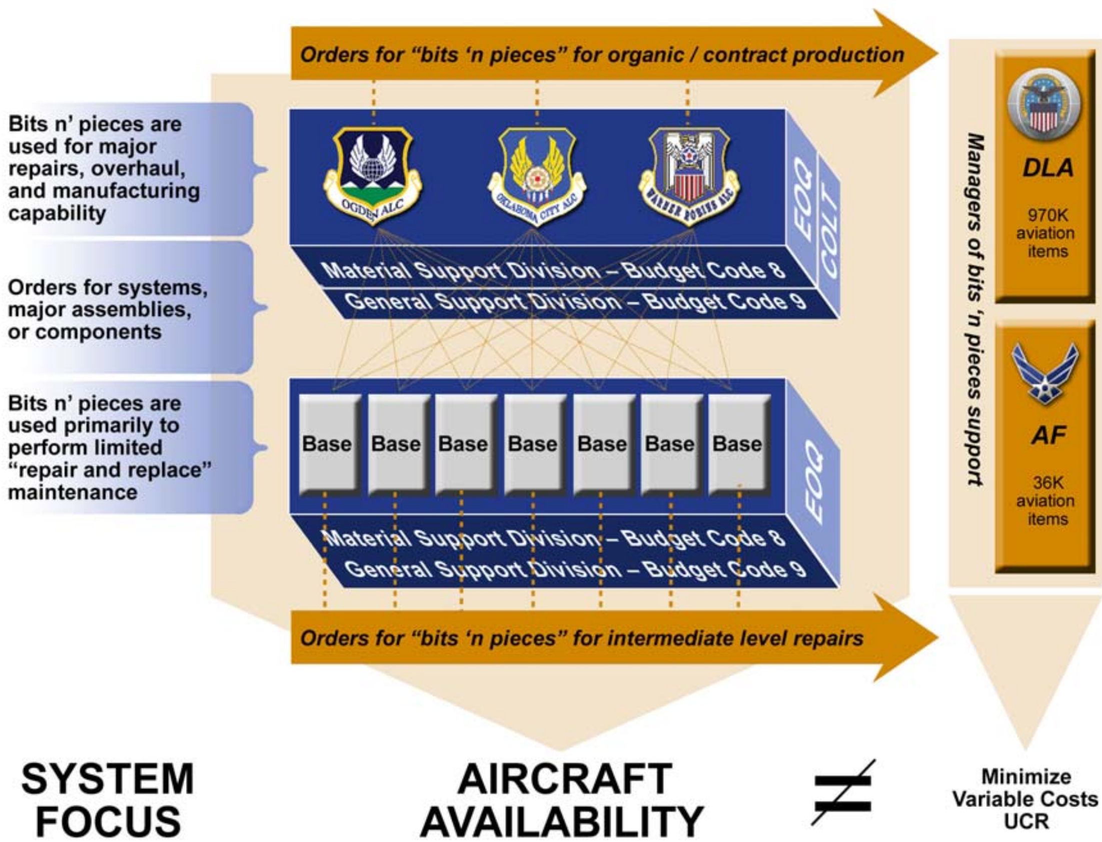
As depicted in our original figure (Figure 1.1), the spares contribution to aircraft availability can be represented in a closed loop—such that, the Air Staff AAT can be directly linked to the number of MICAP hours for a given aircraft or weapon system. In short, the business objective of AFMC/LGI is to minimize the cost of spares required to achieve the Air Staff AAT. Our product is aircraft availability, and our mission is to provide the resourcing, policy, processes, and systems required to achieve the stated AATs.

1.4. AWARD CATEGORY OF THE SUBMISSION (OPERATIONS, ACADEMIC, TECHNOLOGY).

Supply Chain Operational Excellence Award

1.5 BRIEF DESCRIPTION OF THE SUPPLY CHAIN AND THE PROCESSES THE SUBMISSION SPANS (PLAN, SOURCE, MAKE, DELIVER, RETURN, ETC). – 15 PTS

Figure 1.4. A Simple View of the Supply Chain

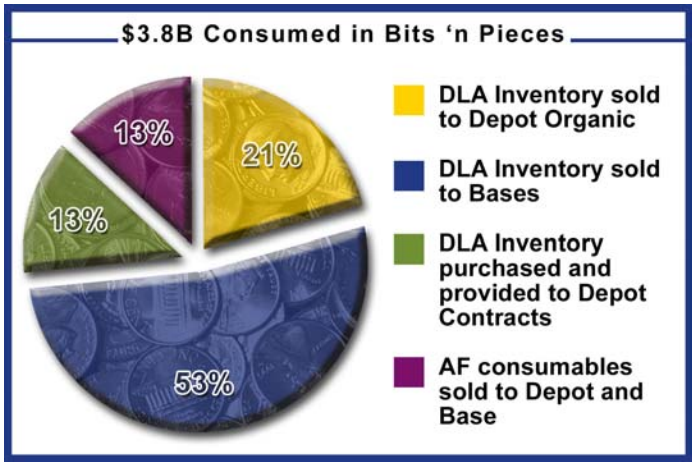


In support of achieving the AATs that have been discussed, Figure 1.4 illustrates the basic role of the AFMC supply chain. AFMC/LG provides supply policy, procedures, business systems, and funding to AF wholesale supply activities—the Air Logistics Centers (ALCs). In particular, HQ AFMC/LG provides oversight and funding to the ALC supply activities that directly support three major business activities: 1) repair of commodities (end items for other systems, e.g. landing gear, radars), 2) repair/overhaul of engines, and 3) Programmed Depot Maintenance (PDM), i.e. periodic inspection and overhaul of aircraft and missiles. Based on the level of complexity, the equipment and skills required, etc—each of these activities may occur at the base or depot echelon of the supply chain, and may be accomplished with organic resources or through contractual agreements with commercial providers. As depicted in the supply chain model, the system focus of the depot and base production functions should be to maximize aircraft availability. However, as also noted on the figure, consumable item management practices may not be consistent with the objective function of the maintenance process. ***The focus of this submission is the supply activity/process that ensures parts—bits n' pieces—are available to support maintenance actions that maximize the AF's ability to achieve its AATs.*** Toward this end, the following sections briefly discuss:

1. AF consumption of bits 'n pieces across its supply chain
2. The different consumable level setting processes used across its supply chains
3. How the funding methodology impacts supportability

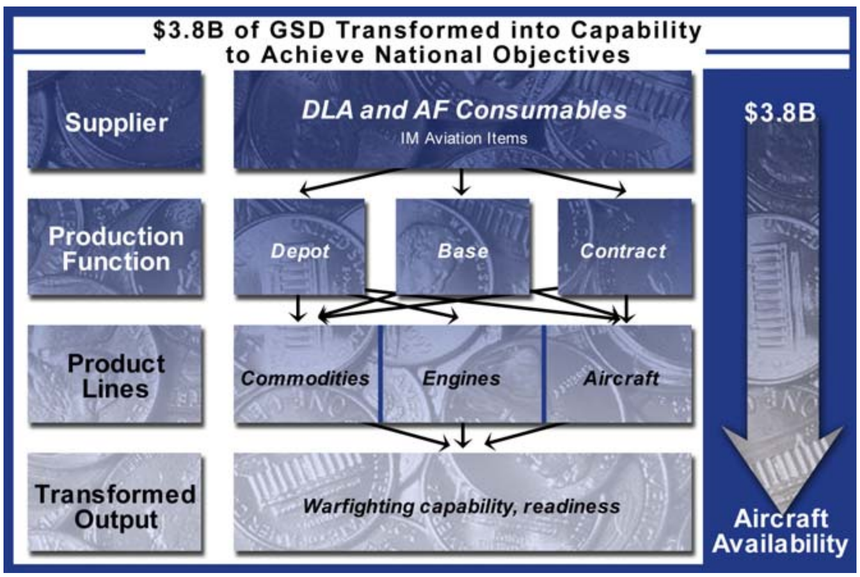
Consumable Items…Low Cost, Big Dollars?

Figure 1.5. Consumable Pareto



As depicted in Figure 1.5, the more than 1M aviation investment items managed by DLA and the AF result in sales of over $3.8B per year to DLA and the AF. The AF consumables comprise approximately $500M per annum, while DLA reaps the remaining $3.3B in revenue in support of depot organic, depot contract, and base repair functions. DLA manages the preponderance of the items—more than 970K, while the AF manages approximately 35K. Furthermore, of the million items, roughly 175K will actually be sold in a given fiscal year, thus making inventory level setting, stock fund management, and support to the myriad demand patterns—a daunting challenge.

Figure 1.6. Transforming DLA Bits n' Pieces into Warfighting Capability



Given the enormous impact that consumable items have in the availability of weapon systems, it becomes imperative that the supply chain continually seek to optimize the policies, processes and systems that affect the level setting, funding, and distribution of these items.

Level Setting

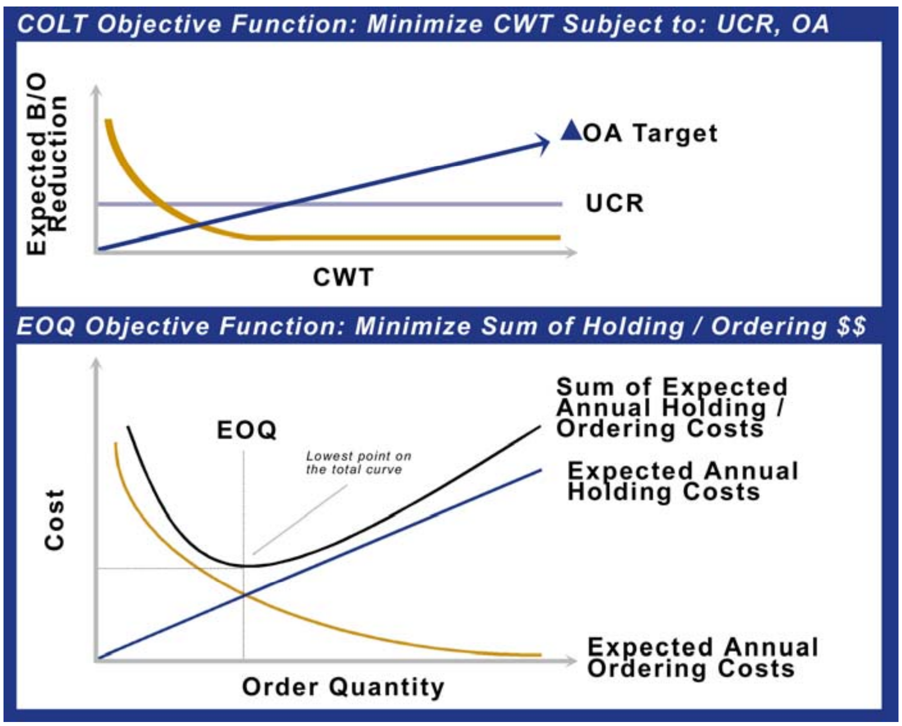
As a means of assuring bits n' pieces are available when needed, the ALC and base level supply functions compute stock levels for consumable items that are provided by the Defense Logistics Agency (DLA) or the AF. As Figure 1.7 below documents, different algorithms are used for setting consumable levels within the supply chain—primarily based on who manages the consumable item.

Figure 1.7. Different Algorithms For Managing Consumable Items

Echelon of Supply Chain	Who Manages the Consumable Items?	Type Leveling Algorithm Used
AF Depot	AF Depot	Economic Order Quantity Lot Size Model
AF Depot	DLA	Customer Oriented Leveling Technique (COLT)
AF Base	AF Depot	Economic Order Quantity Lot Size Model
AF Base	DLA	Economic Order Quantity Lot Size Model

In FY03, as a continued result of implementing the COLT model in FY01/02, depot stock levels were predominantly computed off-line by a PC program that leverages both marginal analysis algorithms and a collaborative data sharing process—DLA performance data and depot consumption data—to establish levels. Figure 1.8 illustrates the differences in the COLT vs EOQ level-setting techniques.

Figure 1.8. Consumable Item Level Setting Processes



* Unit Cost Ratio (UCR), Obligation Authority (OA)

While the COLT model seeks to minimize time-weighted EBOs, the EOQ model seeks to minimize the sum of expected annual ordering and holding costs. Consequently, these algorithms result in different configurations of inventory—that provide different service levels—and equivalently, different levels of ADOs. The EOQ model—which is generally computed for an item when it reaches its reorder point—will gravitate toward ordering large quantities of cheap items. Conversely, the COLT model—which is run against all items once a quarter—will gravitate toward frequent orders on items that have low CWTs while creating larger levels for items with larger CWTs.

Budgeting and Funding

As previously stated, AFMC's goal is to maximize aircraft availability by optimizing the distribution of buy & repair cost authority and consumable item obligation authority to the three ALCs. However, the

AF budgeting and funding processes for consumable items does not support this goal. Traditionally, AFMC budgets for repair are linked to AATs—and are submitted as a requirement for the Materiel Support Division (MSD). Concurrently, AFMC budgets for DLA bits 'n pieces needed for those same repairs, and the expected consumption of DLA bits n' pieces by its own bases—all of which are predicated on forecasted sales of those same bits 'n pieces, and is managed via a unit cost ratio. The unit cost ratio is used to control the amount of bit 'n piece inventory ordered as a function of the bit 'n piece inventory that is sold. Meanwhile, the remaining MAJCOMs submit budgets for the obligation authority they anticipate they'll need for the consumption of DLA bit n' pieces—and do so without linking their requirements to AATs. In total, given the allocation of funds to procure DLA items across the supply chain are based on forecasted sales and unit cost ratios—it becomes problematic to suggest that the AF funding allocation process aligns with the AATs that the buy and repair budgets are based on.

Applying the Supply-Chain Operations Reference (SCOR) Model

This section discusses the different segments of the Supply-Chain Operations Reference (SCOR) model that apply to this submission. As an overview, this project primarily involves the *planning* of bits n' pieces needed to repair spare parts, support PDM schedules, and intermediate level repair processes. Next, how the bits n' pieces are *sourced,* then used to *make* serviceable end items to meet base-level needs and Programmed Depot Maintenance (PDM) schedules. The objectives of this enterprise supply chain management project were to:

a. Within AFMC, optimize the distribution of funding between the repair process (MSD) and the bits 'n pieces needed for repair (GSD)
b. Continue monitoring effects of COLT implementation from the prior FY
c. Leverage DLA wholesale and AF base/retail supply information within available funding to reduce the delay times for DLA bits 'n pieces needed to perform AF base repairs on end items. Essentially, implement COLT at the operational bases and attempt to replicate the successes COLT had when implemented at the AF depots.
d. Continue working with DLA to develop enterprise solutions for consumable item management that would facilitate the AF attaining its AATs, while concurrently supporting DLA stock fund financial objectives
e. Begin developing a process to link AF managed consumable items to AATs, and concurrently improve the requirements computations of these items
f. Minimize risk and inventory investment for Government Furnished Materiel (GFM) provided to contractors for items the AF was purchasing from DLA

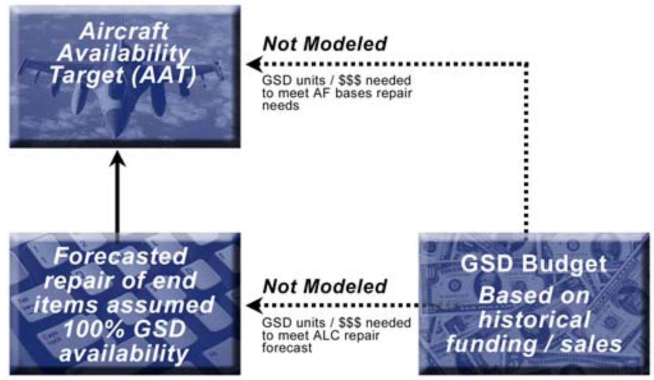
Plan

The most fundamental aspect of this submission lies in the planning activities of the ALCs and bases. Annually, the ALCs perform a workload review of their anticipated production requirements and their forecasted capacity to meet those requirements. At the lowest level, the workload review assesses the ALC's ability to meet the needs of the AF bases and the requirements of the PDM/overhaul processes. Of particular importance to this discussion, is the plan for DLA units/dollars required to satisfy the anticipated repair/overhaul requirements is reflected through the following two processes:

- Stock levels for DLA bit n' pieces that are unique to each ALC
- The budgeting process that funds those levels

Historically, stock levels fluctuated in concert with actual consumption patterns, and funding was based on the historical sales of DLA bits n' pieces at an ALC. As Figure 1.9 depicts, the ALC production plans are designed to meet warfighting capability targets. However, the ALCs did not assess the ability of stock levels or funding required to achieve their production objectives. Similarly, base level funding was predicated on historical sales—not the required financial obligation authority that would be needed to meet AATs.

Figure 1.9. How did we plan for GSD requirements?



Source

DLA is the source for more than 83% of the consumable line items required to perform the vast majority of the repair, overhaul, and PDM processes at an ALC. In particular, this project looked at the following processes related to sourcing items from DLA:

- What was the historical availability for a given bit n' piece
- To what degree were DLA stockage policies in concert with AF ordering policies
- How could AF ordering policies be adjusted to optimize support of DLA stockage policies
- What was the impact of AF stock leveling policy on performance of DLA item availability

Just as significant as the support afforded by DLA, this project also looked at the sourcing process for funding. In particular, what was the historical budgeting process for determining the requirement for GSD obligation authority? What was the flexibility to increase GSD obligation authority to satisfy short-term requirements or compensate for periods of abnormal variability in consumption?

Make

After assessing the planning and sourcing processes, this project then reviewed the production processes that consumed the DLA bit n' pieces. As part of the "make" process at an AF base, this project reviewed the similar *constraints* that it reviewed within the depots during the prior FY. The AF categorizes these constraints into four areas:

- Funding
- Shop capacity/capability
- Carcasses (the unserviceable end item to be repaired)
- Consumable piece parts

This effort specifically focuses on reducing the amount of time that mechanics in AF base repair functions spend waiting for *consumable piece parts.* Items in AWP status reduce the availability of end items to the flying units, thus likely limiting the AA for a given base. In the end, it directly affects the availability and readiness of AF and DoD weapon systems to perform their peacetime and wartime missions.

1.6. NAMES OF THE SUPPLY CHAIN PARTNER ORGANIZATIONS (EXTERNAL) INVOLVED IN THE PROJECT. (INCLUDES THE NUMBER OF PEOPLE INVOLVED FROM EACH PARTNER ORGANIZATION AND THE FUNCTIONAL CATEGORY OF EACH.)

External Supply Chain Partners	# of People	Functional Category
OC-ALC/MAM	1	▪ Field Operations ▪ Program Development ▪ Systems
OO-ALC/MAM	3	▪ Field Operations ▪ Systems
WR-ALC/MAM	4	▪ Field Operations ▪ Program Development ▪ Systems
HQ DLA/J-3	3	▪ Staff Analysis
DDC/J-3	5	▪ Field Operations
DORRA	2	▪ Staff Analysis
HQ USAF/ILG	3	▪ Management Oversight
ACC/LGS & RSS	4	▪ Field Operations
AMC/A4S & RSS	5	▪ Field Operations
AFLMA	2	▪ Staff Analysis

1.7. NAMES OF THE FUNCTIONAL ORGANIZATIONS (INTERNAL) INVOLVED IN THE PROJECT. (INCLUDES THE NUMBER OF PEOPLE INVOLVED FROM EACH FUNCTIONAL ORGANIZATION AND THE FUNCTIONAL CATEGORY OF EACH.)

Internal Functional Organizations	# of People	Functional Category
HQ AFMC/LGR	6	▪ Staff Analysis ▪ Project Management ▪ Systems
HQ AFMC/LGP	1	▪ Staff Analysis ▪ Systems
HQ AFMC/XPS	3	▪ Program Development ▪ Systems
HQ AFMC/LGI	6	▪ Staff Analysis ▪ Systems

1.8. PROVIDE A POC FOR EACH SUPPLY CHAIN PARTNER (NAME, MAILING ADDRESS, COMMERCIAL TELEPHONE NUMBER, DSN, AND E-MAIL ADDRESS).

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SECTION 2: IMPLEMENTATION (75 POINTS)

2.1. EXPLAIN WHY THE SUPPLY CHAIN INITIATIVE WAS UNDERTAKEN AND HOW IT WAS SELECTED – (10 PTS)

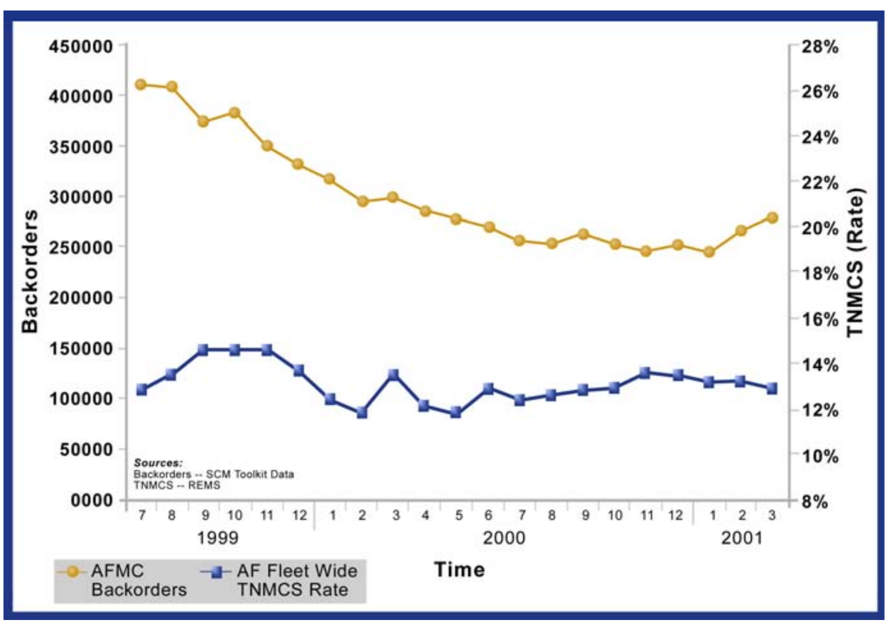
FY00 – FY02...the Formative Years

In 1999 and 2000, KPMG Consulting (now Bearing Point) performed a study, called the Constraints Analysis Program (CAP). That analysis identified consumable piece part support to depot maintenance as one of the six constraints limiting the ALC's ability to:

1. Complete Programmed Depot Maintenance (PDM) within cost and schedule
2. Efficiently/effectively produce end items for warfighter "make to order" requests and prepositioned levels

The CAP analysis postulated that increasing the availability of consumable parts would likely lead to increased repair facility productivity. Furthermore, the CAP analysis stated that not all items should be treated the same way by the supply system and, as a result, inventory stratification was briefed to and approved by the AFMC/LG. At that time—and still today—D035K was/is very limited in its flexibility and there has been a great deal of effort in this area at each of the ALCs. Subsequently, the Stockage Policy Integrated Product Team (IPT) was formed to develop a new, standard, stockage strategy for AFMC. Given the relative inexpensive nature of bit n' pieces vs. the serviceable inventory they support, this was a logical "first step" in resolving the constraints identified in the CAP.

Figure 2.1. TNMCS Was Not Decreasing With Rate of Backorder Decline



As Figure 2.1 depicts, in addition to the CAP analysis, the AF was witnessing a drastic decline in backorders—with relatively no gain to show in its Total Not Mission Capable Supply (TNMCS) metrics. In light of this trend, it raised the general question, is AFMC applying its stock fund to the best items in terms of improving weapon system availability? Furthermore, as noted earlier, $800M in DLA bit n' pieces consumed by the depots support the production of billions of dollars in sales to the warfighter—literally pennies on the dollar. As such, CAP and irreconcilable trends provided significant insight and impetus to alter consumable item management practices. Last, the only options to improve support to the warfighter were to:

1. Determine if there's a better methodology of level setting for DLA items
2. Spend hundreds of millions or several billion dollars to augment reparable item inventories to compensate for variability in bit n' piece support
3. Spend billions of dollars for additional weapon systems/aircraft to compensate for the variability in end item availability which is driven by variability in bit n' piece support

As such, financially, this initiative was the least prohibitive and offered the most to gain with the least possible investment.

In March 2000, an IPT was chartered by AFMC's Director of Logistics to look at methods to improve support on these consumable parts. The IPT was comprised of members from the supply divisions at each of the ALCs, the HQ AFMC Supply Division, the HQ AFMC Studies and Analysis Office (XPS), and DLA.

Initially, the IPT conducted an in-depth analysis of the existing stockage polices, metrics, and initiatives—and tried to understand where these efforts had fallen short. For example, historically, the depot retail supply system (D035K) used a traditional Economic Order Quantity (EOQ) model to set stock levels (similar to the method used by the base level supply systems). However, the IPT determined that in many cases, D035K ordered stock so infrequently that the policy actually "drove" poor support from DLA. The AF algorithm tended to order annual demand quantities—large amounts of stock. Operating this way, EOQ orders at the beginning of a fiscal year will tend to be for annual quantities—thus reducing flexibility of the stock fund when the obligation authority ceiling has been met. Conversely, DLA algorithms more optimally support smaller demand quantities. The EOQ model attempts to minimize the sum of annual variable holding and ordering costs—in the absence of knowing the Unit Cost Ratio (UCR) or annual obligation authority target.

In response to the inconsistencies in EOQ , AFMC adopted "1-for-1" ordering in 1998 to improve DLA's visibility of the true customer demand stream. However, the implementation of the "1-for-1" policy varied drastically across the ALCs – there was no consistent policy across the command. Additionally, all previous initiatives focused on the well known issue effectiveness (IE) (percent of time any item is immediately available for a customer demand) and stockage effectiveness (SE) metrics, both of which fail to capture the length of time that backordered requisitions stay on order. For example, if a mechanic ordered 10 parts that were needed to complete a job, and 8 were immediately issued from depot supply, the IE would be 80%. But if the 2 that weren't immediately available then took 2 months to be sourced and delivered, the job was stalled all that time in an AWP condition. As an alternative, the IPT adopted customer wait time (CWT), which accounts for the time it takes for supply to issue a part, regardless of whether the item is immediately available or has to be ordered from DLA.

Armed with an understanding of the consumable parts history, the team created and analyzed several alternative stockage policies, assessing each option in light of the expected cost, performance, and risk. Of particular concern was the ability to change the method for setting stock level without increasing the requirement for obligation authority. It generally takes up to two years to acquire additional dollars for GSD items—because of the time it takes to submit new requirements in the Program Objective Memorandum (POM) process. Following this initial analysis, XPS developed a new alternative—COLT. This new level setting technique took into account known wholesale (DLA) support data when setting the retail stock levels – *leveragin*g this information to improve the return on investment from AFMC's existing inventory of consumable parts. Furthermore, the COLT model objective function seeks to minimize EBOs through minimizing CWT—as a function of the available obligation authority, and in concert with the established UCR.

Exhaustive analysis predicted that the policies contained within COLT had the potential to reduce CWT by up to 80% across AFMC without increasing the size of the inventory or requiring any increase in funding. The AFMC LG at the time fully endorsed the initiative and it was implemented with the cautious enthusiasm of the senior leaders at each of the three ALCs.

From implementation of COLT in August to October 2001 through 1 February 2003, average CWT for DLA-managed piece parts for all three AF ALCs decreased by 65% and has held steady or slightly declined since then.

FY03...Metrics Highlight Consumable Contribution to TNMCS

The COLT implementation at the ALCs during early FY02 created the foundation for pursuing and applying supply chain solutions to the management of consumable items. Yet, there were significantly greater reasons to pursue continued improvements in consumable item management. As stated at the outset of this document, MSD MICAP hours correlate very highly with the AF TNMCS rate—92% from Oct 00 – Oct 03. During FY03, the focus of the metrics process has been to tie our most relevant measures to TNMCS, and to begin to understand the pacing constraints and drivers of TNMCS. Adding the DLA data to the previously shown MICAP vs TNMCS figure, we see an even stronger correlation between MICAPs vs TNMCS—95% from Oct 00 to Oct 03. As Figure 2.2 illustrates, MICAPs for DLA items are generally for items that are a fraction of the cost of an MSD reparable asset. Whereas 40% of the MICAP hours for DLA items have a unit price that is less than $100, you'll note that to achieve that same percentage of MICAP hours for MSD items—you have to resolve MICAPs for items whose unit price may be as high as $10,000—a penny per dollar to achieve the same reduction in MICAP hours! Given the relative inexpensive nature of consumable items, their pervasiveness in supply chain processes, and the colossal potential gains to be had in reducing TNMCS through improved consumable item supply chain solutions—all add up to increased AA for pennies on the dollar.

Figure 2.2. FY02 MSD, DLA MICAP Hours & Incidents Stratified by Unit Cost[1]

Budget Code	Unit Cost of MICAP Item	Total MICAP Hours	% of Total MICAP Hrs	Running Sum
8 (MSD)	<$100	359,619	0.80%	0.80%
8 (MSD)	=>$100 & < $500	1,416,747	3.17%	3.97%
8 (MSD)	=>$500 & <$1,000	1,638,887	3.67%	7.64%
8 (MSD)	=>$1000 & <$2,500	3,590,565	8.03%	15.67%
8 (MSD)	=>$2500 & <$5000	4,091,703	9.15%	24.82%
8 (MSD)	>=$5,000 & <$10,000	6,613,183	14.79%	39.61%
8 (MSD)	=>$10,000 & <$25,000	8,230,203	18.41%	58.02%
8 (MSD)	=>$25,000 & <$50,000	5,381,410	12.04%	70.06%
8 (MSD)	=>$50,000 & <$100,000	4,564,180	10.21%	80.27%
8 (MSD)	=>$100,000 & <$250,000	3,642,503	8.15%	88.42%
8 (MSD)	=>$250,000 & <$500,000	2,048,448	4.58%	93.00%
8 (MSD)	=>$500,000 & <$1,000,000	1,112,399	2.49%	95.49%
8 (MSD)	>$1,000,000	2,017,555	4.51%	100.00%
		44,707,402		

[1] See Attachment 1 for FY03 data.

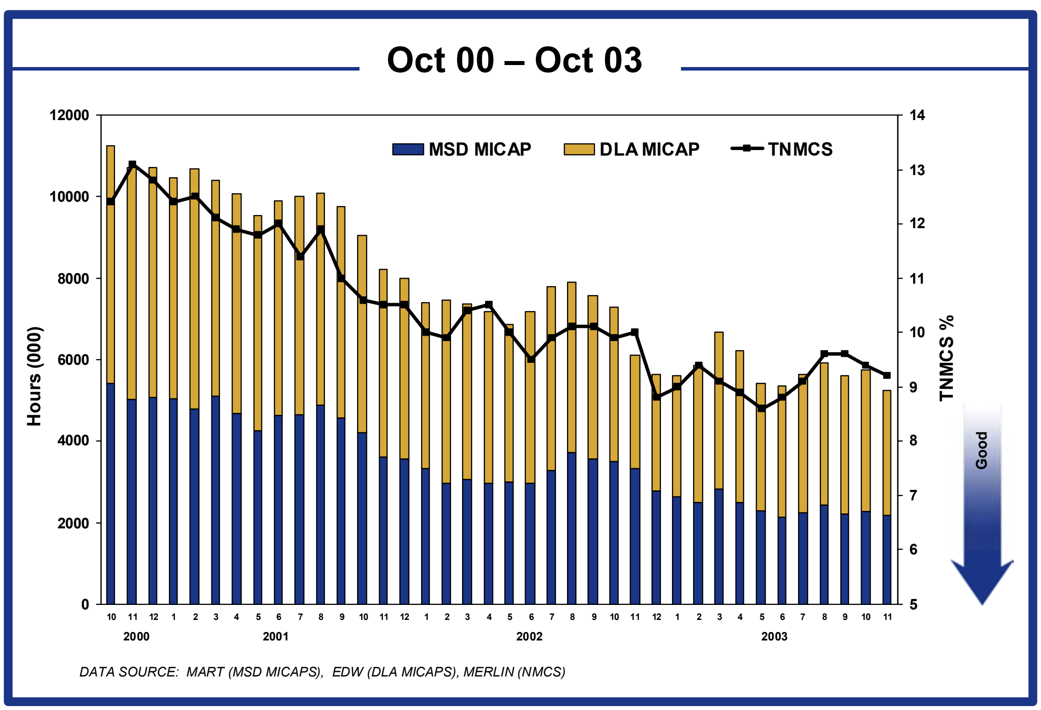
Budget Code	Unit Cost of MICAP Item	Total MICAP Hours	% of Total MICAP Hrs	Running Sum
9 (DLA)	<$100	20,026,702	35.47%	35.47%
9 (DLA)	=>$100 & < $500	13,580,892	24.05%	59.52%
9 (DLA)	=>$500 & < $1,000	6,860,027	12.15%	71.67%
9 (DLA)	=>$1000 & <$2,500	6,606,880	11.70%	83.37%
9 (DLA)	=>$2500 & <$5000	4,488,623	7.95%	91.31%
9 (DLA)	>=$5,000 & <$10,000	2,923,250	5.18%	96.49%
9 (DLA)	=>$10,000 & <$25,000	1,367,215	2.42%	98.91%
9 (DLA)	=>$25,000 & <$50,000	264,080	0.47%	99.38%
9 (DLA)	=>$50,000 & <$100,000	125,801	0.22%	99.60%
9 (DLA)	=>$100,000 & <$250,000	142,155	0.25%	99.86%
9 (DLA)	=>$250,000 & <$500,000	79,806	0.14%	100.00%
9 (DLA)	=>$500,000 & <$1,000,000	1,920	0.00%	100.00%
9 (DLA)	>$1,000,000	86	0.00%	100.00%
		56,467,437		

Budget Code	Unit Cost of MICAP Item	Total Incidents	% of Total Incidents	Running Sum
8 (MSD)	<$100	1,841	1.21%	1.21%
8 (MSD)	=>$100 & < $500	3,904	2.56%	3.77%
8 (MSD)	=>$500 & < $1,000	4,913	3.22%	6.99%
8 (MSD)	=>$1000 & <$2,500	12,319	8.07%	15.06%
8 (MSD)	=>$2500 & <$5000	17,709	11.61%	26.67%
8 (MSD)	>=$5,000 & <$10,000	27,650	18.12%	44.79%
8 (MSD)	=>$10,000 & <$25,000	31,282	20.50%	65.29%
8 (MSD)	=>$25,000 & <$50,000	19,092	12.51%	77.81%
8 (MSD)	=>$50,000 & <$100,000	13,089	8.58%	86.39%
8 (MSD)	=>$100,000 & <$250,000	10,907	7.15%	93.53%
8 (MSD)	=>$250,000 & <$500,000	6,263	4.10%	97.64%
8 (MSD)	=>$500,000 & <$1,000,000	2,283	1.50%	99.14%
8 (MSD)	>$1,000,000	1,319	0.86%	100.00%
		152,571		

Budget Code	Unit Cost of MICAP Item	Total Incidents	% of Total Incidents	Running Sum
9 (DLA)	<$100	112,098	52.56%	52.56%
9 (DLA)	=>$100 & < $500	44,257	20.75%	73.31%
9 (DLA)	=>$500 & < $1,000	18,635	8.74%	82.05%
9 (DLA)	=>$1000 & <$2,500	18,476	8.66%	90.72%
9 (DLA)	=>$2500 & <$5000	8,497	3.98%	94.70%
9 (DLA)	>=$5,000 & <$10,000	4,859	2.28%	96.98%
9 (DLA)	=>$10,000 & <$25,000	2,186	1.03%	98.00%
9 (DLA)	=>$25,000 & <$50,000	391	0.18%	98.19%
9 (DLA)	=>$50,000 & <$100,000	158	0.07%	98.26%
9 (DLA)	=>$100,000 & <$250,000	179	0.08%	98.35%
9 (DLA)	=>$250,000 & <$500,000	100	0.05%	98.39%
9 (DLA)	=>$500,000 & <$1,000,000	9	0.00%	98.40%
9 (DLA)	>$1,000,000	3,420	1.60%	100.00%
		213,265		

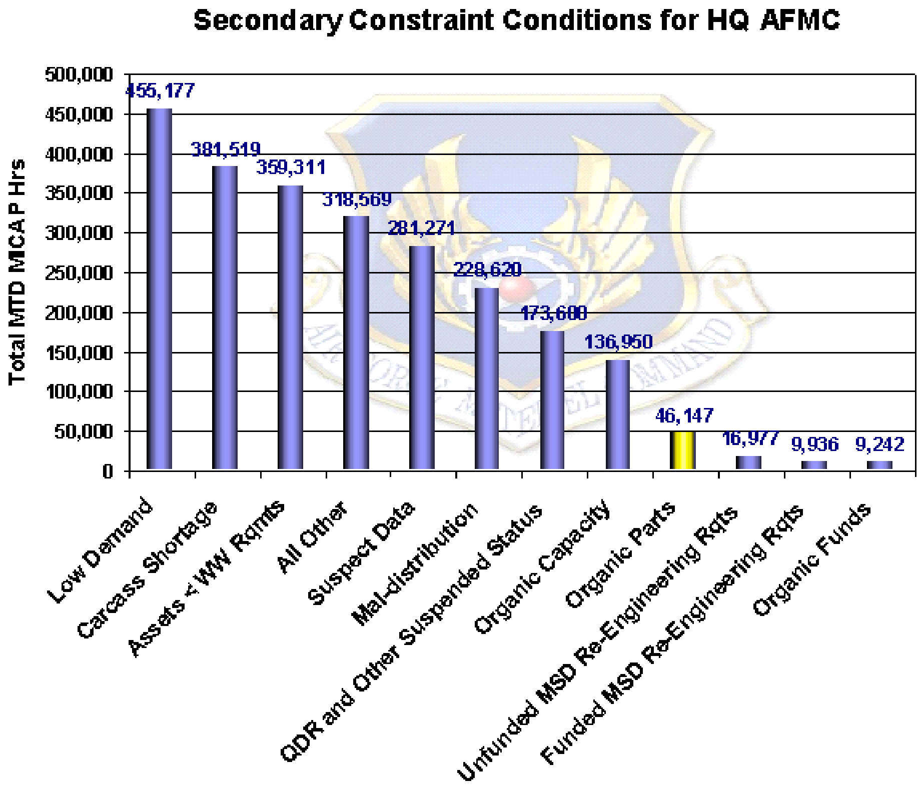
Historically, DLA and MSD items account for over 99% of the reported MICAP hours each month. As Figure 2.3 illustrates, understanding the factors that pace MSD and DLA contributions to MICAP hours provides meaningful insight into those issues most likely affecting TNMCS. As such, armed with this information, AFMC set a course to focus its processes and supply chains on MICAP hour mitigation and reduction. In Nov 03, AFMC/LG officially released its first-ever Supply Chain Metrics manual—highlighting the significance of the relationship between TNMCS and MICAP hours.

Figure 2.3. MSD & DLA MICAP Hours Plotted against TNMCS



Seeking formalized, systematic processes for identifying pacing constraints to MSD items, HQ AFMC hosted an IPT in Sept 03 with representation from each of the ALCs, XPS, WISMIS SAV—and developed the business rules for what is now referred to as the Constraint Condition Report (CCR). With the posting of a beta version of the CCR in Nov 03, the ALCs had their first automated, command-wide process to identify and categorize constraints to MICAP items. As reflected in Figure 2.4 below, bit 'n piece constraints are but one of many constraints linked to items with MICAPs. More importantly, the CCR reinforces the importance of MICAP reduction and working systemic constraints to supply chain effectiveness, by allocating MICAP hours to identified constraints, and allowing the roll-up of those hours against primary and secondary constraints. In future iterations of the CCR, the availability of DLA inventory/contract/PR/backorder/etc data holds the promise of incorporating DLA MICAP hours in the CCR—and developing a more comprehensive supply chain CCR.

Figure 2.4. CCR…Systematic Identification, Quantification of Constraints



In summary, the initiatives to pursue supply chain solutions to consumable item management are the culmination of several factors, namely: A) CAP analysis in 1999 and 2000 highlighted impacts of poor consumable item support to depot maintenance, B) successful implementation of COLT wrought huge reductions in depot CWT for DLA items, C) DLA MICAP hours continued to outpace MSD MICAP hours, at a fraction of the cost, D) extensive supply chain analyses during the past four years continues to highlight the impact of supply chain solutions in consumable item management. The initiatives discussed in this submission have been chosen based on their potential to increase support to the warfighter—at no extra cost, or their potential to maintain current levels of support to the warfighter—at reduced cost.

2.2. INDICATE THE DURATION OF THE PROJECT. NOTE IF THE PROJECT WAS A PILOT THAT IS BEING ROLLED OUT. NOTE IF THE PROJECT IS ONGOING OR STILL IN DEVELOPMENT. – (5 PTS)

As cited in this paper, several initiatives were initiated or on-going during this award submission period. This section briefly discusses each of these initiatives.

Continuing the use of COLT at the AF Depots

The depot IPT met for the first time in Mar 00 to discuss alternatives and focus on the overall project objective to optimize depot levels for DLA managed consumable items. A prototype of the solution was completed in Mar 01 and the first "full-up" version was deployed to the Ogden ALC in Aug 01. All three depots were up and running with the new system by 1 Nov 01. During the period of this award nomination, the IPT:

1. Continuously assessed model performance
2. Quantify the effects to operational stocks and stock fund performance
3. Met to revise the logic of the model
4. Ensured that operational and financial objectives were being met
5. Determined if projected improvements fell short, were realized, or exceeded

The COLT model has been distributed to each of the ALCs, and the IPT continues to meet periodically to discuss, analyze, and plan minor model and process improvements. Additionally, the IPT used the COLT model in 2003 to optimize the allocation of the $800M depot spares budget to the three depots, including allocating fall-out FY02 dollars and the initial FY03 budget.

Application of COLT to the Retail Echelon of the Supply Chain

Capitalizing on the success of COLT at the depots, the IPT expanded the implementation of COLT in the supply chain to more closely touch the warfighter. Base-level supply buys almost $2B in bits 'n pieces from DLA annually. As highlighted in the MICAP hour vs TNMCS charts in this package, these bits 'n pieces directly influence the mission capability of the warfighter. We began evaluating implementing COLT at the bases in late 2002. Working with our analysis partners on the IPT, we identified specific changes to the depot COLT model that were needed for successful implementation at the bases. This culminated with the initiation of tests of COLT at two base supply accounts: Seymour-Johnson AFB in Oct 03 and Travis AFB in Nov 03.

Working with DLA…Developing Supply Chain Solutions

COLT provides an automated means for collaborating with DLA. But DLA supply policies have remained unchanged. These policies drive DLA support in the DoD supply chain. DLA initiated a restructuring of their policies in 2003 called the Weapon System Readiness Improvement initiative that would more closely align DLA policies with weapon system availability. The IPT evaluated the initial proposal during 2003, and by year's end, the IPT developed a specific analysis plan for evaluating alternative DLA policies.

Linking AF Managed Consumable Items to AATs

The USAF Spares Campaign identified several initiatives in 2001 for improving spares support. One of the key issues was including AF-managed consumable parts in the process for optimizing Air Force spares to achieve weapon system availability targets. The IPT conducted analyses in 2002 and 2003 that identified the benefits and the specific changes required. This culminated in submission of formal system change requirements in late 2003.

AA Focus…Balancing MSD vs Depot GSD Funds within AFMC

Initiated during the summer of calendar year 2003, this initiative focused on balancing the distribution of cost and obligation authority between the depot repair fund and the depot bit 'n piece fund. This initiative underwent two iterations of model development, and holds the promise of developing a methodology that synchronizes the dollars allocated toward repair—and the bit 'n pieces that are needed for those repairs. As noted earlier, GSD funds are allocated based on prior year sales and unit cost targets—not a repair requirement that is directly linked to an AAT. This pilot project resulted in a formal review of the recommended model allocations of MSD vs GSD funds to the depots at the outset of FY04, and will reconvene with updates and potential recommendations to reallocate funds during FY04—pending the release of the summary Sep 03 D200 computation and an update of the available cost/obligation authority for FY04.

GFM→CFM for Contractors…Reducing Risk, Inventory, Cost

The implementation of DMRT Financial Initiative 2.2 changes the funding source for Contract Depot Maintenance (CDM). Under the current working capital fund concept, Air Force Working Capital Funds (AFWCF) are used to fund CDM costs with subsequent reimbursement from customers. The new process will use customer accounts directly when funding CDM costs. In a 19 Apr 02 memorandum signed by Lt Gen Michael E. Zettler, USAF/IL and Michael Montelongo, SAF/FM, AFMC/CC was directed to begin planning for transition of CDM out of the Depot Maintenance Activity Group--immediately. In calendar year 2003, this initiative focused on reducing the risk of providing GFM to contractors—which may often result in surplus inventory being returned to the government. During FY03, approximately $500M of DLA consumable inventory was issued to contractors as GFM. With the release of an official HQ AFMC policy letter on 8 Sep 03, the ALCs were directed to discontinue the practice of providing DLA consumables to contractors. This initiative is projected to reduce the $500M in GFM we issue today to approximately $90M—as contracts at the ALCs have already begun implementing this new policy. In addition to reducing the inventory the government will have to track—and potentially maintain, this initiative also potentially eliminates or reduces the 3% surcharge that is affixed to GFM contracts today—thus reducing costs to the warfighter for contractor provided repairs and services.

As evidenced by the myriad initiatives discussed in this section, enterprise management of consumable items has truly come to the forefront of supply chain solutions that offer the greatest return on our most important products—AA and readiness.

2.3. DESCRIBE, IN DETAIL, THE PROCESS USED TO COMPLETE THE INITIATIVE. – (15 PTS)

Continuing the use of COLT at the AF Depots

Initiated and refined in FY02, using COLT to set levels for DLA managed items at the depots continued during FY03—and is still used today. COLT, a government-owned Microsoft (MS) Access database, is installed and run on a personal computer (PC). COLT accesses the D035K accounts at each of the ALCs – this link provides information on the unit prices, demand rates, demand patterns, and order quantities of the parts as well as to the cataloging information for each item. This link to D035K is "live," meaning that the data is new each and every day that the model runs. Next, COLT accesses wholesale data regarding the expected level of support from DLA by stock number. Once per quarter, DLA provides an automated file transfer from its supply systems that updates a set of data for COLT. This DLA data shows the expected percentage of the time that an item will be available, the historical wait times when they have run out of the item, and their current asset balances by location.

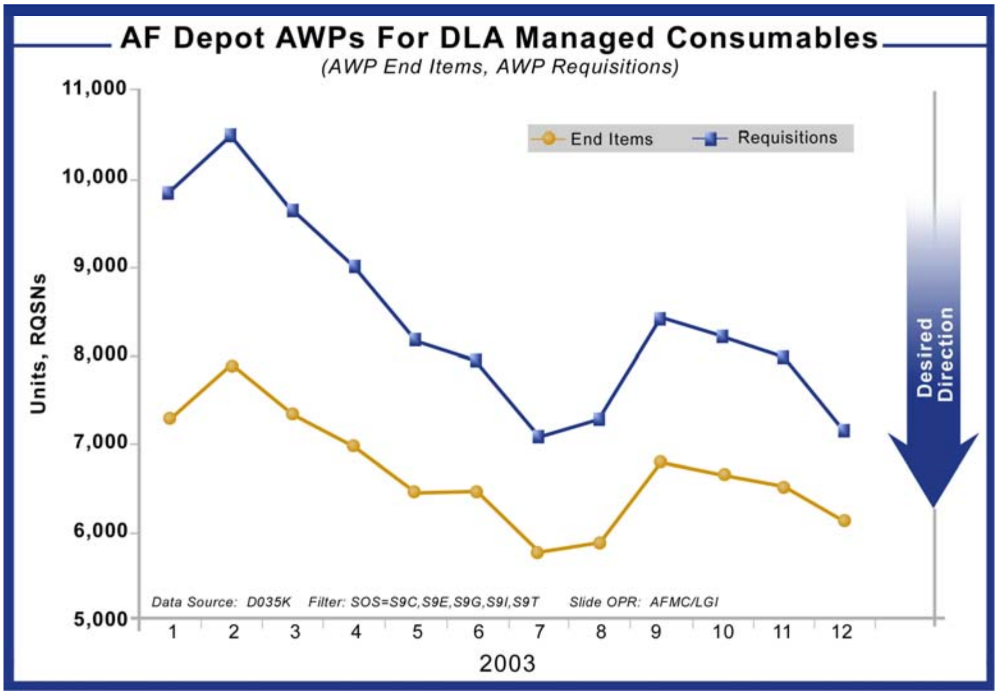
COLT uses all of the information from Phase 1 to set optimal stock levels during Phase 2. Again, "optimal" is defined here as minimizing the expected wait time for consumable parts for a given level of investment in inventory. COLT uses a marginal analysis technique, similar to that used in other Air Force logistics models, to allocate the available funding to the parts that will yield the largest return on investment, or "bang-per-buck." Stated another way, for every dollar that the model invests in consumable inventory, COLT finds the part where the next $1 will result in the largest reduction in average CWT across the population of parts being considered. This iterative process continues as long as the levels being set don't violate any of the user defined financial constraints – the budget. Phase 2 ends with a list of level changes, in MS Access, that COLT says will produce the lowest possible average CWT for the set level of investment in inventory.

During phase 2, retail stock levels are set according to a set budget and taking into account expected levels of DLA support. By understanding which items DLA has readily available and which items have short delay times when they stock out, COLT is able to shift AFMC's limited inventory investment towards the parts that require larger buffer to guard against long delays in the event of a stock out.

As an added benefit of setting stock levels based on the budget, AFMC now has a tool that aids in distributing the GSD funding each year. Historically, funding was passed out based on the percentage of past years' sales that came from each site. While this methodology is correct if the inventory investment is distributed optimally, this was not the case when COLT was first implemented. Instead the model showed that the previous distribution of funds did not provide the right allocation to insure the best total level of support from AFMC to its customers. By shifting the investment mix, each ALC realigned them selves to make AFMC more efficient as an *enterprise*. Perhaps the best thing about using COLT to pass out the GSD budget is that it removed emotion from the equation and resulted in a distribution that could be defended in terms of optimizing customer support. COLT processing concludes each quarter when it exports its proposed levels changes in the form of a flat text file of data that is easily fed into D035K.

As Figure 2.5 illustrates, depot AWPs continued to decline during FY03, as the COLT model continued reshaping the DLA-managed consumable inventories that were needed for organic repairs. This continued reinforcement of the COLT collaborative level-setting process provided impetus to initiate the transfer of this tool and process to the retail echelon of the supply chain.

Figure 2.5. Depot AWPs Continue Declining During CY03



Application of COLT to the Retail Echelon of the Supply Chain

With the tremendous success realized implementing COLT at the Air Logistics Centers (ALC's), we turned our attention to implementing COLT at the base level. If setting stock levels as a function of part demand patterns, costs, expected support from the wholesale supplier (the Defense Logistics Agency -- DLA), and the General Support Division (GSD) budget could result in significant reductions to customer wait time (CWT) at the depots, then we believed the same logic and results would migrate successfully to the bases. To test this hypothesis, we developed a Standard Base Supply System (SBSS)-tailored version of COLT to test at the base level.

With the recommendation of the Air Fore Stockage Policy Working Group (AFSPWG), the Air Force Materiel Management Board (AFMMB) tasked HQ USAF/ILGP to develop a plan to test COLT at two or three USAF bases. In response, HQ USAF/ILGP developed an Integrated Product Team (IPT) with representatives from HQ AFMC/XPS, AFLMA (Air Force Logistics Management Agency), and HQ ACC/LGS.

We worked with the IPT to complete the analysis of COLT and adjust the model to better fit the base level operation. Previously, COLT assumed that the bases order a part every time one broke. We improved COLT by importing the SBSS Economic Order Quantity logic to recognize that orders are frequently batched. We also improved the mathematical algorithm within COLT to account for variability in the demand for parts. Teaming with the IPT, we analyzed a number of options to affect the range of items to be stocked. Through this analysis, the IPT agreed to force a positive stock level on all parts that previously caused a MICAP incident. Most importantly from a user acceptance perspective, the COLT model was changed to target a performance requirement as opposed to a funding requirement or restriction. This allows COLT to set "required" safety stock levels, rather than set "affordable" safety stock levels, and solves the problem encountered in the initial test with funding parameters. Ultimately, XPS, with assistance from AFLMA and the COLT IPT, was able to provide a product that more accurately reflects the base supply environment and produces better safety levels that improve support to the base level maintenance customers. We estimate that backorders to maintenance at both Seymour-Johnson AFB and Travis AFB will decrease by close to 70% with the implementation of COLT. The figure below indicates the expected backorders given the current SBSS stock level computation compared to the expected backorders given the stock levels computed by COLT.

Figure 2.6. Expected Backorders—COLT vs SBSS

Base	EBO - SBSS	EBO – COLT	% Change
Seymour-Johnson	32,810	11,181	-65.9%
Travis	9036	2859	-68.4%

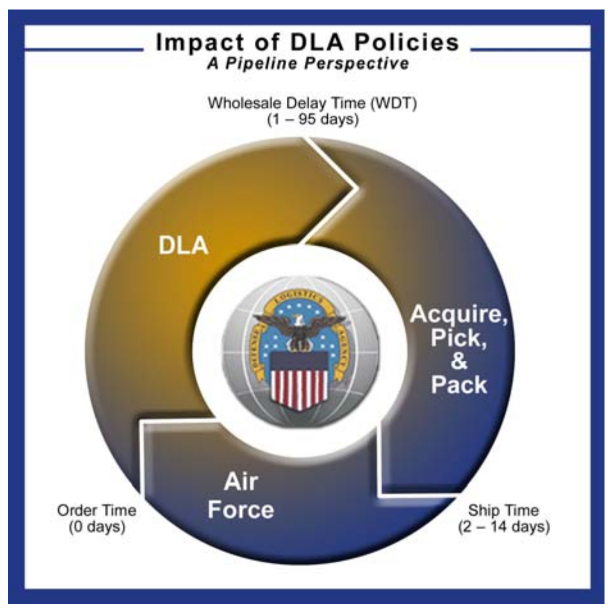
In Sep 03, we briefed our proposed changes to the AFSPWG—ACC, Air Mobility Command (AMC) and Pacific Air Forces (PACAF) all expressed interest in participating in the next test. The AFLMA briefed ACC/LGS and obtained approval to resume testing at Seymour-Johnson in Oct 03. Both AFLMA and XPS briefed AMC/LGS and their Regional Supply Squadron (RSS) staff in Oct 03 and obtained agreement to begin testing at Travis AFB. To focus the appropriate attention to the two test bases, it was decided to limit PACAF involvement to analysis of data only. Implementing a full, live test at a PACAF base would stretch the limited resources of XPS and AFLMA too far and could potentially disrupt the overall success of the tests.

Should COLT prove successful at the base level, we would expect to see improved parts support directly to the flight line. Furthermore, the magnitude of the dollars is smaller at each base than at the depots; when factored at the MAJCOM level, the dollar implications become significant. Given the preliminary results are very favorable, we are guardedly optimistic that the most recent implementation of COLT will improve warfighter support for DLA-managed parts Air Force-wide.

Working with DLA…Developing Supply Chain Solutions

DLA is the wholesale supplier of most of the parts that comprise Department of Defense weapon systems. These parts tend to be less expensive and less reliable than the weapon system parts that the individual Services manage. DLA's current process for computing spares requirements is not readiness-based and is biased against weapon systems that have expensive parts (e.g., aviation). They use math models to compute stock levels (i.e., reorder points) to meet wholesale performance metrics (e.g., supply materiel availability, also known as fill rate, issue effectiveness, etc.) at least cost. They apply their inventory models separately at each of their Inventory Control Points (ICPs) across all items at the ICP, so less expensive parts on one weapon system compete for spares with more expensive parts on other weapon systems. Since aviation weapon systems tend to have more expensive parts, their support will suffer relative to other weapon systems with less expensive parts.

Figure 2.7. Impact of DLA Policies



DLA has proposed a plan (aka "Weapon System Readiness Improvement", WSRI) to change the application of their models to remove this bias. The proposal is remarkably consistent with the themes behind the Air Force's Spares Campaign:

- Instead of applying the model separately for each of their ICPs, they will apply it from a corporate perspective across all their ICPs
- Instead of applying the models across all items across all ICPs, DLA will apply the models to weapon system groupings (e.g., aviation, land-based, maritime-based)

We evaluated the benefits the Air Force could expect with WSRI. Using data supplied by DLA's Office of Operations Research and Resource Analysis (DORRA), we showed that $200M of the total $302M investment in WSRI would be applied to the weapon systems the Air Force has told DLA should receive highest priority. In addition, roughly $90M would be applied to parts that have previously grounded one of these weapon systems. We projected there would be a 54% reduction in retail backorders for these parts under WSRI, and a 46% reduction in retail backorders for all the 71,000 parts that would be affected by WSRI. These results indicated that WSRI could provide significant readiness improvements for the Air Force.

Linking AF Managed Consumable Items to AATs

D200A is the system that computes worldwide spares requirements for the USAF. The logic in D200A that computes requirements for AF managed consumable parts is a carryover from logic the AF has historically used to manage reparable parts. We recommended two changes be made to the D200A system to improve the treatment of consumable parts: 1) Add the base Economic Order Quantity (EOQ) to the D200A requirement as an additive requirement, and 2) Incorporate a new formula for computing expected backorders that considers the EOQ in its calculation.

USAF policy calls for the bases to order an Economic Order Quantity whenever they place an order, but the policy only allows the EOQ for consumable parts. The EOQ can vary and is computed with the intent of minimizing ordering and holding costs. If the order is placed once a year, then the EOQ will be large enough to cover the demand over that year. This minimizes the cost to order, but the cost to hold the stock that arrives can be rather large. On the other end of the spectrum, the EOQ can be one. Every time a part breaks, an order is placed. This minimizes the cost to hold, but the cost of placing numerous orders can be expensive.

Our analysis showed, depending on when orders are placed, D200A may compute enough stock to cover the base EOQs. However, with competing users ordering differing amounts of stock, the assets may be in the wrong places. As the number of users increase and the EOQs become more diverse, it becomes more likely stockouts will occur—due to not including the EOQ in the D200A spares requirement. Including the EOQ in the D200A requirement will provide an additional “safety level” to guard against these expected stockouts. But the D200A expected backorder formula assumes the EOQ is one, so it doesn't recognize this additional safety. Correcting this will cause the D200A safety level requirement to decrease for consumable parts.

As shown in the following table, adding the total EOQ to the D200A requirement would increase the requirement by 125,860 parts. At Latest Acquisition Cost (LAC), the dollar value of this increase is $9.5M. However, correcting the expected backorder formula will reduce the safety level by 26,618 spares ($8.1M). The net effect of our proposed changes is an increase in the gross requirement of 99,242 spares—at a cost of $1.3M.

Figure 2.8. Net Impact to Inventory Requirements Based on Changes to D200A

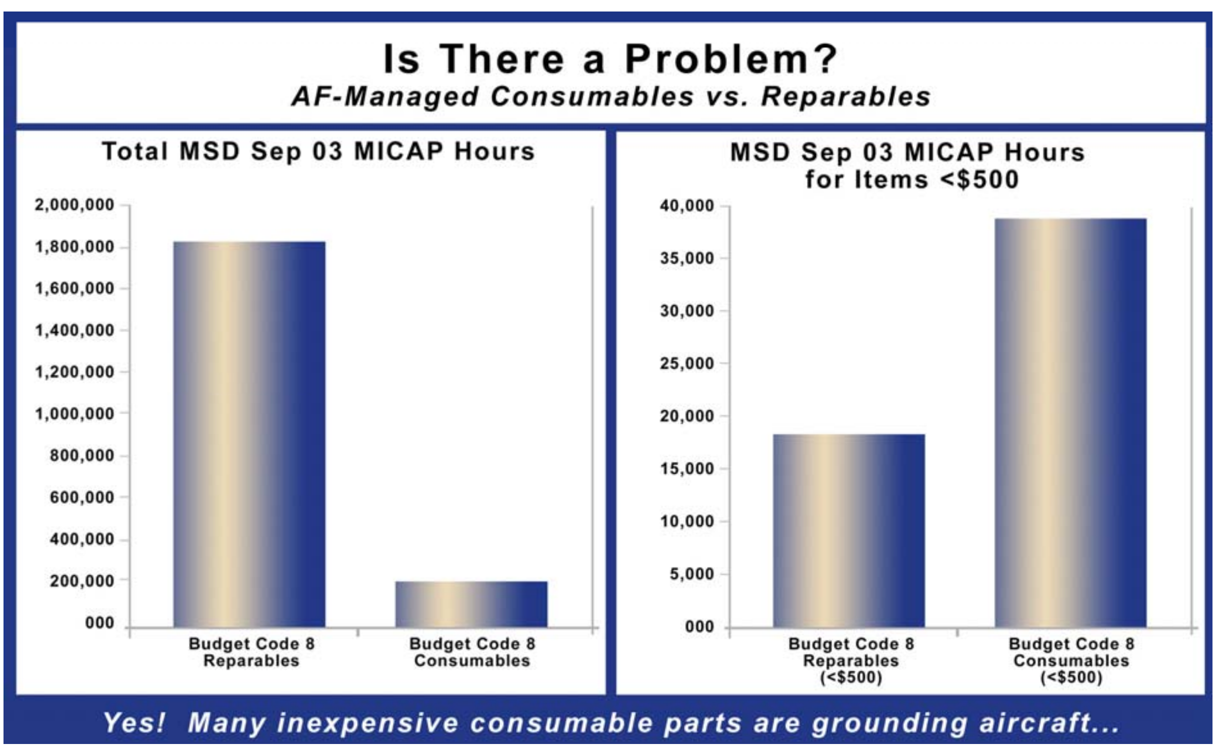
	Parts	Dollars
Increase Due to Addition of Base EOQ	125, 860	$9.5M
Decrease Due to Change in Safety Level Calculation	-26,618	($8.1M)
Net Effect of Proposed D200A Changes	99,242	$1.3M

We estimated that this increase would improve the stock availability of consumable parts from 83% to 98%.

Readiness Based Levels (RBL) is the system that sets stock levels for all AF-managed reparable parts. Previous analyses by XPS and the Air Force Logistics Management Agency (AFLMA) concluded that two issues needed to be resolved before RBL could be used to set stock levels for consumable parts. The first issue deals with the D200A requirement, which was addressed above. The second issue was that RBL could not handle an EOQ in its expected backorder calculation, much like the problem we addressed for D200A. We recommended that RBL incorporate the same fix we developed for D200A. We also identified other changes to allow RBL to collect and store consumable item data, and to produce a transaction that sets the stock levels in SBSS for the bases, and in D035K for the depots.

We evaluated our recommendations and showed that they would produce 26% fewer backorders than the current level setting process. Because the D200A requirement is usually greater than the current worldwide stock levels, the levels generated by RBL will provide more support than the levels computed by SBSS and D035K. Additional benefits from using RBL to set levels are: 1) it coordinates the requirements determination (D200A) and the level setting processes and 2) RBL can identify problem parts for Item Managers (IMs) to improve the D200A requirement. These changes were briefed to the Air Force Materiel Management Board and approved for implementation. AFMC/XPS will work with AFMC/LGI in 2004 to implement the changes.

Figure 2.9. AF Managed Consumable vs Reparable MICAP Hours



AA Focus… Balancing MSD vs. Depot GSD Funds within AFMC

AFMC/LGI worked closely with AFMC/XPS in developing a methodology to create a direct link between the depot funding for repair—that is predicated on AATs—and the funding for bits 'n pieces at depots, which is historically based on prior year sales and unit cost ratios. Preliminary meetings were used as brainstorming sessions, wherein logisticians and analysts charted a process and identified the needed data sources to implement their methodology. AFMC/LGI and XPS worked with the Materiel Systems Group, AFMC/LGP, and AFMC/FMR and acquired the needed data to develop and implement the proposed model. Using an iterative approach to model development and validation, AFMC/LGI and XPS then formally briefed the AFMC/LG in Dec 03 of the model results.

GFM→CFM for Contractors… Reducing Risk, Inventory, Cost

In Apr 03, the Contract Depot Maintenance (CDM) IPT met to begin identifying the implications making contractors procure all materiel required to support the repair of an end item. Represented in this early meeting were SAF/FMB, AFMC/LGP/LGI/FMR,PKL. This initial cadre discussed the implications of transitioning requirements from GFM to CFM, and began to identify major issues that would have to be resolved before implementing a new policy. In subsequent modeling IPTs, weekly Executive Steering Group (ESGs) meetings, etc—a host of organizations were brought in, as needed, to assist in defining the criteria, processes, and implications of transitioning contracts from GFM to CFM. Those organizations included during this process re-engineering effort ranged from the ALCs to DFAS—if an organization could be affected by this transition, it was invited to participate. Initially, the IPT sought to disallow all GFM—which would have driven the contract repair sources to procure all materiel they required to overhaul or repair our aircraft, engines, and commodities. However, a business case analysis demonstrated the government saves money by issuing reparable assets to the contractor—vs having the contractors buy new end items, components, etc. that we could otherwise repair. In Jul 02, AFMC/LG and the team reached consensus that DLA-managed consumable items would no longer be authorized as GFM to contractors (unless waiver authority had been granted by AFMC/LG for those contracts warranting special dispensation, i.e., Department of State agreements with foreign countries), and that reparable items could be provided as GFM when beneficial to the government. On 08 Sep 03, a HQ AFMC/LG policy letter was forwarded to each of the ALCs, and they have since begun transitioning or modifying contracts to comply with the policy.

2.4. IDENTIFY SIGNIFICANT CHALLENGES ENCOUNTERED, THE PROCESS FOR RESOLUTION, AND THE SOLUTIONS. IDENTIFY ANY BEST PRACTICES EMPLOYED OR DEVELOPED. – (10 PTS)

Continuing the use of COLT at the AF Depots

There were four significant challenges faced during the initial development and implementation of COLT in FY01/02. The first involved convincing senior leaders to make this transformational change with the risks to their operational environment. The next two challenges dealt with paradigm shifts in the supply community and the fourth involved a financial practice that was not accurately captured in the first version of the model. In all four cases, the process for resolution was to analyze the scenarios, understand the implications, and educate users on the results of the analysis.

First, it was very difficult to educate and convince senior leaders at the ALCs on the projected benefits of using COLT versus their perceived risks. Admittedly, this new software would completely reshape their stock levels within a day—as many as 40,000 level changes per ALC. With such drastic changes, the

ALCs had great concerns that the supply processes for which they were responsible would be severely degraded—overnight.

Senior leaders were rightfully apprehensive. After site visits and briefings to senior leaders at the ALCs, numerous actions by IPT members, and the support of HQ AFMC's Deputy Director for Supply Management, COLT was finally implemented at OO-ALC in August 2001. Then, after initial results met expectations, the other two ALCs came on line in the next two months.

The second challenge faced during the development of COLT was the shift to setting stock levels as a function of the available funding. In the past, levels were set independent of the annual budget and as a result stock replenishment was typically suppressed towards the end of the fiscal year – indicating that the majority of the funding had been expensed. With COLT, instead of running out of money towards the end of the year, the model will actually reduce some stock levels, earlier in the year, to stay within the budget – reducing the amount of money spent on stock replenishment. The analysis showed that CWT would be significantly reduced despite this lowering of stock levels on some items. This new practice also ensured that money needed to cover work stoppage backorders in the closing months was not spent on replenishment earlier in the year.

The third challenge was a shift in the primary supply performance metric to CWT, away from issue effectiveness IE and SE. This was a significant step forward in driving improved support to customers. IE and SE gave supply a great feel for the percentage of the time that they had the parts on the shelf that their customers were asking for, but did not account for the amount of time those same customers had to wait when the parts went to backorder. The specific goal of COLT was to minimize the total CWT, without regard for the number of immediate issues. The thinking behind this push is that the customer cannot complete a repair action until all needed consumable parts have been received. CWT gives a much better feel for customer support. The first key IPT action was to define how we would measure the merit of proposed stockage strategies. Issue and stockage effectiveness have been the standard, but we have introduced a new measure to this environment…customer wait time. CWT is the average amount of time that depot maintenance has to wait for a part from depot supply. The equation below shows what this means in a mathematical equation. Simply stated, CWT accounts for the percentage of time that supply has the requested part (IE) as well as a separate factor that accounts for how long maintenance has to wait for the item once supply stocks-out.

- CWT = [IE * 0] + [(1 – IE) * (Time on Backorder)]

CWT accounts for the percentage of the time that depot supply has the part on the shelf (IE) and the fact that there is essentially "zero" delay in these cases—and then the percentage of the time that depot supply has to backorder the part times how long, on average, it takes to satisfy the requisition. While IE is a partial metric, CWT tells the complete story. Finally, we measured the financial implications of each proposed stockage strategies—the UCR. The UCR is a fiscal constraint imposed upon the ALCs to prevent them from buying too much slow moving stock.

Lastly, about halfway through the first year of implementation, the GSD, which pays for the consumable assets described in this paper, was in a very poor cash position. There were a number of independent actions that contributed to that position, one of which was a business rule contained within COLT. Specifically, the model originally governed the stock levels using the UCR alone – UCR is simply the ratio of sales versus obligations (with consideration for credit returns), but does not show when the "overall" authorized obligation total is reached. Throughout this particular year (which was somewhat of an anomaly due to OPERATION ENDURING FREEDOM), ALCs were surging and sales were increasing every month over the rate that were expected to come in – the demand rates for parts were going up. Each time COLT ran it saw that additional sales were coming in and that additional obligation authority would be available as a result. In essence, COLT was trying to get ahead of these increasing sales so that customer support wouldn't be negatively impacted. All of this was happening within the prescribed UCR that was set by the users of the model. In practice, however, it was discovered that additional obligation authority (OA) does not automatically increase as sales themselves increase. In fact, additional OA in the year of execution must be requested and approved, so the business rule of only tracking the UCR was faulty. This error led COLT to spend more money earlier in the year than it should have. However, in the end, additional obligation authority was approved to cover the increased depot activity in support of the war on terrorism. Subsequently, the new UCR was correctly achieved by the model at the end of the fiscal year. Additionally, a new constraint was added to the model to prevent this situation from recurring.

The development and implementation of COLT certainly did not go without issue, but in the end a very valuable tool has been adopted that is making great leaps toward reducing the wait times for consumable spare parts.

Application of COLT to the Retail Echelon of the Supply Chain

There were four significant challenges we faced with implementing COLT at base level supply during 2003:

1. The first was that COLT was developed by AFMC, which has no responsibility for setting stock levels at other MAJCOM's bases. Unlike the MSD, where AFMC owns the stock in base supply worldwide (via the MSD), stock in base supply for DLA-managed parts are owned by the MAJCOM (via the GSD). The other MAJCOMs were hesitant to rely on AFMC to decide how they should spend their GSD dollars to buy parts from DLA.

   We resolved this issue by including the other MAJCOMs on our IPT which was chartered with identifying base-unique characteristics that COLT needed to account for. We also included the AFLMA, who are recognized as the base-level supply experts by all the MAJCOMs. We worked as an IPT to identify the specific issues, to conduct the analysis to evaluate the issues, and to develop solutions for the issues. So all MAJCOMs were part of the process and they bought-in to the process for applying COLT at base level. The proposed solutions were eventually presented to an AF-wide board (AF Stockage Policy Working Group) to be approved, which they ultimately were.
2. The second challenge was we had to overcome some early misunderstandings about the way that COLT recognizes funding constraints when setting stock levels. COLT can set stock levels based on the availability of spares dollars, or it can set stock levels to attain a target performance objective (customer wait time). Initially, the other MAJCOMs wanted to limit COLT to the available spares dollars. However, the incremental nature with which GSD spares funding is allocated drove COLT to set stock levels that were extremely low. It quickly became apparent that this was not a viable alternative for implementing COLT. Working with the IPT, we refocused the COLT implementation to focus on targeting a performance objective. This alternative was presented to an AF-wide board (AFSPWG) who approved it as the logical approach to implementing COLT at base level.
3. The third challenge was the different environment that exists at base level than exists at the depots. Depot maintenance is a large scale industrial activity, which consumes roughly $750M in spares every year. By contrast, the two bases we used to eventually implement COLT only consume roughly $40M in spares every year. The more sporadic nature of the spares consumption can make forecasting spares needs more difficult at the bases. Working with the IPT, we decided to have COLT rely on the same forecasting technique that was implemented in the legacy system for setting stock levels. This approach recognizes each supply accounts

individual consumption history to forecast demands. The IPT presented this option to the AFSPWG who also approved it for COLT implementation at the bases.

4. The final challenge, and maybe the most important, was that spares availability at a base is a much bigger driver to readiness than spares availability at a depot. Not having spare parts to complete the repairs of assemblies at the depots may not drive any readiness impact if there are sufficient assemblies in the supply chain to buffer the delays. But not having spare parts at the base level can drive an immediate readiness impact if that part is needed for an aircraft to fly a mission. The other side to this issue, however, is that improvements to parts support at base level will have a more direct impact on warfighter support than improvements to part support at the depot. The IPT evaluated the COLT logic to identify specific changes needed to accommodate the more direct impact to warfighter readiness. After numerous studies, we decided to bias the COLT logic to give larger stock levels to parts that are more likely to ground a weapon system. The legacy system has a code used to identify these items. The IPT presented analysis showing that overall customer wait time would not be as good with this sort of bias, but the customer wait time on the parts that drive readiness would be improved. Again, this recommendation was presented to the AFSPWG who approved it for implementation in COLT.

Working with DLA…Developing Supply Chain Solutions

The biggest obstacle faced in this analysis was the ability to quantify the relationship between wholesale supply support and weapon system support. As a wholesaler, DLA is concerned with responding to requisitions from other supply activities. Some requisitions could be for shelf stock, which won't impact weapon system support for some period of time. Others are to satisfy existing MICAPs, which are existing holes that are grounding a weapon system. Using multi-echelon stockage theory as identified by Dr. Craig Sherbrooke et al, we showed that wholesale supply support impacts retail supply support that ultimately impacts weapon system support. By holding retail supply support constant in our mathematical model, we were able to show the impact the wholesale supply support (DLA) had on weapon system support.

Linking AF Managed Consumable Items to AATs

The biggest obstacle we had to deal with for these parts was the different inventory policy that is used for these parts. AF-managed recoverable parts are ordered by base supply locations immediately after one is issued from base supply to maintenance. But AF-managed consumables are managed differently. In order to reduce ordering costs, they are ordered in batches using an economic order quantity inventory policy. Because this policy is different than it is for AF-managed recoverable parts, we couldn't simply apply our mathematical models for predicting supply performance for these parts. So we again relied on the world-class research from the Army Material Systems Analysis Activity to solve this problem. Dr. Meyer Kotkin of AMSAA is a world-renowned expert in the field on inventory theory, and his work is documented in several papers and reports. We used a particular report that applied to our situation ("Computational Improvements in the Application of Negative Binomial Probability to Inventory Control"). That report identified the following code to be used for computing expected backorders (EBOs) in an inventory system that uses economic order quantities:

$$EBO = \frac{1}{2*EOQ}\left\{\begin{array}{l} \left[(ROP+EOQ)^{2}+ROP+EOQ\right]*NB(ROP+EOQ;r)-ROP(ROP+1)*NB(ROP;r)+ \\ \frac{rq}{p}*\frac{(r+1)q}{p}*\left[NB(ROP+EOQ-2;r+2)-NB(ROP-2;r+2)\right]+ \\ 2*\frac{rq}{p}*\left[ROP*NB(ROP-1;r+1)-(ROP+EOQ)*NB(ROP+EOQ-1;r+1)\right]+ \\ EOQ*\left[2*\frac{rq}{p}-(2*ROP+EOQ+1)\right] \end{array}\right\}$$

After struggling with understanding the terminology, we eventually coded the logic and validated it against actual logic from the Army.

AA Focus…Balancing MSD vs. Depot GSD Funds within AFMC

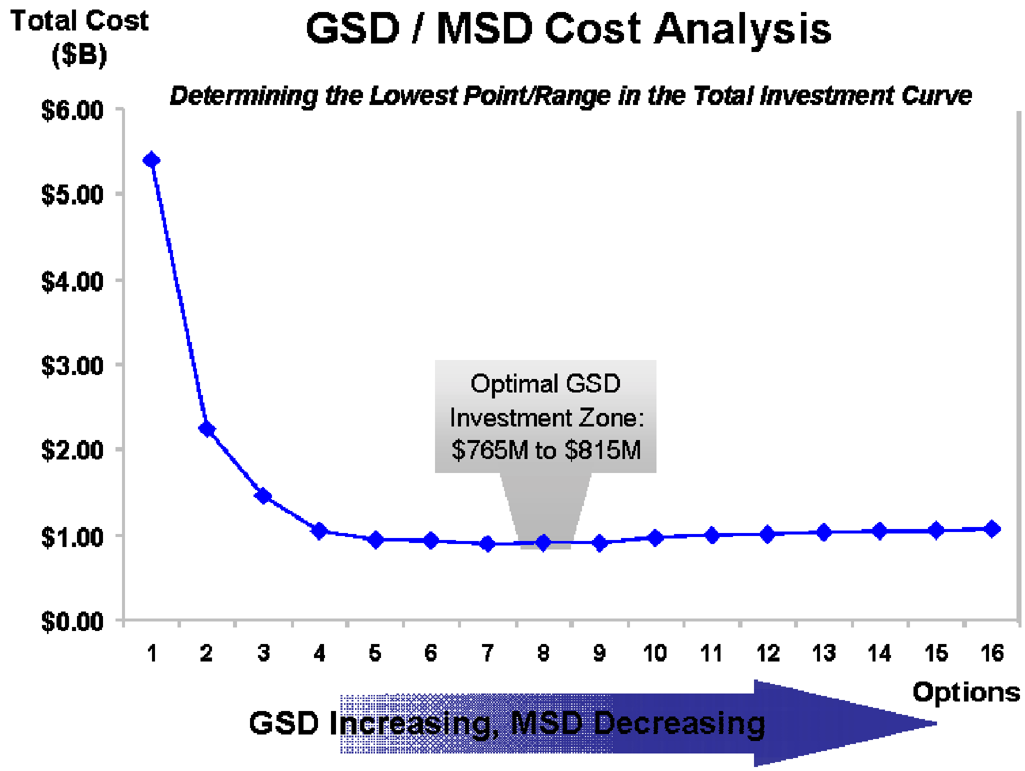
This kind of analysis has never been performed before in the USAF. It involved being able to forecast the spares performance for each part in the GSD, and then translate that support to the impact on the repair process for an assembly, and ultimately to the performance for the assembly. Each of these processes presented a challenge. To AA, a "spare is a spare", a "dollar is a dollar"—there are no artificial barriers.

To start with, we needed to develop a forecast of the spares performance for each part in the GSD. This involved acquiring the data from all three depots that identifies and describes these parts. Since there are several hundred thousands of these parts, simply acquiring and managing the data was challenging. Using relational databases and ODBC technology, we acquired the part-unique data from all three depots and combined it into a master database of depot part information. Once we had the data, we needed to be able to forecast spares performance for each of the parts. Prediction is never easy, but we relied on state-of-the-art theory developed by the Army Management Systems Analysis Activity to identify formulas for doing this prediction. Through years of research and practical application, they've validated their formulas, so we used it in our study. We developed hundreds of lines of Visual Basic code that implemented the Army theory and used it to forecast part performance (i.e., CWT).

Next, we needed to relate GSD part performance to the impact on the depot repair process. CWT identifies the expected delays for each part, but the impact on the repair process is also a function of the number of each part being demanded for each repair, and the expected delay from other parts needed to perform the same repair. We needed a bill of material to identify the material requirements for each potential assembly repair action. We relied on the G005M system to provide this information, as it is the standard source of depot-level BOM data. G005M identifies each possible type of repair action, and the parts expected to be needed during the repair. Through an intense series of database queries and programming, we extracted the data needed to determine impact on the repair process (i.e., expected delay time for spare parts).

What remained was to identify the impact that this delay had on the spares performance for the assembly. If there are unplanned delays in the repair process, there will likely be insufficient spares in the supply chain to buffer those delays, meaning maintenance demands for assemblies will go unfilled, and weapon systems will be grounded. So we needed to understand the level of spares required to be in the system to buffer the increased delays. So the trade-off becomes balancing the number of additional assemblies required to be in the system to buffer delays in the depot repair process with the number of GSD parts that can reduce the delays in the repair process. We obtained the cost figures for each alternative, and recommended the option with the lowest total supply chain cost. As reflected in Figure 2.10, that value was approximately $765M to $815M.

Figure 2.10. Optimizing the AFMC Funding Distribution Between MSD & GSD



GFM→CFM for Contractors…Reducing Risk, Inventory, Cost

At the outset of establishing this policy, AFMC/LG and the command were optimistic that an "all CFM" policy would be beneficial to the government. After all, the government would no longer be a potential bottleneck or source of variance in the contractor's repair or overhaul of aircraft, engines or commodities. However, the first significant challenge lay in determining if the policy was truly "cost neutral"—ie, would not result in additional expenditures to the government for the procurement of the same service. Even more enticing—perhaps an analysis would reveal the policy would reduce costs.

To determine the effect of such a policy, data had to pulled from either a contract or production management system, and then priced against appropriate cost indices to determine the impact of the policy. Much like the effort to balance MSD vs GSD, this effort required the team to collect several hundred thousand records to perform the analysis. Again, simply acquiring and managing the data was challenging. Using relational databases and ODBC technology, we acquired the item-unique data from both a financial system (Keystone) and a production system (G009)—and combined it into a master database of contract asset information.

Next, we used an FY03 price file to price the transactions from each of the systems, using Standard and Exchange prices to determine the effect of an all GFM policy. This was done solely with the exchangeable items—those items that the AF has already determined are economical to repair. Using the data from the two different systems allowed us to have a "check and balance" in the costing process, thus mitigating the probability of having data irregularities that would otherwise have skewed the results of the analysis. The following table displays the summary results of this effort:

Figure 2.11. Impact of an "all CFM" Policy...Exchangeable Items

Data Source	ERRC	Std	Exch	▲ Std – Exch
G009	T	$436.2	$153.7	$282.5
Keystone	T	$432.0	$163.4	$268.6

As the table illustrates, the effect of an "all CFM" policy would result in a significant potential cost increase to the government of approximately $270M -$280M per FY. More importantly, further analysis revealed more than half of this increase would be passed directly to the MAJCOM customers—without having let them budget for the increases in advance. Once the effect of an "all CFM" policy had been analyzed and presented to management for review, the major obstacle was to determine the effect of a policy that mandated we would no longer issue consumable GFM to the contractor.

Relative to the pricing dynamics for exchangeable items, the pricing dynamics for consumable items is constant—regardless of whether the government purchases consumables and provides them to the contractor, or if the contractor purchases consumables themselves, the price is the same—the team did not need to do the same extensive pricing analysis to determine the effect of a consumable GFM→ CFM policy. Rather, the team focused on the procedural and policy aspects of the new process—ie, would contractors be able to use the DLA E-Mall to purchase consumables themselves, and would controls need to be put in place to regulate the materiel that was purchased? In addition, the team had to identify the likely exceptions to the new policy and commence requesting waivers so that support to contractors would not be degraded. The process for resolution was generally founded on a) performing thorough analysis, b) modeling possible courses of action as an IPT, for each process constraint, and c) developing and implementing solutions as a team while continually striving to achieve management objectives. For this initiative, the solution was a new policy that will result in $386M in DLA-managed consumable GFM no longer being issued to contractors, and the probable reduction in contract costs of 3% to MAJCOM customers—truly a win-win situation for both the Warfighter and the supply chain.

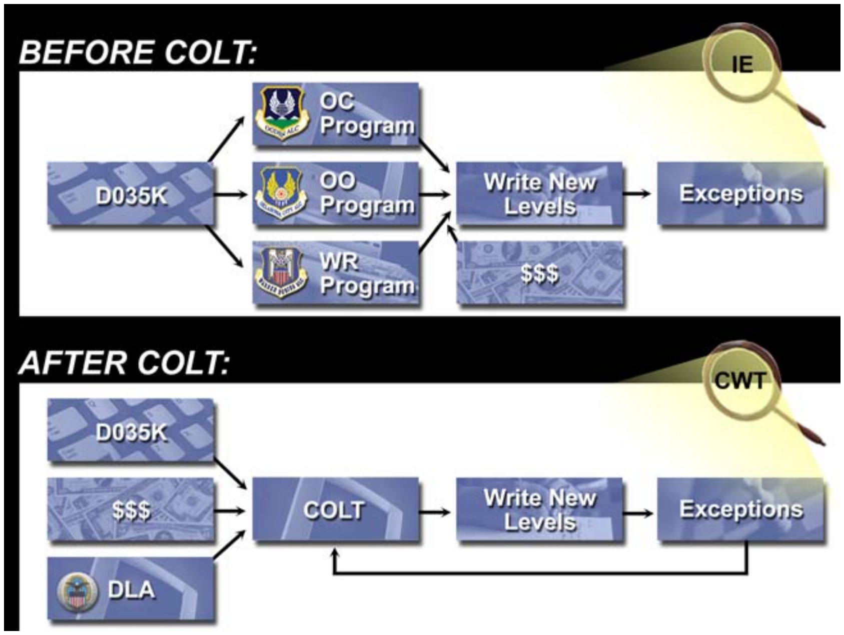
Best Practices—Employed or Developed

Optimizing Performance within Fiscal Constraints

Prior to the implementation of COLT, leveling algorithms took into account the price and average demand of an item over time. COLT looks at the same factors, but also looks at the variability of the demand pattern—and the mean and variability of the expected DLA pipeline time. In addition to using information about the DLA pipeline, COLT also looks at item individually as opposed to in groups—these differences set this new methodology apart from traditional stock leveling algorithms. As illustrated in Figure 2.12 on the following page, while keeping within fiscal constraints, COLT minimizes the total expected CWT for a given cost by using a marginal analytic approach to pass out available dollars. It does this by taking each dollar that it has to allocate and looking across all of the items in the population to determine the one item that gives us the largest bang for the buck in terms of CWT reduction. In short, there are three reasons why COLT performs better than traditional stock leveling strategies:

1. COLT considers items individually rather than in groups, but still acknowledges that one-size doesn't fit-all
2. Accounts for DLA expected performance
3. Targets CWT as opposed to other internal supply metrics (IE/SE)

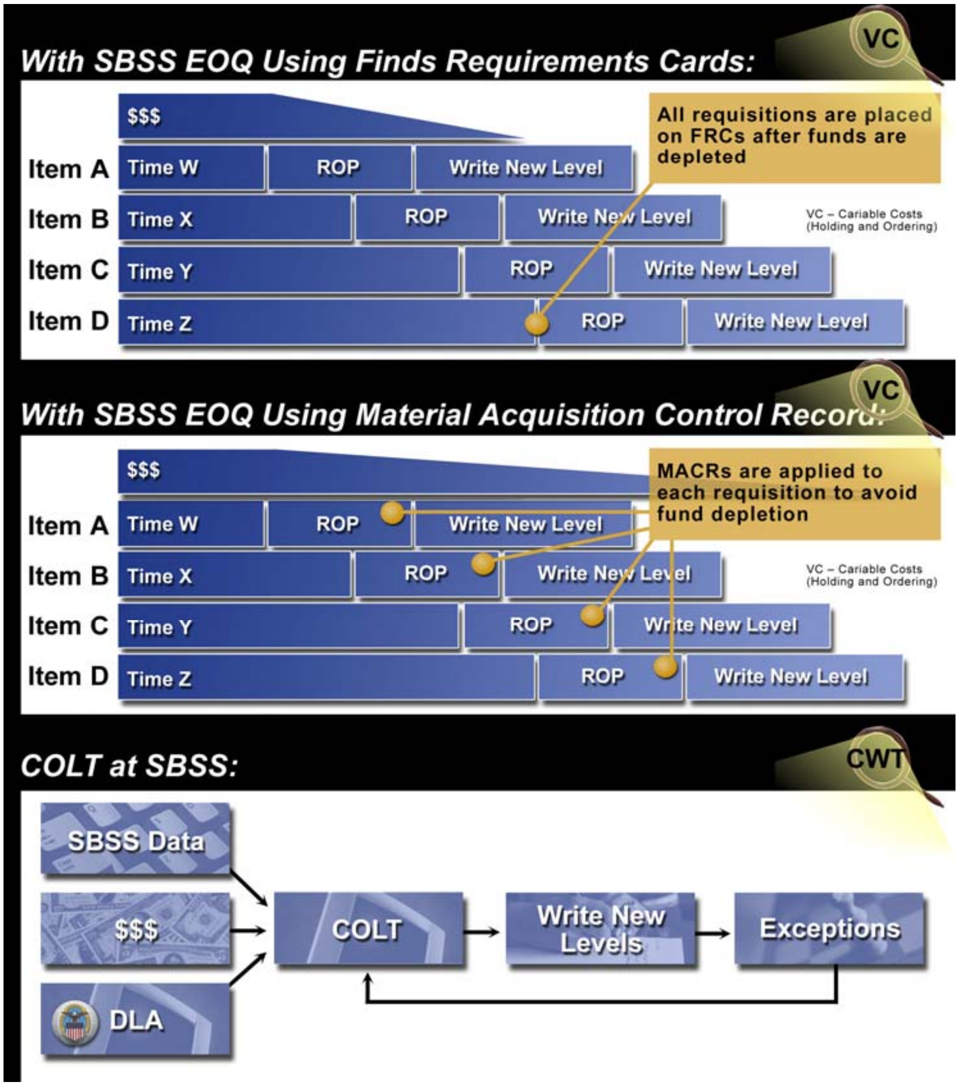
Figure 2.12. "Before" & "After" COLT



This approach to level-setting reaped significant results when implemented at the AF depots. Similarities in the base level process suggested similar results could be reaped in the retail echelon of the supply chain. As Figure 2.13 illustrates, the EOQ model that is used at base level is designed to optimize variable costs (VC)—and assumes that funding is not a limitation. As such, as individual items reach their reorder points (ROPs), the EOQ model uses the most current information it has at that point to determine an optimal order quantity to minimize expected annual variable costs. The model will continue to compute unconstrained order quantities, even after funds have been exhausted. As such, retail stock controllers have two options. As depicted in Figure 2.13, one option is to let the funds run out—and then to have subsequent orders placed in abeyance until funds are available—these are commonly referred to as Funds Requirement Cards, or "FRCs". Note that this process does not reduce the size of the EOQ, but rather, simply places orders aside until funds are made available. Alternatively, the retail stock controller may monitor the expenditure of funds, and at some point, may choose to reduce the size of the orders as a means of reducing the obligation rate. Through the use of Materiel Acquisition Cost Records, or MACRs, the retail stock controller can automate the application of percentages to orders—again, this does reduce the size of the EOQ that is calculated, but rather reduces the size of the order that is placed. In each of these methodologies, the EOQ is unrestricted, does not consider the marginal gain each consumable item contributes to AA, and fails to optimize limited funds.

Conversely, as Figure 2.13 illustrates, applying the COLT model to retail consumable items affords them the same benefit the depot level consumables reaped during COLT implementation. Levels are set with the expressed objective function of optimizing available funding. The CWT of each item is weighted against that of the population to produce a mix of levels that are designed to minimize the total CWT of the population. Most importantly, levels are established with the benefit of DLA performance and availability data, thereby increasing the probability that levels will be optimized to achieve performance objectives.

Figure 2.13. EOQ Compared to COLT at the SBSS



Process Improvements

In the process of developing COLT, there were four major outgrowths—each of which represented significant process improvements. First, COLT allowed financial planners and logistics alike to calculate the investment required to reach a CWT target. This information facilitated the development of budgets that were based on objective performance targets—rather than historical expenditure rates. Second, COLT allowed HQ AFMC to determine the optimum budget allocation amongst the ALCs—subject to achieving optimum system performance, vs. distributing funds based on historical consumption. Third, COLT represented a new methodology for developing, computing and distributing levels. Using common software, a common PC, and existing file transfer capabilities, the IPT was able to develop, institute, analyze, and refine an entirely new method of computing and updating stock levels—a process normally measured in months vs. years by existing software/system development standards. Last, the analysis capabilities that emanated from the development of COLT provided unprecedented insight for financial, program, and logistics managers. "What if" analyses for CWT or UCR now offer insight into item-level data to address DLA support issues or substantiate funding needs to the Air Staff.

2.5. INDICATE THE METRICS USED TO MEASURE PROGRESS AND SUCCESS. – (5 PTS)

Metrics Used to Measure Progress and Success

There were three key metrics that the teams focused on throughout all the phases of this effort – MICAP hours, CWT, and UCR. MICAP hours accrue against a part when the lack of a serviceable part causes a major end item to be unable to perform it's mission. CWT measures operational performance, while UCR measures financial performance. CWT was defined as the amount of time from customer request until the time that the part was available for issue in the retail supply system. Both MICAP hours and CWT are representations of perfect order fulfillment SCOR metrics.

UCR actually served as more of a constraint metric than a performance metric in that it served as the "throttle", limiting the amount of money that COLT could spend. Each time the model was run, the objective function was to minimize CWT while simultaneously ensuring that the user-defined UCR was met by the end of the fiscal year. UCR is a representation of the supply chain cost SCOR metric.

In tandem, these metrics ensured operational performance was optimized within stated cost parameters.

2.6. DOCUMENT AND QUANTIFY COST AND PERFORMANCE BENEFITS, INCLUDING THE PROJECTS RETURN ON INVESTMENT AND CHANGES IN THE VALUE OF ONE OR MORE OF THE SCOR LEVEL 1 METRICS (NOT ALL METRICS MUST BE CAPTURED OR REPORTED) – (15 PTS)

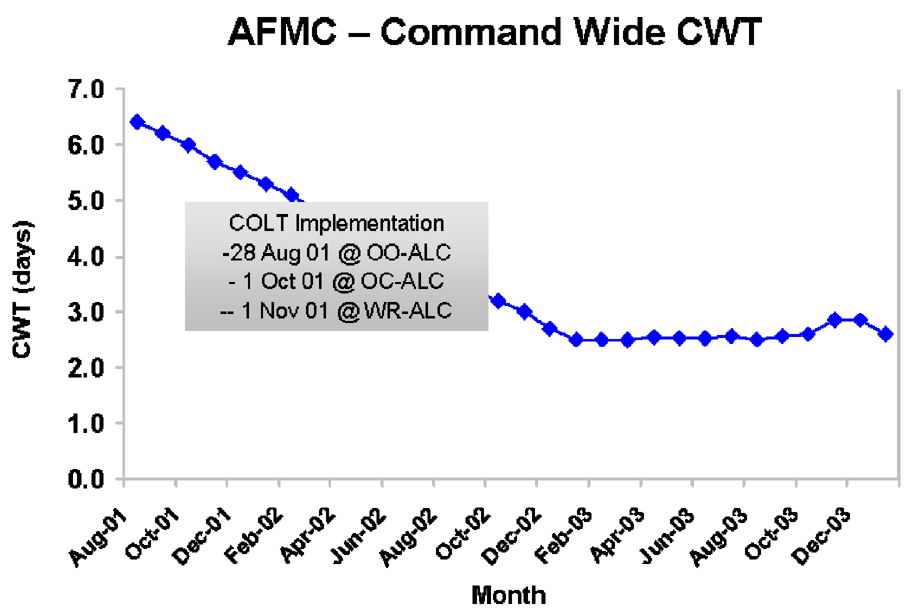
Cost and Performance Benefits

Continuing the use of COLT at the AF Depots

First and foremost, there was no inventory augmentation cost associated with the implementation of COLT at the AF depots. By definition, all inventory shifts were accomplished by operating within the set UCR. So inventory costs were the same during 2003 that they were during previous years.

The sharp improvements in performance realized in previous years were maintained during 2003. This is reflected in the following chart that depicts CWT, a measure of perfect order fulfillment:

Figure 2.14. Effect of COLT on CWT



The CWT was 2.5 days as of the beginning of Jan 03 and it was 2.6 days as of the beginning of Jan 04. These results clearly indicate that inventory has been optimized with the stable level of funding that has been provided to attain a CWT of 2.5 to 2.6 days. The impressive 66% reduction since the initiation of COLT at the depots has been maintained, despite the uncertainty in requirements brought about by Air Force contingency operations throughout the world.

The return on investment for this effort is difficult to quantify, but for the purpose of this write-up, an estimate has been provided. All work performed on this initiative was accomplished by organic government resources (military and civilian). During, 2003, we estimate 500 man hours were invested in the sustainment of the tool. Although it is a sunk cost, these hours translate to an invested $25,000 in wages. There were no additional costs incurred in 2003 that would not have been otherwise spent on the supporting the previous stock leveling approach, making the total investment $25,000.

Had we not sustained COLT at the depots during 2003 and reverted to the previous methodology for setting stock levels, the performance chart shows that we'd expect an additional 5 days of CWT. These additional 5 days of spares delays would need to be compensated for in other areas of the supply chain to maintain support to the warfighter. From previous studies, we've shown that the Air Force would need to invest from $10M to $35M in spare parts for more expensive MSD assemblies for every 1 day of additional depot repair time in repairing those assemblies to maintain support. Using the more conservative $10M figure, by maintaining COLT during 2003 we avoided spending $50M in inventory in more expensive assemblies. That equates to an ROI of 2000 to 1.

Application of COLT to the Retail Echelon of the Supply Chain

The first implementation of COLT at the base level didn't occur until Oct 03, so there was very little time remaining in 2003 to see much of a performance impact. However, the initial results from Seymour-Johnson AFB are very positive, as depicted below:

Figure 2.15. COLT Implementation Reduces MICAP Hours at Bases

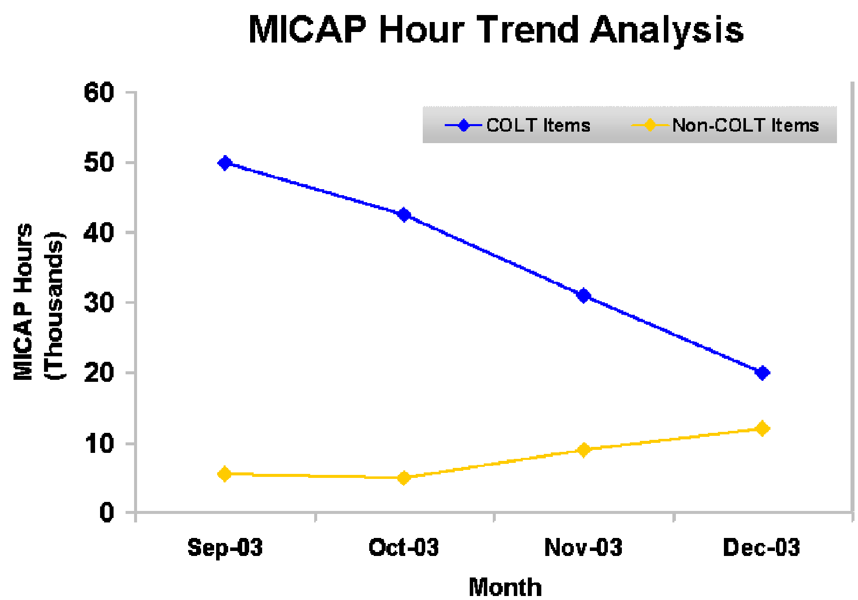
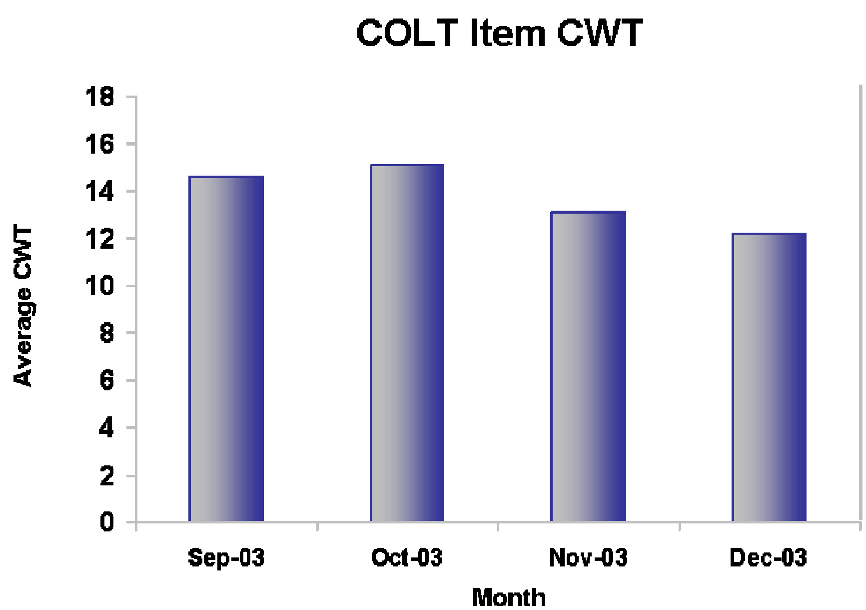


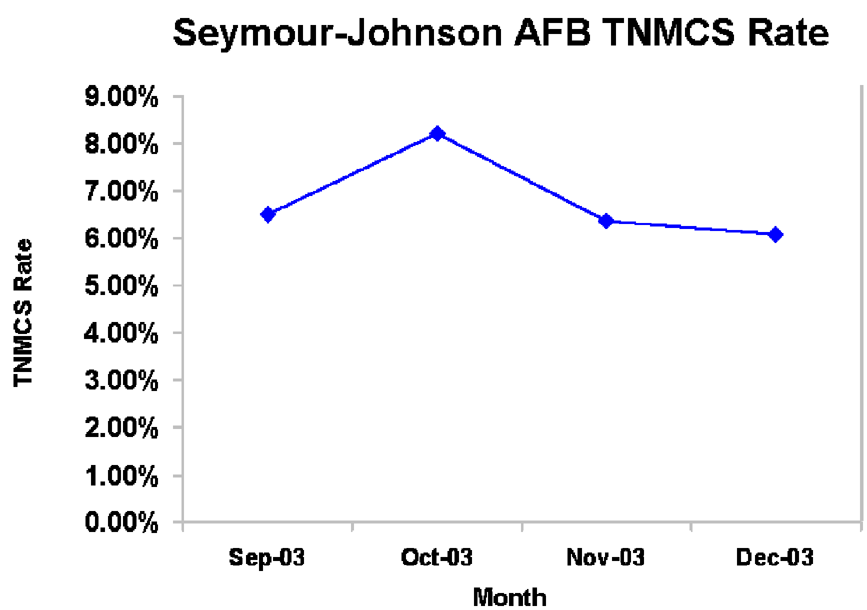
Figure 2.16. COLT Reduces CWT at Bases



Summarizing these charts, **MICAP hours have decreased 53% and CWT has decreased 21%** from the start of the COLT implementation until the beginning of Dec 03. To show the importance of these figures, we also looked at the Total Not Mission Capable Supply (TNMCS) rate at Seymour-Johnson.

This measures the percent of the time that the planes at a base are not able to fly due to the lack of a spare part. This is the ultimate measure of the AF supply system.

Figure 2.17. COLT Reduces TNMCS Rate at Bases



Because TNMCS is a measure of the total spares support, including many spare parts that are not being influenced by COLT, it is not a direct measure of the performance of just COLT. But the 26% improvement in the TNMCS rate, taken in combination with the improvements in MICAP hours and CWT, suggest that COLT is likely a contributing factor to this ultimate measure of warfighter supply chain support.

As for the ROI, all work performed on this initiative was accomplished by organic government resources (military and civilian). During, 2003, we estimate 1000 man hours were invested in the development, testing, and fielding of the tool. Although it is a sunk cost, these hours translate to an invested $50,000 in wages. There were minor additional TDY costs that we estimate at roughly $10,000, making the total investment $60,000.

Had we not implemented COLT at the Seymour-Johnson during 2003 and reverted to the previous methodology for setting stock levels, the CWT chart shows that we'd expect an additional 3 days of CWT. These additional 3 days of spares delays would need to be compensated for in other areas of the supply chain to maintain support to the warfighter. From work on previous studies, we can estimate that the Air Force would need to invest from $0.5M to $1M in spare parts for more expensive MSD assemblies for every 1 day of additional base repair time in repairing those assemblies to maintain support at a base. Using the more conservative $0.5M figure, the AF avoided spending $1.5M in inventory in more expensive assemblies. ***That equates to an ROI of 25 to 1.*** Please note that the investment in resources was focused on developing an AF-wide solution. As we export COLT to other bases, the investment will stay relatively stable, but the return will grow with each implementation. When many or all bases are running COLT, the next step will be to run the model across all of them to produce an optimum AF solution.

Working with DLA…Developing Supply Chain Solutions

The primary metric we used, and are using, to evaluate the effectiveness of alternative DLA support is MICAP hours. Because we haven't implemented any of the alternatives to date, the only metrics we have are projections. But we accurately projected the level of improvement that COLT eventually achieved at the depots, and the actual measures of performance at the bases are approaching our projections.

We projected MICAP hours for DLA parts would decrease by 46% if DLA were to implement their proposal. But this is an aggregate measure, so we wanted to see how it would apply to individual weapon systems. We also wanted to see if the benefits the AF would receive are greater (per dollar spent) with this approach than the benefits (per dollar spent) that we currently get from buying AF-managed parts. We computed these availability improvement ratios and showed that they were larger for all AF weapon systems than the improvement ratios we currently get from AF-managed parts.

There are no actual ROIs to report yet from this initiative, but the potential is impressive. We have shown that by investing the same amount of money in DLA parts and AF parts, we achieve 4200 fewer grounding incidents with the DLA parts and only 900 fewer grounding incidents with the AF parts. So our projected ROI is almost 5 to 1.

Linking AF Managed Consumable Items to AATs

Again, our primary metric here was MICAP hours. We showed that by making the spares requirements computation readiness-based, and by setting stock levels in a comparable manner, we would expect a 25% reduction in MICAP hours for these parts with no increase in cost. These changes have yet to be fielded, but they are approved by AFMC/LG and being developed and tested for D200A by AF system developers.

As for the ROI, there is no investment in spares required, so the only cost will be the organic manpower cost to do the analysis and define the specific system changes. These costs are likely to not exceed $50,000. To achieve the same readiness benefits without making these changes for these parts, the AF would have to spend $2M in buying additional parts. That equates to an ROI of 40 to 1.

AA Focus…Balancing MSD vs Depot GSD Funds within AFMC

This initiative was prototyped in 2003, and it suggested that the GSD/MDS funding allocation was already optimized. We held supply chain performance constant in this effort, and focused on minimizing costs to attain the same level of performance. As depicted earlier in this document, based on the D200 statement of requirement at the outset of FY04 (Oct 03), total MSD and GSD costs are minimized if the GSD funding allocation (to the ALCs to support depot maintenance) is in the range of $765M to $815M. The actual GSD allocation was approximately $800M (annualized for the year), so the funding was determined to be optimized.

There is no ROI to report, yet, on this initiative. But we expect there will be opportunities to balance support across these two stock funds. We've shown in previous sections how relatively small investments in GSD parts can have huge returns, so we expect that will be the case over time.

GFM→CFM for Contractors…Reducing Risk, Inventory, Cost

The policy letter for this initiative was sent to the ALCs during Sep 03. Since then, the ALCs have begun transitioning contracts that were formerly GFM to CFM. The real benefits of this initiative will be witnessed during the next two years, as GFM contracts are attrited from the CDMAG, as GFM inventories shrink, and as MAJCOMs begin to reap the benefit of the anticipated 3% reduction in the applicable contracts.

Changes in the Value of One or More SCOR Metrics

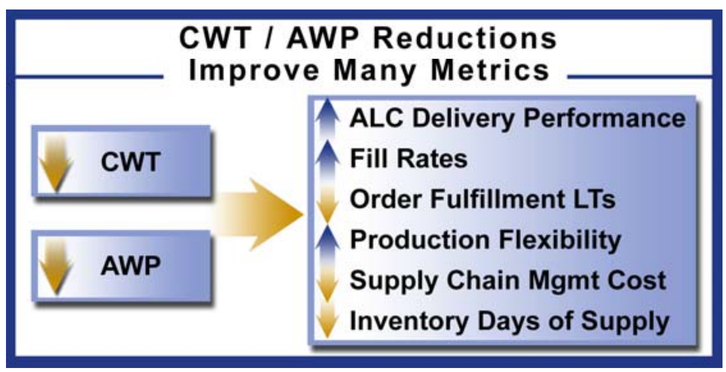
As reflected in the figure on the next page, reducing the CWT for bits n' pieces drove reductions in the number of incidents that maintenance personnel had to wait for bits n' pieces to repair major end items. This corollary reduction has several benefits. For example, this lessens the number of times PDM would have to re-sequence job orders or production tasks, thereby reducing management overhead expenses. Lessening the number of instances that a critical repair is "put on hold" increases ALC delivery performance, and also reduces the order fulfillment lead time. With less idle work-in-process, customer levels for items decline as they reduce the amount of production variability they have to guard against—thus reducing inventory days of supply. Furthermore, the ALCs experience greater production flexibility, as the likelihood of having needed bits n' pieces to perform a repair increases. Last, maintenance personnel in the field see less need for cannibalizations, as availability rates climb and lead times shrink.

The same tenets hold true for base maintenance. Reducing their CWTs inherently promotes production flexibility and reduces idle work in process. Furthermore, as COLT has demonstrated, reshaping the inventory actually increases inventory turns, as smaller levels are placed on those items with inherently smaller DLA leadtimes.

Balancing MSD vs. GSD inputs—though initially only being done at the depots—increases the likelihood that the optimal amount of funds will be placed in both the depot repair fund—and the bits 'n pieces needed for those repairs, to optimize the probabilities of producing the right parts, at the right time, to be distributed to the right locations, in the right quantities—to maximize each locations probability of achieving the AATs that are set forth by Air Staff.

These efforts are only enhanced when DLA is engaged to collaborate in the development of enterprise solutions. Their contribution to AA cannot be undervalued or understated—it is huge. As demonstrated throughout this document, optimizing the management of consumable items—whether they're managed by DLA or the AF—offers the greatest potential to benefit the entire supply chain through the reduction of CWT and AWPs—and ultimately, MICAPs.

Figure 2.18. CWT/AWP Reductions Drive Improvements Across the Supply Chain



2.7. OUTLINE HOW THE SUCCESS OF THIS EFFORT SUPPORTS THE ORGANIZATIONAL OBJECTIVES DESCRIBED IN SECTION 1, ITEM 3 – (15 PTS)

Implementing COLT at the Depots and Bases Supports Organizational Objectives

Having the right spare parts available when maintenance needs them is integral to the success of any maintenance activity. Lack of these parts causes work stoppages in the repair operation and places increased labor requirements on expediting the procurement of the part. In the final analysis, not having a bit n' piece at the right place, at the right time—has an adverse impact on aircraft availability and impacts the readiness of the major commands. Prior to COLT, the primary influence on the setting of stock levels for the DLA-managed consumable bits and pieces was the historical demand experience for the item. The process of allocating available dollars to stock these items was primarily manual, and very labor intensive. COLT brought several new innovations to this process. In the first analysis, it used an automated state-of-the-art modeling process to allocate dollars to items with the highest potential for return on investment. Secondly, it measured the propensity for DLA to deliver the material by considering their stockage capability. Lastly, it controlled the expenditure of GSD monies to ensure that end of year unit cost ratio would be met and obligation authority would not be exceeded. The end result of the application of COLT can be seen in the dramatic impact it has had on the time our maintenance customers have to wait for their material, and the decrease in instances of repair actions experiencing parts shortages.

In addition, there are several other positive effects:

1. MSD pipeline reduction. Although this effect has not yet been directly measured, because there are many factors which impact it, when repair cycle times are reduced for producing Material Support Division (MSD) components, the overall MSD pipeline requirement will be reduced. Currently, the estimated value, per day, of the MSD pipeline requirement is over $50M.
2. No legacy system modification. Legacy systems, such as D035K, are extremely expensive to modify via Computer System Requirements Documents (CSRDs). Even minor changes, e.g. adding "cause codes" for back orders, cost around $100,000. Major changes, e.g. adding total asset visibility, can cost several million dollars. COLT did not cause any CSRDs to legacy systems.
3. Time savings for ALC supply analysts. Prior to COLT implementation, an estimated 324 man-days or nearly 2,592 man-hours per year were spent across the three ALCs performing stock level setting/validations. That time is now reinvested by those analysts in other analysis activities to further improve supply chain performance.
4. Calculating future funding. The COLT model can run in performance or budget allocation modes. In performance mode, it takes the desired performance level defined in CWT (or IE/SE, if desired) and will compute the required funding, by item, to achieve that performance. That assists budgeting, and recently has proved beneficial in computing "what if" scenarios for the cost of potential future surge operations to support war. In budget allocation mode, it takes the available funding and determines the appropriate allocation to produce the lowest overall average CWT for the command.
5. Source of supply analysis. Because COLT evaluates projected DLA performance, it is a useful tool to target problem items for the source of supply. Basically, COLT tends to set higher stock levels on items that have poorer support. Those items can then be evaluated for improvement, thus providing the framework for continuous supply chain improvement.
6. Customer synchronization. COLT identified typical maintenance order quantities and takes them into consideration when setting levels to assure that "whole" quantities are obtained to support maintenance jobs.

Working with DLA…Developing Supply Chain Solutions…Supports Organizational Objectives

DLA currently represents 58% of the MICAP hours the entire AF experiences on a daily basis. Harmonizing AF and DLA stockage, support, and distribution polices offers the greatest potential to reduce AF TNMCS rates for the least cost. As demonstrated earlier in this document, 40% of the DLA MICAP hours are for items whose unit price is less than $100. Correspondingly, 40% of the AF MICAP hours are for items whose unit price is $10,000 or less. Simply put, focusing on improving DLA support to the AF enterprise offers the greatest potential to purchase AA for "pennies on the dollar".

Linking AF Managed Consumable Items to AATs…Supports Organizational Objectives

As repeatedly demonstrated, low cost items cause a disproportionate amount of MICAP hours, relative to their unit price. This phenomenon is seen in both DLA and AF managed items. Our product is aircraft availability, and our mission is to provide the resourcing, policy, processes, and systems required to achieve the stated AATs. Targeting lost cost items that offer the greatest return on AA increases our ability to meet our objectives. As reported in this document, for less than a two million dollar investment in AF managed consumables, a system change estimated to cost $50K—the AF can expect to achieve an ROI of 40 to 1. This is truly minimizing the cost of spares required to achieve the Air Staff AATs.

AA Focus…Balancing MSD vs Depot GSD Funds within AFMC…Supports Organizational Objectives

Balancing funding inputs to achieve AA goals is consistent with AFMC/LG objectives. As AFMC/LG begins to implement more supply chain initiatives that are designed to reduce the cost to achieve AATs, developing models of this nature will assume a preeminent role. As the AF evolves beyond individual stock funds that sub-optimize their contributions to AATs, in retrospect, efforts such as this will be viewed as pioneering strikes into the frontier of enterprise supply chain management.

GFM→CFM for Contractors…Reducing Risk, Inventory, Cost…Supports Organizational Objectives

While this initiative has the least quantified potential ROI at this time, it does offer several benefits:

A. Reduced manpower to acquire, distribute and track GFM inventories

B. Eliminating the government as a contributing source of variance to contractor production

C. Potentially eliminating 3% of the contract costs applied to GFM contracts today as a consequence of providing GFM to the contractor

D. Reducing our inventory investment as a result of significantly reducing the amount of GFM that could potentially be returned to the AF from production complete contracts

All of these benefits are in concert with our objective of minimizing our investment to provide AA.

SECTION 3. KNOWLEDGE TRANSFER (10 POINTS)

3.1. DESCRIBE THE EFFORTS TO SHARE LESSONS LEARNED FROM THIS EFFORT WITH OTHER INTERNAL ORGANIZATIONS – (5 PTS)

There have been many efforts to partner with internal organizations and to share lessons learned.

First, members from the IPT have been called on to share their findings/research with the Air Force Spares Campaign as well as the Depot Maintenance Review Team. Specifically, the discussion focused on how to export the COLT concepts to other than DLA managed spare parts. The concept applied in this initiative, leveraging wholesale support data, is equally applicable to items managed by the Air Force as well as items managed by other services. Working through the implementation issues, the Air Force has begun applying COLT principles to these other consumable parts.

In addition to working with non-DLA spares, the teams have extended the discussion to brainstorm additional ways that DLA and the AF can work together to improve customer support. By linking wholesale and retail levels of support to the expected CWT, it is now possible to identify cases where changes in wholesale support would have the biggest impact on the supply chain as a whole. The goal of ours efforts is to be able to communicate with DLA the ways that they can best help AF supply help the warfighter. We continue to pursue academic tests with DLA to further explore this concept of total supply chain optimization.

In addition, we now have ways to quantify the cost required to achieve a better level of support. HQ AFMC/LGR plans to use this tool in the future to help forecast budget requirements for consumable items, and the tool as already been used by the Air Force to help develop Cost of War estimates. Now, instead of saying we need $X million to support the effort, our models allow us to say that we need $X million to support this effort otherwise performance will degrade by X% over the next fiscal year. Quantifying the impact of an under-funded requirement will go a long way in ensuring integrity of the budgeting process.

Much of the research and knowledge gained through the development and implementation of these initiatives has been passed on to the AFMC Purchasing Supply Chain Management (PSCM) team. Throughout the process of the PSCM defining the future state of supply chain management, much of the knowledge gained from these initiatives has been shared with PSCM team members. Their Balance Scorecard is a reflection of much of the efforts put forth by the teams that are represented in these initiatives. In addition, COLT was a finalist for the AF Chief of Staff Team Excellence Award (CSTEA).

3.2. EXPLAIN HOW THIS INITIATIVE CAN BE TRANSFERRED TO OTHER ORGANIZATIONS, AND SPECIFY THE LIKELY CANDIDATES FOR TRANSFERENCE – (5 PTS)

HQ AFMC has advertised the achievements of the COLT initiative, and continues to work closely with DLA, AF bases, and depots in determining where and how COLT can be applied. The concept of setting levels to minimize CWT—based on a view of the suppliers historical delivery profile and current asset position—has many applications. For instance, how might Consumable Readiness Spares Package (CRSP) requirements to support contingency operations change with this type of information? Given COLT is able to determine the level of funding required to meet a stated CWT, could COLT not also compute the GSD requirement needed to support the ALCs total repair requirement? This analysis of this latter question is already underway at HQ AFMC. In short, AFMC has already begun targeting processes to transfer this initiative. The AF bases were the first target of “transfer”, and that process is well underway. If improvements are found, then an AF-wide implementation of COLT would be the next step. HQ DLA has also expressed interest in the COLT model. Since DLA currently uses “supply availability” as their bottom line metric, COLT could prove to be an important addition to their analytic tools.

The MSD vs. GSD model represents a significant step forward in developing a supply chain funding synchronization model. Though the uniqueness of data in the model is likely to limit the candidates for transferring the model, the concept underlying the model is more appropriately a transfer candidate. Other services with organic production processes are viable candidates to review this process.

The AF effort to convert GFM contracts to CFM has already begun to have a “transfer” effect. As part of transitioning the CDMAG out of the Working Capital Fund, CDM selected the Commercial Asset Visibility II (CAV II) inventory management system as its new data system. As a new member to the DoD system that is currently managed by the Navy, the AF has already begun sharing its contract practices with the other services through the quarterly CAV II Integrated Product Reviews (IPRs). Furthermore, by establishing and funding new functional requirements within CAV II, the AF has begun to establish the foundation for enterprise contract management practices.

In short, there are plenty of candidates on the near-term horizon that stand to reap the benefits of the knowledge gained by the development and implementation of these initiatives.

SUMMARY

As evidenced by the myriad initiatives discussed in this document, enterprise management of consumable items has truly come to the forefront of supply chain solutions that offer the greatest return on our most important products-AA and readiness. In tandem, DLA and the AF manage more than 1M aviation investment items that result in consumable item sales exceeding $3.8B per year. During FY02 and FY03, DLA managed consumable items accounted for 53-58% of the total AF MICAP hours; concurrently, AF managed consumables outpaced similarly priced reparable item MICAP hours by a ratio of 2:1. In light of the enormous impact that consumable items have in the availability of weapon systems, it becomes imperative that the supply chain continually seek to optimize the polices, processes and systems that effect the level setting, funding, and distribution of these items. As illustrated in this document, current policies, processes, and systems result in relatively inexpensive consumable items contributing an inordinate amount toward the AF TNMCS rates. While 35-40% of the MICAP hours for DLA items have a unit price that is less than $100, to achieve the same percentage of MICAP hours for exchangeable MSD items-you have to resolve MICAPs for items whose unit price may be as high as $10,000.

Our initiatives continue to focus on systematically reducing MICAP hours by targeting those areas with the greatest potential return on AA for our investment. By maintaining COLT during FY03, we avoided spending $50M for exchangeable inventories-an ROI of 2000 to 1. Early COLT implementation results at Seymour Johnson AFB and Travis AFB have seen MICAP hours reduced 53% and CWT reduced 21%-with no additional inventory investment. As we export COLT to other AF bases, we anticipate our current ROI of 25 to 1 remaining relatively constant-but the return on AA will grow with each implementation. Focused on improving our support to AF managed consumable items, we've anticipated a 25% reduction in MICAP hours for these parts with no increase in cost-an anticipated ROI of 40 to 1. Our initiative to eliminate DLA managed items as GFM is projected to reduce our GFM inventories from $500M today-to approximately $90M in the next couple of years. Furthermore, we anticipate passing on the 3% reduction in contract costs for these GFM contracts to our customer, the Warfighter. Last, our initiatives to collaborate with DLA on enterprise solutions, and develop our own internal funding trade-off models, offer significant promise as we continually seek to achieve AATs at reduced costs-this remains our true focus.

The relatively inexpensive nature of consumable items, their pervasiveness in supply chain processes, and the colossal potential gains to be had in reducing TNMCS through improved enterprise consumable item supply chain solutions-all add up to increased AA for pennies on the dollar!

ACRONYMS

ACC	Air Combat Command
AETC	Air Education Training Command
AF	Air Force
ALC	Air Logistics Center
AFMC	Air Force Materiel Command
AFMMB	AF Material Management Board
AWP	Awaiting Parts
BO	Backorder
CAP	Constraints Analysis Program
COLT	Customer Oriented Leveling Technique
CRSP	Consumable Readiness Spares Package
CSRD	Computer System Requirement Document
CWT	Customer Wait Time
DoD	Department of Defense
DLA	Defense Logistics Agency
DMAG	Depot Maintenance Activity Group
EOQ	Economic Order Quantity
GSD	General Support Division
HQ	Headquarters
IE	Issue Effectiveness
IPT	Integrated Product Team
MSD	Materiel Support Division
MS	Microsoft
NMCS	Not Mission Capable Supply
OA	Obligation Authority
OC	Oklahoma City
OC-ALC	Oklahoma City Air Logistics Center
OO	Ogden
OO-ALC	Ogden Air Logistics Center
PC	Personal Computer
PDM	Programmed Depot Maintenance
SCOR	Supply Chain Operations Reference (model)
SE	Stockage Effectiveness
TNMCS	Total Not Mission Capable Supply
UCR	Unit Cost Ratio
UCT	Unit Cost Target
WARRS	Wholesale & Retail Receiving/Shipping
WR	Warner Robins
WR-ALC	Warner Robins Air Logistics Center

GLOSSARY

Customer Wait Time (CWT)	CWT accounts for same percentage and how long requesters wait for backordered parts. CWT provides an accurate representation for how well the customer is being supported and is an important link to weapon system support
Issue Effectiveness (IE)	Percentage of time supply has any part requested
Stockage effectiveness (SE)	Percentage of time supply has stocked part when requested
Unit Cost Ratio (UCR)	Equals total obligations divided by total sales

ATTACHMENT 1. FY03 MSD, GSD MICAP HOURS & INCIDENTS DATA STRATIFIED BY UNIT PRICE

Budget Code	Unit Cost of MICAP Item	Total MICAP Hours	% of Total MICAP Hrs	Running Sum
8 (MSD)	<$100	200,693	0.73%	0.73%
8 (MSD)	=>$100 & < $500	850,183	3.08%	3.81%
8 (MSD)	=>$500 & <$1,000	1,109,353	4.02%	7.83%
8 (MSD)	=>$1000 & <$2,500	2,186,111	7.92%	15.76%
8 (MSD)	=>$2500 & <$5000	2,949,108	10.69%	26.45%
8 (MSD)	>=$5,000 & <$10,000	3,935,058	14.27%	40.71%
8 (MSD)	=>$10,000 & <$25,000	4,900,870	17.77%	58.48%
8 (MSD)	=>$25,000 & <$50,000	3,606,413	13.07%	71.55%
8 (MSD)	=>$50,000 & <$100,000	2,941,512	10.66%	82.22%
8 (MSD)	=>$100,000 & <$250,000	2,446,426	8.87%	91.08%
8 (MSD)	=>$250,000 & <$500,000	1,278,443	4.63%	95.72%
8 (MSD)	=>$500,000 & <$1,000,000	411,769	1.49%	97.21%
8 (MSD)	>$1,000,000	769,130	2.79%	100.00%
		27,585,069		

Budget Code	Unit Cost of MICAP Item	Total MICAP Hours	% of Total MICAP Hrs	Running Sum
9 (DLA)	<$100	15,507,999	42.74%	42.74%
9 (DLA)	=>$100 & <$500	8,645,169	23.82%	66.56%
9 (DLA)	=>$500 & <$1,000	3,764,884	10.37%	76.93%
9 (DLA)	=>$1000 & <$2,500	4,071,275	11.22%	88.15%
9 (DLA)	=>$2500 & <$5000	2,235,704	6.16%	94.31%
9 (DLA)	>=$5,000 & <$10,000	1,205,206	3.32%	97.63%
9 (DLA)	=>$10,000 & <$25,000	663,441	1.83%	99.46%
9 (DLA)	=>$25,000 & <$50,000	117,055	0.32%	99.79%
9 (DLA)	=>$50,000 & <$100,000	47,401	0.13%	99.92%
9 (DLA)	=>$100,000 & <$250,000	21,874	0.06%	99.98%
9 (DLA)	=>$250,000 & <$500,000	5,184	0.01%	99.99%
9 (DLA)	=>$500,000 & <$1,000,000	3,467	0.01%	100.00%
9 (DLA)	>$1,000,000	59	0.00%	100.00%
		36,288,718		

Budget Code	Unit Cost of MICAP Item	Total Incidents	% of Total Incidents	Running Sum
8 (MSD)	<$100	1,031	0.80%	0.80%
8 (MSD)	=>$100 & <$500	3,015	2.33%	3.12%
8 (MSD)	=>$500 & <$1,000	4,081	3.15%	6.28%
8 (MSD)	=>$1000 & <$2,500	10,569	8.16%	14.44%
8 (MSD)	=>$2500 & <$5000	14,642	11.31%	25.75%
8 (MSD)	>=$5,000 & <$10,000	22,462	17.35%	43.09%
8 (MSD)	=>$10,000 & <$25,000	26,057	20.12%	63.21%
8 (MSD)	=>$25,000 & <$50,000	16,926	13.07%	76.29%
8 (MSD)	=>$50,000 & <$100,000	12,869	9.94%	86.22%
8 (MSD)	=>$100,000 & <$250,000	10,038	7.75%	93.98%
8 (MSD)	=>$250,000 & <$500,000	5,094	3.93%	97.91%
8 (MSD)	=>$500,000 & <$1,000,000	1,648	1.27%	99.18%
8 (MSD)	>$1,000,000	1,059	0.82%	100.00%
		129,491		

Budget Code	Unit Cost of MICAP Item	Total Incidents	% of Total Incidents	Running Sum
9 (DLA)	<$100	98,529	52.77%	52.77%
9 (DLA)	=>$100 & <$500	40,541	21.71%	74.48%
9 (DLA)	=>$500 & <$1,000	17,019	9.12%	83.60%
9 (DLA)	=>$1000 & <$2,500	16,812	9.00%	92.60%
9 (DLA)	=>$2500 & <$5000	7,451	3.99%	96.60%
9 (DLA)	>=$5,000 & <$10,000	3,960	2.12%	98.72%
9 (DLA)	=>$10,000 & <$25,000	1,908	1.02%	99.74%
9 (DLA)	=>$25,000 & <$50,000	278	0.15%	99.89%
9 (DLA)	=>$50,000 & <$100,000	114	0.06%	99.95%
9 (DLA)	=>$100,000 & <$250,000	72	0.04%	99.99%
9 (DLA)	=>$250,000 & <$500,000	17	0.01%	100.00%
9 (DLA)	=>$500,000 & <$1,000,000	7	0.00%	100.00%
9 (DLA)	>$1,000,000	1	0.00%	100.00%
		186,709		