

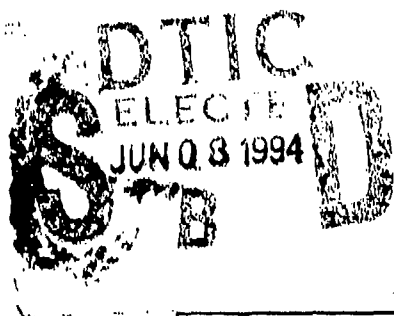
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NAVAL POSTGRADUATE SCHOOL

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THESIS

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**ANALYSIS OF IN-TRANSIT VISIBILITY
AS A METHOD OF REDUCING
MATERIAL LOST IN SHIPMENT**

by

Arthur D. Hughes

March, 1994

Principal Advisor:
Associate Advisor:

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Lieutenant, United States Navy
B.A., University of North Florida, 1983

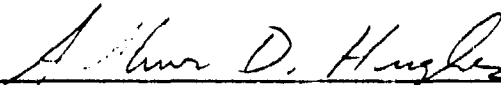
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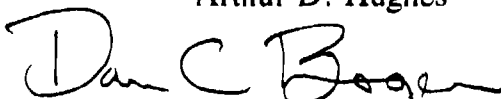
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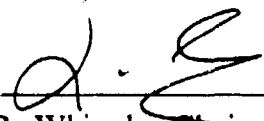
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I. INTRODUCTION

Effective transportation and accurate logistics data are vital to national security. The uninterrupted flow of material, provisions, equipment, and repair parts is absolutely necessary to support sustained forward presence and permit continued power projection.

This influence has been acknowledged at the highest levels of military planning and is articulated in current operational doctrine. The military's capstone document, National Military Strategy of the United States, for example, asserts that "extended supply lines demand the unimpeded flow of assets" [Ref 1:p.9]. Other examples include the Nation's leading document on joint warfare, JOINT PUB 1, Joint Warfare of the US Armed Forces, which states the "projection of power relies upon the mobility inherent in air, naval, and land forces, supported by the defense transportation system" [Ref 2:p.56], and the Navy's leading strategic document, From The Sea, Preparing the Naval Service for the 21st Century, which identifies logistics as "the critical element of any military operation" [Ref 3:p.9].

Effective logistics requires that material not only be transported efficiently from origin to destination, it also requires accurate and continuous tracking of the material and timely reporting of status information. Logistics systems must be able to identify the location of material in

transit and provide a close approximation of when the material should be delivered. Moreover, the information must be accurate and trustworthy. The consequences associated with lost or delayed material are just too great to rely on inaccurate, late, or (worse) no status information at all.

The current logistics system, however, does not fulfill these requirements. It moves material effectively enough, but it does an inadequate job of tracking requisitions and provides status that is neither timely nor accessible by most of the activities that require this information, particularly end-use (field) activities.

Material requisitions submitted by end-use activities are tracked by an antiquated system that provides information related almost exclusively to material availability rather than shipment visibility. This deficiency often results in the premature classification of material as lost in shipment and, subsequently, leads to unnecessary reorders in support of maintenance schedules, equipment repairs, and stock requirements. Consequently, large quantities of government funds are tied up in useless (and unproductive) requisitions, and unnecessary surveys are prepared to write off material that could otherwise be located with real-time logistics data.

This lack of In-Transit Visibility (ITV) is common throughout the armed services. Consequently, the Department

of Defense (DoD) has implemented a progressive program to improve inventory management and increase material tracking capabilities for all activities. This program is being established within the Defense Total Asset Visibility (DTAV) plan and is being designed to track material from original procurement at the Inventory Control Point (ICP), through the wholesale and retail supply chains, to the final destination at the requisitioning (end-use) activity. Essentially, "the DTAV seeks to improve current capabilities and move toward a *seamless* logistics system" by correcting existing visibility deficiencies in the supply system, between transportation segments, and across DoD Components [Ref 4:p.v]. The plan is currently in prototype with implementation expected by the end of FY-96 [Ref 5].

The focus of this thesis will be the impact that improved In-Transit Visibility will have on end-use Navy activities - in particular, Navy ships. For the first time, underway activities will be able to access up-to-date logistics information on incoming material and personnel via a modern transportation information system titled the "Global Transportation Network" (GTN). This system is being designed to collect data from existing DoD and commercial transportation systems and integrate it in a central database.

Access to this information should greatly enhance visibility, and thus reduce reliance on outside supporting activities and decrease the tendency to prematurely survey and reorder delayed material. This should reduce the burden on the shipment pipeline and greatly improve the performance of field logisticians attempting to support their respective activities. It should also result in direct savings to the Navy through more efficient use of resources and operating funds.

A. OBJECTIVE AND SCOPE OF THESIS

The primary research objective of this thesis is to evaluate the impact that improved in-transit visibility, obtained through implementation of the DTAV and GTN, will have on reducing material lost in shipment. This research involves a study to determine the possible savings of resources, if any, that can be derived from improving material visibility at the requisitioner level.

Other objectives of this study include evaluating what type of GTN data should be provided to Navy ships via the Streamlined Automated Logistics Transmission System (SALTS) interface (an electronic data transmission system with batch processing capabilities), and whether underway Navy ships should be permitted to access GTN directly or whether they should be limited to access GTN only through a SALTS interface in order to minimize communication costs.

B. METHODOLOGY

The existing system used to track material in transit will be thoroughly reviewed, weaknesses and deficiencies identified, and the resource impact of improved in-transit visibility will be evaluated. Also, the Defense Total Asset Visibility (DTAV) plan will be introduced and examined, a detailed analysis of the Global Transportation Network (GTN) will be conducted, and the Streamlined Automated Logistics Transmission System (SALTS) interface option will be reviewed.

The research is conducted utilizing shipment data obtained through analysis of financial/inventory reports generated aboard Navy activities equipped with the Shipboard Uniform Automated Data Processing System-Real Time (SUADPS-RT) and the Shipboard Non-Tactical ADP Program (SNAP-1). These activities are located worldwide and include the Navy's largest afloat commands such as aircraft carriers, large amphibious assault platforms, combat logistics force (CLF) vessels, and support/repair ships. As such, the requisitions generated at these activities represent a significant portion of the total Navy requisitions produced aboard ships.

SUADPS/SNAP-1 systems generate sophisticated financial and inventory reports that provide accurate and detailed data including total throughput (business activity),

inventory adjustments, and shipment losses. Moreover, these reports specifically classify material losses (and gains) within individual categories according to type and dollar value and provide this information to respective Type Commanders (TYCOMs) in a common format to permit consolidation. This process provides an excellent data source to evaluate actual shipment losses reported by Navy activities.

II. BACKGROUND

The analysis presented in this thesis will be based on operating data obtained from ships equipped with the Shipboard Uniform Automated Data Processing System-Real Time (SUADPS-RT). SUADPS is an operating system that functions within a structured environment and incorporates a specific collection of procedures, programs, and processes not necessarily common to any other activities.

As such, a basic working knowledge of the SUADPS operating system is needed to interpret this analysis and evaluate its applications and limitations. To this end, the SUADPS operating system and its associated hardware configuration (SNAP-1) are described here along with the environment in which it operates. This chapter also evaluates the current deficiencies in the supply system logistics pipeline (which cause poor in-transit visibility) and examines the impact of these deficiencies.

A. SHIPBOARD UNIFORM AUTOMATED DATA PROCESSING SYSTEM - REAL TIME (SUADPS-RT)

The SUADPS operating system is a large inventory and financial management program which operates multiple, and extensive, databases within an automated data processing environment. It is used primarily to maintain inventory records, process supply transactions, and produce detailed financial and inventory reports in a common format that can

be consolidated by higher echelon commands. While some batch processing is required for many of the applications, the SUADPS database is updated each time a transaction is entered. It is therefore regarded as a "real-time" system. Technically speaking, "SUADPS-RT is a menu driven, on-line, interactive system operating in a distributed processing environment" [Ref 6:p.3-16].

Communication between SUADPS and the user is conducted through an "executive" subsystem plus four "application" subsystems. The executive subsystem provides centralized control of all common functions through the use of menu screens and serves as the primary interface between the system and the user. The four application subsystems are process oriented, and each performs specific operating functions as described below.

- The Logistics Management Subsystem records Direct Turn-Over (DTO) requisitions, stock receipts and issues, and assists the tracking of Depot Level Repairables (DLR).
- The Inventory Management Subsystem allows the user to establish and update material files, maintain inventories, and process stock reorders and offloads.
- The Financial Management Subsystem processes financial adjustments, maintains appropriation data, and provides assorted financial reports. The most important of these reports is the SUADPS monthly financial statement (DI-100) which summarizes all financial transactions impacting the ship's Operating Target (OPTAR) and the Defense Business Operations Fund (DBOF) account [Ref 7].
- The Incoming Batch Transaction Subsystem allows batch processing of large quantities of data. This subsystem

allows data to be received (and sent) via a number of available formats including magnetic tape reels, punched data cards and floppy disks. [Ref 6:p.3-19]

The specific functions performed by each of the SUADPS application subsystems are summarized in Table 2-1 [Ref 6:p.3-21]. More information can be found in SUADPS-RT Support Procedures, Volumes I, II, and III. [Ref 6:p.3-19]

B. SHIPBOARD NON-TACTICAL AUTOMATED DATA PROCESSING PROGRAM (SNAP-1)

The SUADPS operating system is maintained on magnetic disk within the Shipboard Non-tactical Automated Data Processing Program (SNAP-1). The SNAP-1 system provides real-time interactive capabilities and can support a multitude of software simultaneously. The system also provides hardware configuration that supports the SUADPS operating programs. The hardware is comprised of a Honeywell DPS-6 (AN/UYK-65(V)) mainframe and includes all of the required peripheral equipment such as the disk storage units, tape drives, keyboards, and video display terminals that make interactive communication with the user possible. [Ref 6:p.3-11]

The SNAP-1 hardware is not limited to SUADPS. It can also support other financial systems, personnel administration programs, shipboard maintenance management functions, food service operations, and retail sales programs. It is basically the support system for all of the business activities which operate aboard a large ship.

TABLE 2-1: PRIMARY FUNCTIONS OF SUADPS SUBSYSTEMS

LOGISTICS MANAGEMENT	INVENTORY MANAGEMENT
-Processing Stock/DTO Material Requests -Physical Material Receipt, Issue, and Storage -Query System Files -Track DLR Carcasses -Manage Suspense Processing -Monitor Requisition File Priority Processing -Document Control/Screening -IMA Material Requests -Maintenance of Non-Privileged Validation Tables -Maintenance of SUADPS-RT Validation Files -Material File Maintenance -Material Turn-In -Internal/External MOVs -NIS Review -Quality Assurance -Requisition File Maintenance -Requisition Release -SUADPS-RT Access/Security -External Record Release	-Processing Inventories -Processing Offloads -Processing Reorders -Establish and Update Material Files -Manage SEAMART/PEB Reviews -Manage Packups -Processing Excess Cancellation Requests -Allowance Processing -AVCAL Maintenance -COSAL Maintenance -Load List Updating Tape Processing -Local Change Notice Processing -Location Changes -Processing SAMMA/SAL Reports -Processing Storeroom Audits -Demand History Processing -Demand Recording
FINANCIAL MANAGEMENT	BATCH PROCESSING
-Record OPTAR Allotments/Withdrawals -Process Financial Adjustments -Update Appropriation Data -Produce OPTAR and Financial Inventory Reports -Performance Monitoring -Quality Assurance	-Processes Large Volumes of Incoming Transactions That Cannot (or Need Not) Be Processed Interactively -Performance Monitoring -Report Generalization (Request Prioritization, Distribution) -Processing Incoming Status -COSAL/AVCAL Allowance Processing -Change Notice Processing

This system also provides activities with the capability to interface with other computer systems located at other activities. Through the use of SUADPS batch processing techniques, information can be received (or transferred) using economically efficient methods such as magnetic tape, floppy disks, punched data cards or punched paper tape. Interfacing and batch processing improve flexibility in the management of information and minimize the amount of manpower required to record data. It also opens the door for more advanced techniques such as electronic data transfer.

However, while SNAP-1 is a capable system, its use is limited because of its large size and considerable maintenance requirements. It requires the direct support of an Automated Data Processing (ADP) staff, and therefore, installation is restricted to only the largest afloat activities with the space to support both the equipment and the associated personnel to maintain it.

Smaller activities are supported by a micro-computer based system (called SNAP-2) which does not provide the vast array of detailed reports available under the SUADPS/SNAP-1 interface. It must be noted that this limitation is a considerable drawback of the SNAP-2 system. It prevents consolidation of meaningful information at the Type Commander (TYCOM) level and limits the flow of information between activities. This limitation prevented the use of SNAP-2 data in this analysis.

The SUADPS/SNAP-1 interface is currently limited to installation on aircraft carriers (CV, CVN), amphibious assault ships (LHD, LHA, and LPH), combat logistics force (CLF) ships (AFS, T-AFS, AOE, and AOR), support/repair ships (AD, AS, and AR), Marine Aviation Logistics Squadrons (MALs), and Shore Intermediate Maintenance Activities (SIMA).

The inventory carried at these activities is categorized by the Navy's Weapon Systems File (WSF) as Service

Application Code (SAC) 207 material. (The WSF is a configuration database operated by the Ships Parts Control Center (SPCC)). As such, SUADPS/SNAP-1 activities are commonly referred to as SAC-207 ships/commands. Likewise, their respective financial and inventory reports are often referred to as SAC-207 reports.

This acronym is very common, and therefore, is used extensively throughout this analysis. Normally, aviation activities are more specifically identified as "SAC AV-207" or (more simply) as "AV-207" activities. However, for the purpose of this report, the term SAC-207 will be considered synonymous with all SUADPS activities (and/or their reports) unless specific aviation related data is being discussed and it seems necessary to distinguish between the two.

C. MATERIAL REQUISITIONING PROCEDURES UNDER SUADPS

Material requirements originating onboard SAC-207 activities are usually filled using one of two methods. If the material is carried in stock onboard the ship and sufficient material is available to support the requirement, the material is issued from the onboard inventory. A stock requisition is then submitted by the supply department to a Fleet Industrial Supply Center (FISC) to replenish the inventory.

If material is not carried (NC) onboard the ship or is not in stock (NIS), the requisition is normally passed directly from the requisitioning department to a FISC where it

is filled and shipped to the requisitioning department. This type of requisition is referred to as a Direct Turn-Over (DTO) requisition, because the material is turned over directly to the requesting department when it is received. The supply department onboard the requisitioning activity monitors the requisition through the supply system, records all supply status and shipping status, acts as a receiving agent on behalf of the requisitioning department, records the receipt of the material and verifies that the issuing activity (normally the FISC) is reimbursed.

Material can also be issued from the inventory of other SAC-207 activities such as Combat Logistics Force (CLF) ships supporting a task force, and, if necessary, transferred from non SAC-207 activities as well. However, most NC/NIS material is requisitioned directly from the supporting FISC.

The type of requisitioning procedure (stock or DTO) is significant because it establishes the point at which ownership passes from one activity to the next. All consumable material carried as inventory onboard SAC-207 activities (plus DLRs aboard CLF ships) is maintained as property of a revolving fund called the Defense Business Operations Fund (DBOF). As long as this material remains DBOF property, the SAC-207 activity is free and clear of any risk associated with loss or damage. Likewise, when this material is

ordered for stock, it is ordered as DBOF property, and any losses in shipment (or damage) are absorbed by the DBOF. This is discussed in more detail in Chapter III.

Direct Turn-over (DTO) requisitions submitted on behalf of operating departments (and DLRs aboard non-CLF ships) are charged directly to the requisitioning activity when shipped by the FISC. Since the material is never ordered as DBOF property, the DBOF does not accept any of the risk. Essentially, the material is shipped FOB origin, and any losses must be absorbed by the requisitioning activity. In periods of limited (and sometimes declining) budget environments, this risk can play a significant role in determining how material will be ordered and, moreover, how losses will be recorded.

Regardless of which method is used, and/or which activity owns the material while it is in the shipment pipeline, the overall requisitioning process remains basically the same. A requisition is submitted to a supporting activity, the material is issued, and it is then shipped to the requisitioning activity.

1. Requisition Format and Submission

Requisitions are submitted in accordance with Military Standard Requisitioning and Issue Procedures (MILSTRIP). These procedures establish a common format for requisitions, and for the most part, require that they be submitted in a single line, 80 card column, document.

The requisitions can be transmitted to supporting supply activities (normally the FISCs) via a number of available methods including naval message, telephone, magnetic tape, and electronic data transfer via communication satellites and the Automated Digital Network (AUTODIN). The priority of the requisition usually determines which method is used and also serves to establish the timeframes in which the supply system must process the requisition and provide status information to the requisitioner.

2. Assigning Requisition Priorities

The priority of a requisition is designated in accordance with the Uniform Material Movement and Issue Priority System (UMMIPS). This system requires that requisitioning activities identify which material is most important to them by assigning priority designators (PDs) to requisitions. This requirement was established to provide issuing and shipping activities a basis upon which to determine the relative importance of material requirements. The PDs range from 01 (the highest priority) to 15 (the lowest).

Under normal conditions, SAC-207 activities use priority 01 only for critically needed aviation and nuclear propulsion repair parts and priorities 02 and 03 for all other critical requirements. Priorities 04 through 06 are used for short lead time (but not critical) material, and priorities 11 through 13 are used for routine replenishment.

Requisitioning activities are not free to assign priorities at their discretion. They are limited to a specific series of requisition priorities based on a classification system called a Force/Activity Designator (FAD). The FAD is used to identify and categorize an activity on the basis of its military importance and/or mission. FADs range from FAD-I (highest) to FAD-V (lowest).

Deployed SAC-207 activities operating in wartime are placed in FAD-I and receive precedence over other activities. FAD-II is assigned during extended peacetime deployments, and FAD-III is assigned to activities operating near their homeport and not preparing for an extended deployment. FADs-IV and V are limited primarily to non-operational activities. The specific priorities used for each FAD are summarized in Table 2-2 [Ref 6:p.4-56].

3. Requisition Classification and Issuing Procedures

Supporting supply activities (i.e., FISCs) arrange priority designators into three categories called "issue groups." Requisitions with priority designators 01 through 03 are assigned to Issue Group 1 (the highest group priority). Requisitions with priorities 04 through 06 are placed in Issue Group 2, and requisitions with priorities 07 through 15 fall into Issue Group 3.

This classification allows issuing activities to categorize requisitions by their relative importance and

TABLE 2-2: REQUISITION PRIORITY BY FORCE/ACTIVITY DESIGNATOR

FORCE/ACTIVITY DESIGNATOR					
	I	II	III	IV	V
PRIORITY DESIGNATOR (PD)					
UNABLE TO PERFORM PRIMARY MISSION	01	02	03	07	08
MISSION PERFORMANCE IMPAIRED	04	05	06	09	10
ROUTINE REQUIREMENT OR STOCK REPLENISHMENT	11	12	13	14	15

helps them to allocate limited material and logistical resources among competing requirements.

When a requisition is received at the supporting supply activity, an initial screening is conducted to verify that it complies with UMMIPS requirements. It is then placed into one of the three Issue Groups and matched with on hand stock levels to determine if sufficient quantities are available to fill the order. Basically, the available stock is apportioned to requisitions according to the Issue Group assigned. Issue Group 1 requisitions are filled first, and so on.

If sufficient material (including substitutes) is not available in stock to fill a requisition, and material on order is not expected to be received within a prescribed timeframe, the requisition is referred upward to the next echelon of supply. In most cases, this is the item manager at an Inventory Control Point (ICP) or at the Defense Logistics Agency (DLA). The item manager either locates available assets at another supply point and forwards the requisition to that activity for processing, or he/she submits it to procurement personnel who arrange to purchase the material on the open market (open purchase).

4. Requisition Status Information Timeframes

Each supporting activity that handles the requisition is responsible for providing up-to-date status information to the requisitioning activity. The type of status, and the method in which it is provided, is predetermined by the requisitioner through the use of a "media and status" code included in the initial requisition. There are a large number of media and status combinations available to the requisitioning activity. However, most activities normally request 100% supply status plus shipment status. This combination provides the requisitioning activity with the most detailed status obtainable under the current system.

The timeframe within which supporting activities must provide this status is based on the priority of the

requisition and whether the status is "supply" related or "shipment" related. Generally speaking, supply-related status (delays, backorders, etc.) must be provided within 48 hours for priority of 01 through 08 requisitions. All other requisitions are allowed up to 5 days. [Ref 6:p.4-168]

Shipment-related status is regulated with slightly different timeframes. For priority 01 through 03 requisitions, shipment status must be provided within 24 hours of releasing the material to a transportation carrier (shipping activity). Priority 03 through 08 requisitions are allowed 48 hours, and priority 09 through 15 are allowed 3 working days. [Ref 6:p.4-168]

These timeframes also apply to follow-up requests for status submitted by requisitioning activities. This pertains to both supply-related and shipment-related follow-ups.

D. REQUISITION TRACKING UNDER THE CURRENT SYSTEM

Requisition status is normally provided by supporting activities through one of three methods: naval message, U.S. mail, or Automatic Digital Network (AUTODIN). As noted previously, SAC-207 activities specify which format will be used.

In the past, SAC-207 activities have predominantly requested that status be provided via naval message for high priority requisitions and by data keypunch cards (via the

mail) for the lower priorities. Recently, however, most activities have been fitted out with an electronic data transfer system called the Streamlined Automated Logistics Transmission System (SALTS) and now have the capability to receive status directly in electronic form via AUTODIN and satellite communication. The SALTS system is discussed in Chapter IV.

Electronic data interface has significantly improved the efficiency and speed at which status can be provided. However, the amount (and quality) of the information available is still extremely limited. The current requisitioning system provides status that is related almost exclusively to supply-related actions occurring at the stock point; it fails to provide shipment-related information that the requisitioner can use to track the material through the shipment pipeline once it leaves the issuing activity.

Under the current system, the requisitioner is informed of every action taken at every supply activity that handles the requisition. No action is overlooked, and status time frames are meticulously adhered to. At the very least, the requisitioning activity can expect to be informed of delays (and the reasons for them), substitutions, backorders, rejections, deletions, cancellations, partial cancellations, changes in stock numbers, etc. The actual list goes on and on. Without question, the requisitioner is overwhelmed with assistance until the moment that the material is shipped.

Once the material enters the shipping pipeline, however, it immediately falls into an information vacuum. The last useful information arrives in the form of a shipment status report (usually via DAAS) which provides only the most basic shipment data such as the issuing activity, date and mode of shipment, and the transportation control number (TCN). Although this may appear, at first glance, to be sufficient, it provides very little information that the requisitioning activity can use to effectively track the material while it is in transit.

While the mode of shipment and the TCN are helpful, they lack detailed information. The mode of shipment is limited to vague descriptions such as: motor truckload (mode A), air parcel post (mode H), and airfreight (mode Q). There are 32 modes, and none of them are particularly informative.

The TCNs present a different problem. They are used as a means to manifest material, and then basically are ignored by the logistics system. There is no database available in the Navy to keep real-time information on the whereabouts of material using TCNs. While each transportation carrier (or activity) is required to keep track of material within its cognizance, this requirement ends when the material changes hands. The information flow does not continue between carriers (or activities), and, as such, the logistics pipe

line becomes more or less a paper trail. Therefore, TCNs are used mostly as a means to find material after it is lost rather than track it during transit.

The usefulness of TCNs as a tracking tool is also limited by the packing method used at the issuing activity. Multiple requisitions destined for the same activity are often packed in a single container (called a "multi-pak") and shipped under a single requisition number (normally that of one of the requisitions within the container). The current transportation system is not equipped to manifest the contents of multi-paks and, hence, only the listed requisition can normally be located with the TCN.

Once the requisitioning activity receives shipping status, it must wait for the material to arrive. If it has not arrived after a "reasonable time" has elapsed, the requisitioning activity can request assistance from a supporting activity. A "reasonable time" is dependent on the current location and operational status of the activity as well as the priority of the requisition. There is no specific guidance which requires an activity to wait a certain number of days before asking for tracking assistance. It is often a judgement call on the part of the requisitioning department and/or the supporting supply department onboard.

Requisitioning activities have the option of submitting a follow-up request to the issuing activity. However, if

they have already received shipment status, it's unlikely that this action will generate any benefit. The issuing activity will simply send the same status again. Like the requisitioner, they do not have access to a single database that can be used by itself to locate the material in transit. The material must be located manually by expeditors following the information paper trail and contacting the various shipping activities.

This problem is so acute that TYCOMS commonly maintain a staff of material "expeditors" to track high priority requisitions (PD 01-03) and/or costly material that has been delayed or lost in the shipment pipeline. The existence of just these expeditors highlights the magnitude of the In-Transit Visibility (ITV) problem.

These services are provided primarily because requisitioning activities simply have no visibility of material in-transit. Requisitioning activities cannot locate their material without outside assistance. (Even SALTS does not help correct this problem. While it accelerates the process of transmitting and receiving status, it only provides access to information that is currently available). As noted previously, there is no database that can be accessed to obtain real-time logistics information. Status must currently be obtained manually by material expeditors. To compound the problem, the sheer volume of requisitions

delayed (or lost) in the system limits available tracking services to only the most important and/or costly material.

Unless a requisition is for high priority or extremely expensive material, the expediting system will not normally track it because of manpower and time constraints. Since most delayed requisitions consist, primarily, of low priority/low value stock replenishments and Direct Turn-Over (DTO) material, they do not warrant the time and expense associated with extensive research. As such, delayed material is simply recorded as lost in shipment and reordered.

E. ACCOUNTING FOR MATERIAL

Once material is classified as "lost," it is written off through an appropriate accounting entry. In the case of SUADPS activities, the vast majority of these entries are charged against the DBOF. Losses charged directly to the activity's OPTAR are restricted to requisitions for depot level repairables (DLRs) carried onboard as end-use material and DTO requisitions for not carried (NC) or not in stock (NIS) material ordered directly for onboard departments.

Although requisitioning activities are required to submit challenges to issuing activities when material is not received, these challenges rarely net any satisfaction and most requisitioning activities know it.

The challenges are normally submitted in the form of a Report of Discrepancy (ROD) which requires only that the

issuing activity (usually the FISC) verify its stock levels. Unless the FISC finds excess material on the shelf, the issue is assumed to have been made correctly. There is really no way to prove that the issue was not made, and therefore, the charge to the DBOF or the requisitioning activity stands.

This is a significant problem for requisitioning activities. They (or the DBOF) must pay for material charged to them and have little or no recourse against the issuing activities. Any losses are automatically assigned to the receiving activity regardless of the fact that they have no control over the material while it is in transit. This problem highlights the need for requisitioning activities to have access to data in order to track the material that they are being held accountable for.

III. ANALYSIS

The benefits to be derived from In-Transit Visibility (ITV) at the fleet (requisitioner) level will occur through a combination of direct and indirect savings arising from improved access to information. This analysis evaluates these benefits by comparing material losses currently reported by afloat Navy (SUADPS) activities with the possible savings that could be generated by improving access to logistics information via the Global Transportation Network (GTN).

A. MATERIAL LOST IN SHIPMENT

Substantial amounts of financial resources are expended annually to replace material classified as lost. The extent of this problem is examined in this analysis by evaluating inventory and shipment adjustments (gains and losses) reported by SAC-207 activities between fiscal year 1990 and 1993 (FY90-FY93). This analysis evaluates data obtained from nearly sixty of the largest Navy afloat activities, and therefore, represents a significant portion of all requisitions submitted by Navy activities [Ref 9]. Specifically, this report examines shipment and inventory adjustments recorded by all aircraft carriers (CV, CVN), large amphibious assault ships (LHD, LHA, etc.), combat logistics ships (AFS, T-AFS, AOE, AOR), and all submarine and surface ship tenders (AS, AD).

1. Data Sources

The information used in this analysis was extracted primarily from summary financial reports provided by the six Navy Type Commanders (TYCOMS) which oversee SAC-207 activities. These reports, called SAC-207 performance reports, are consolidated from monthly financial statements furnished to the TYCOMS by SAC-207 activities under their jurisdiction. The six TYCOMS are:

- COMNAVAIRLANT - Commander Naval Air Force,
U.S. Atlantic Fleet
- COMNAVAIRPAC - Commander Naval Air Force,
U.S. Pacific Fleet
- COMNAVSURFLANT - Commander Naval Surface Force,
U.S. Atlantic Fleet
- COMNAVSURFPAC - Commander Naval Surface Force,
U.S. Pacific Fleet
- COMSUBLANT - Commander Submarine Force,
U.S. Atlantic Fleet
- COMSUBPAC - Commander Submarine Force,
U.S. Pacific Fleet

The monthly financial statements provided to the TYCOMS by SAC-207 activities are called DI-100 financial statements. These statements are produced within the SUADPS/SNAP-1 interface and reiterate all financial transactions impacting the ship's Operating Target (OPTAR) and/or the Defense Business Operations Fund (DBOF) account during a specified reporting period (normally one month).

The DI-100 financial statements consist of a series of individual reports. Together, these reports provide financial and inventory data to TYCOMS and the supporting

financial organizations which perform accounting functions for SAC-207 activities.

The DI-100 report used to evaluate material and inventory movement is the Financial Information Report (FIR). The FIR is primarily a balance sheet which records all increases and/or decreases in the dollar value of material controlled by SAC-207 activities. It categorizes all receipts and expenditures with the aid of two-digit alphanumeric codes (called FIR codes), and uses these codes to identify the various types of transactions affecting the financial records of the individual SUADPS activity.

COMNAVAIRPAC defines it as follows:

Financial Inventory Report (FIR) codes indicate increases and decreases in value of Navy Stock Fund material and end-use DLR material carried in ship inventory. FIR codes also record the value of transactions, such as DTO receipts. FIR Codes print on Report 03, which is generated in DI 100 processing. DI 100 produces Report 03 in two segments on SAC-207 ships and three segments on SAC(AV)-207 ships. All ship types in the SUADPS-RT system generate an NSA FIR and APA FIR.¹ SAC(AV)-207 ships also generate an End-Use FIR.
[Ref 10:p.Y1]

There is an extensive list of FIR codes available for use in DI-100 financial statements. However, only five of these codes (M4, M5, D4, D5 and M6) are used to track inventory and shipment adjustments. Generally speaking,

¹ NSA is Navy Stock Fund material owned by the DBOF. APA is Appropriation Purchase Account material consisting of capital equipment such as propellers, propeller shafts, etc. which are not charged to either the DBOF or the requisitioner. End-Use material is material owned by the individual command and usually consists of depot level repairables (DLRs).

material losses are reported under FIR codes M4 and M5, material gains under D4 and D5, and special categories of material, such as Depot Level Repairables (DLRs) and high dollar-value inventory losses are reported under FIR code M6. Specifically, they are defined as follows [Ref 10]:

- FIR Code M4 (Inventory loss). M4 is the value of material that cannot be found in recorded stowage locations. It consists of material that was previously received but that cannot currently be located. An M4 usually results from periodic inventories or from a futile attempt to issue material to fulfill a requisition.
- FIR Code M5 (Loss from shortage in shipment). M5 is the value of material missing in shipment. It is the difference between the quantity of material reported shipped by the issuing activity and the quantity received. An M5 is usually generated because a requisition, or a part of a requisition (e.g., 1 of 12), is missing in shipment.
- FIR Code D4 (Inventory Gain). D4 is the value of excess inventory found in the custody of an activity. A D4 is usually generated from periodic inventories or from excess inventory found during an issue of material.
- FIR Code D5 (Gain from excess in shipment). D5 is the value of excess material in shipment. It is the difference between the quantity of material reported shipped by an issuing activity and the quantity received. A D5 normally results from excess quantity received in a shipment (e.g., 13 vice 12).
- FIR Code M6 (Survey). M6 is a special category used to report high dollar-value inventory losses (usually \$2,500.00 or greater) and all DLRs. An M6 requires that a formal survey be conducted and that a DD-200 (Report of Survey) be maintained on file to substantiate the loss.

2. Shipping and Inventory Adjustments

The dollar value of the above FIR codes, as reported by SAC-207 activities between FY90 and FY93, are summarized in Table 3-1. This table was consolidated from SAC-207

TABLE 3-1: SHIPPING AND INVENTORY ADJUSTMENTS

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY (LBI)	M4	\$ 32,776,000	\$ 37,334,000	\$ 62,681,000	\$ 39,476,000
LOST IN SHIPMENT (LIS)	M5	54,138,000	81,712,000	58,236,000	50,905,000
LOSS BY SURVEY (LBS)	M6	33,995,000	28,118,000	16,333,000	16,604,000
GAIN BY INVENTORY (GBI)	D4	(44,115,000)	(34,894,000)	(64,064,000)	(40,346,000)
GAIN IN SHIPMENT (GIS)	D5	(3,500,000)	(5,494,000)	(3,958,000)	(3,930,000)
NET LOSS (GAIN)...		73,294,000	106,776,000	69,248,000	62,710,000
THROUGHPUT		4,481,355,000	6,077,895,000	5,642,550,000	5,935,827,000
NET LOSS (GAIN)		73,294,000	106,776,000	69,248,000	62,710,000
NET LOSS AS A % OF THROUGHPUT		1.64%	1.76%	1.23%	1.06%
THROUGHPUT		4,481,355,000	6,077,895,000	5,642,550,000	5,935,827,000
NET LIS (M5-D5)		50,638,000	76,218,000	54,278,000	46,975,000
NET LIS AS % OF THROUGHPUT		1.13%	1.25%	0.96%	0.79%
THROUGHPUT		4,481,355,000	6,077,895,000	5,642,550,000	5,935,827,000
GROSS LIS (M5 ONLY)		54,138,000	81,712,000	58,236,000	50,905,000
GROSS LIS AS % OF THROUGHPUT		1.21%	1.34%	1.03%	0.86%

The above table provides shipping and inventory adjustments (gains and losses) reported by SAC-207 activities under the cognizance of COMNAVIRPAC, COMNAVIRLANT (less 7R), COMNAVSURFPAC, COMNAVSURFLANT, COMSUBPAC, and COMSUBLANT. The table was consolidated from summary reports provided by each of these TYCOMS. These summary reports are presented in Appendix B in the same format as above. NOTE: Due to differences in 7R COG accounting procedures between COMNAVIRLANT and other TYCOMs, COMNAVIRLANT 7R COG data is not included in the above table/analysis (or Appendix B). This table includes inventory related financial adjustments for aircraft carriers (CVCVN), amphibious assault ships (LHA, etc.), combat logistics ships (AFS), and submarine/ship supporting tenders (AS/AD).

performance reports and represents all inventory and material losses reported by SAC-207 activities during this timeframe.

Table 3-1 actually performs a number of functions. First, it consolidates the five inventory and shipment-related FIR codes reported in TYCOM SAC-207 reports. Second, it computes overall (net) losses for all SAC-207 activities. Finally, it performs an analysis to evaluate the relationship between throughput, net loss, and material lost in shipment. The source data for Table 3-1 is shown in Appendix B.

a. Throughput

The throughput figures reported in Table 3-1 represent a measure of business activity conducted by SAC-207 activities. Throughput is a compilation of a number of various FIR codes and serves to measure total material movement. Specifically, it includes all receipts, issues, transfers, cash sales, returns to stock, advance carcass credits for DLRs (standard price less net price), and the value of material turned in for disposal.

Since an item will usually fall into more than one category during the same fiscal year (receipts, issues, returns to stock, etc.), throughput should not be misconstrued as the value of total requisitions generated by an activity. It is a measure of business volume only.

b. Net loss

The net loss figures in Table 3-1 represent the total amount of material reported as lost by SAC-207 activities adjusted (reduced) by the total amount of gains. Net loss is calculated by adding together the inventory and shipment losses ($M4+M5+M6$) and subtracting the gains ($D4+D5$) from this amount. Net loss is a useful figure because it helps provide an overall (big-picture) look at material lost through poor visibility. It includes inventory as well as shipment adjustments and, therefore, highlights any abrupt changes in trends (or pattern shifts) occurring in overall material losses from one year to the next.

As seen in Figure 3-1, net loss will normally track closely parallel to net and gross lost in shipment (LIS) figures. A significant change in this relationship will occur only when the association between overall losses and/or overall gains is somehow impacted. Figure 3-1 shows that a shift in net loss (as compared to gross and net LIS) occurred in FY92.

This shift in the net loss trend line in FY92 was caused by a large increase in material reported as gained by inventory (GBI, Fir code D4) during FY92. This resulted in a corresponding reduction in the overall net loss figures (refer to Table 3-1), which subsequently caused the trend line to shift. This anomaly is likely the result

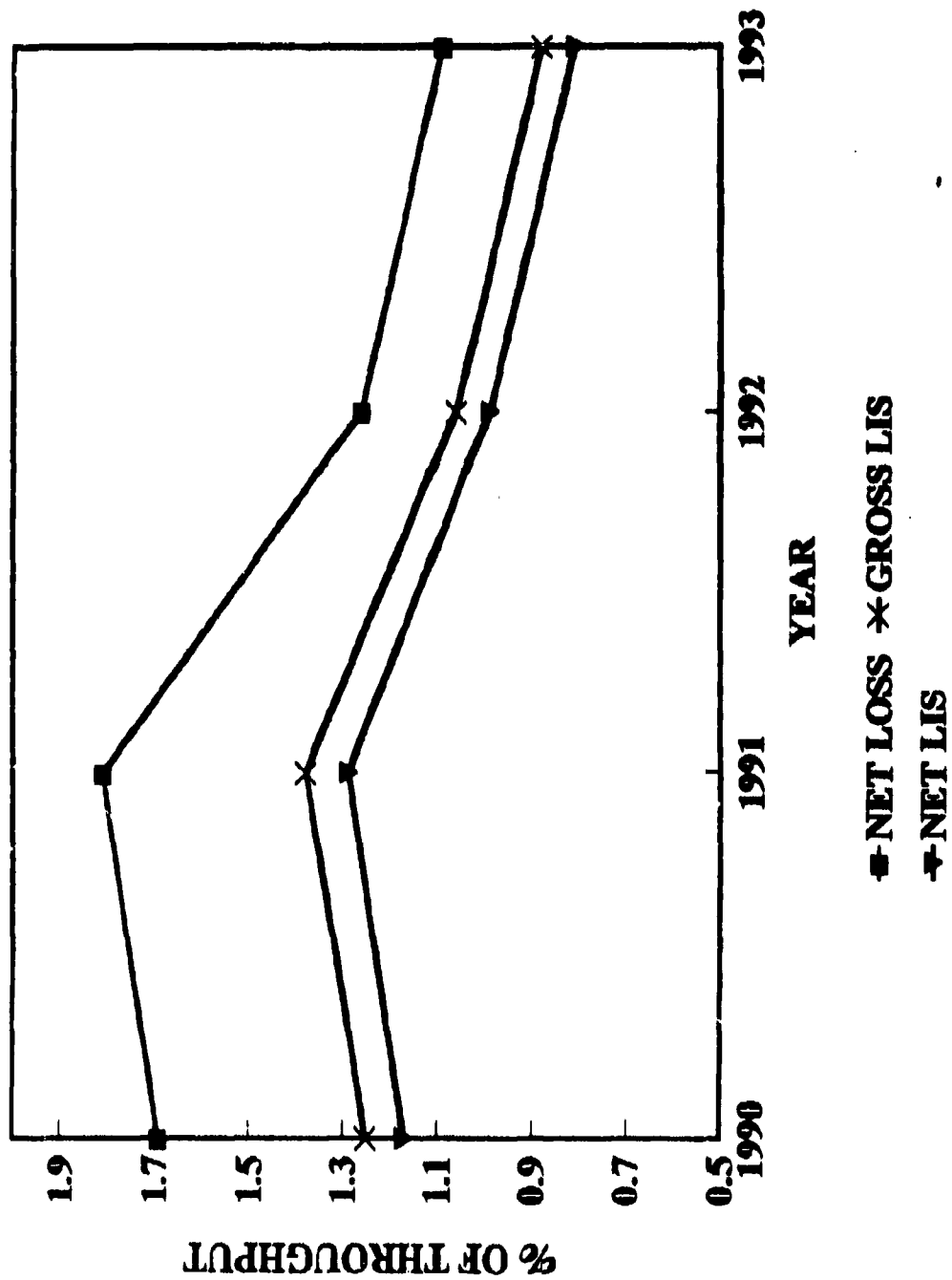


Figure 3-1: Net Losses Compared With Shipment Losses

of material found onboard SAC-207 activities in FY92 which was previously reported as lost in shipment during the Persian Gulf War (as evidenced by the extremely high levels of material lost in shipment (M5) in FY91). This tends to indicate that material is being incorrectly recorded as lost in shipment by requisitioning activities and later reported as a gain in inventory.

These gains, for the most part, represent the value of lost material that was subsequently replaced using resources that could have been more effectively utilized elsewhere. This holds true regardless of whether the material was lost in shipment or lost by inventory. Once it was recorded as lost, it was probably repurchased. When the material was later recovered, this recovery did not serve to eliminate or negate this repurchase since the expenditure would have already been made. Therefore, these "gains" are not simply the recovery of missing material, they are (in fact) a record of wasted government funds.

c. Material lost in shipment

In addition to reporting throughput and net loss, Table 3-1 also provides material lost in shipment (LIS) values as a function of both gross LIS (M5) and net LIS (M5 less D5). Gross LIS depicts the actual value of material recorded as lost in shipment by SUADPS activities. This value represents an actual cost of poor in-transit

visibility because material is automatically reordered when it is recorded as lost in shipment. Every dollar in this category represents a physical loss.

Net LIS, on the other hand, is the total amount of material recorded as lost in shipment minus the value of material recorded as gained (or found) in shipment. Notwithstanding any sudden or unexpected shifts in trends (such as a large increase in FIR code D5), net LIS should reasonably be expected to track consistently with gross LIS. This held true during the period FY90 through FY93.

3. Analysis of Shipping Losses

The data presented in Table 3-1 appears to indicate that a relationship exists between material lost in shipment and overall business activity at SAC-207 activities (represented by throughput). During this period (FY90-FY93), gross LIS consistently tracked at or near one percent (1%) of total throughput². This relationship was further reinforced by net loss and net LIS figures which closely followed gross LIS (as noted with Figure 3-1).

In order to measure the strength of this relationship, further analysis was conducted using linear regression (multiple regression was deemed inappropriate as the variables would not be mutually exclusive). To perform this

² These same trends appear to extend back to, at least, FY-88. Only partial data was available for FY-88 and FY-89, and thus, it was not included in Table 3-1. However, the trends remained constant for the data that was available.

analysis, gross LIS (M5) and throughput measurements were extracted from the data provided by each TYCOM and then correlated using linear regression.

The results of this analysis, consisting of 24 observations, are shown in Figure 3-2. From this comparison, it appears that there is actually a significant correlation between the amount of material that is lost in shipment and overall throughput at SAC-207 activities. Figure 3-2 strongly supports the above approximation that "overall" shipping losses can be expected to be slightly above one percent of throughput (1.1%). The 24 observations are provided in Appendix B; refer to rows LOST IN SHIPMENT (LIS) and THROUGHPUT.

The linear regression equation derived from the analysis [$Y = 171,046 + 0.010881(X)$; where "Y" equals material lost in shipment and "X" equals throughput] is supported by a coefficient of determination (R_2) of 0.73 and a correlation coefficient (r) of 0.854. The standard error of the coefficient is 0.0014, and the standard error of the Y estimate is 5,185,740. This seemingly large standard error of the Y estimate is in large part due to the extremely large numbers associated with throughput (billions) and is partially exaggerated by a single data point [$Y = 42,715,000$ (LIS) and $X = 2,483,113,000$ (throughput)].

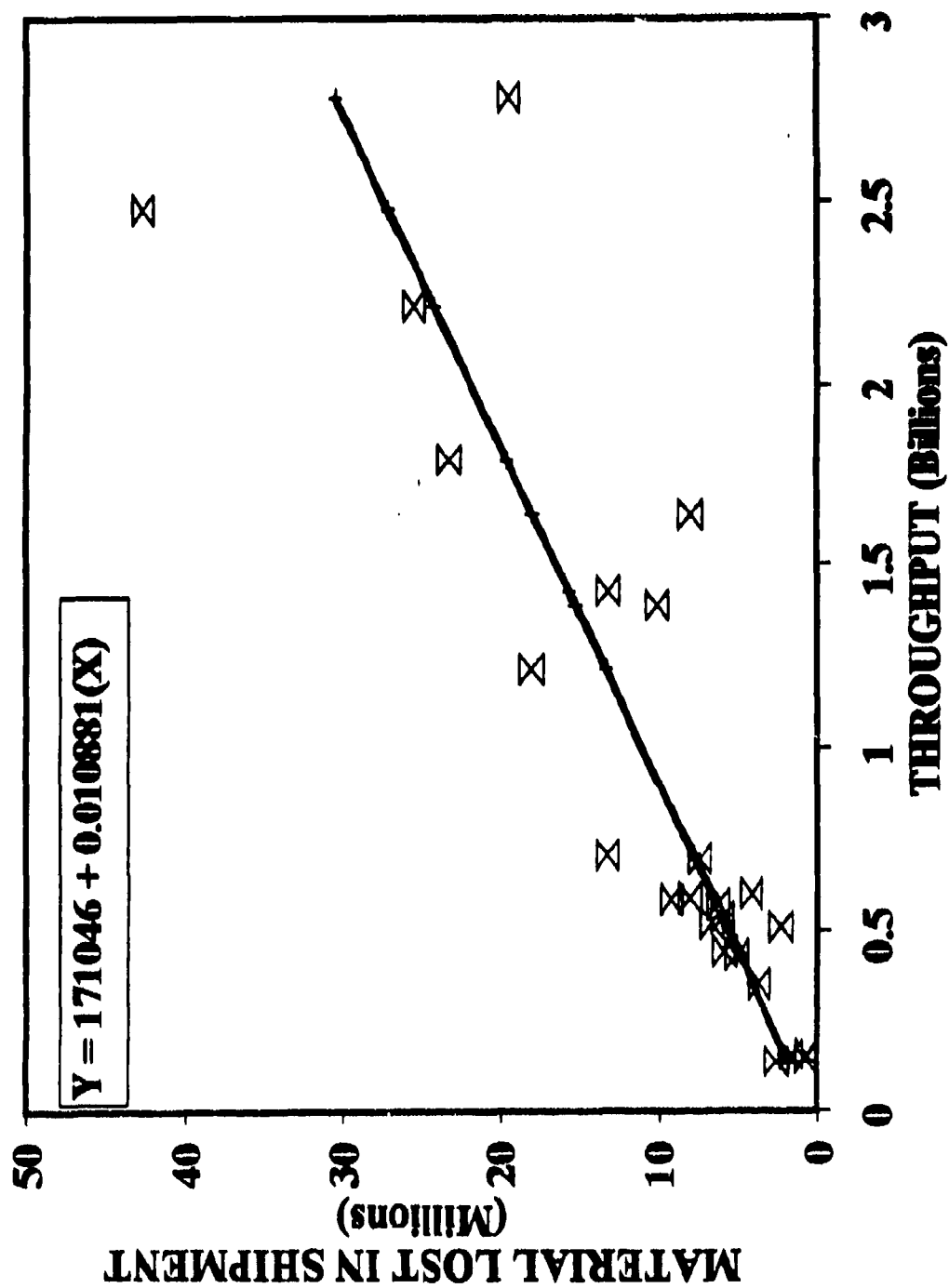


Figure 3-2: Linear Regression Analysis

Removing this single data point lowers the standard error of Y by 30% to 3,662,927 and improves the R^2 value to 0.74. Either way, the data suggest a strong correlation between throughput and material lost in shipment and provides evidence that SUADPS activities can be expected to perform within a stated boundary relative to one another.

Additional analysis was also attempted to analyze the relationship between material recorded as lost in shipment with actual material receipts (rather than throughput). However, TYCOMS are not required to maintain records on receipt information, and, therefore, the data was extremely limited. In fact, it was available from only two of the six TYCOMS (refer to Appendix B).

From the limited data that was available, an argument could be made that gross LIS will likely track somewhere around 3% of overall material receipts. However, this figure is only a rough estimate based on limited data and is provided for information purposes only. It is a relationship that warrants further analysis at the TYCOM level.

4. Receipt Processing and its Impact on Shipping Losses

The material recorded as lost in shipment by requisitioning activities is presumed to have been "lost" in the shipment pipeline through theft (shrinkage) and/or misdeliveries. However, in reality, these types of losses probably

represent only a portion of the total dollar value of material recorded as lost in shipment. The remainder of the reported losses result from improper receipt processing and, to some degree, from poor inventory maintenance (as discussed previously). While better in-transit visibility will not necessarily impact inventory maintenance, it should have a significant impact on receipt processing.

Providing requisitioning activities with the ability to track material through the shipment pipeline will likely reduce the temptation to prematurely reorder material that is geographically close to delivery. Furthermore, it should help prevent (or reduce) invalid surveys by allowing material to be traced to (or near) the receiving activity. If it can be quickly ascertained that the material was probably delivered, the impetus should exist to search for the material rather than simply write it off as lost in shipment.

Without access to adequate shipment information, however, SAC-207 activities are encouraged by current SUADPS accounting procedures to survey missing material as lost in shipment. The DBOF and TYCOMS also unwittingly provide incentives for SAC-207 activities to write off material and reorder it without regard to cost. Under current accounting procedures, it's possible for these activities to report extensive material losses without financial or performance

penalty so long as the material is reported as lost in shipment rather than lost in inventory.

In the case of DBOF material, SAC-207 activities are not charged for an item until it is actually issued from their stock. With the exception of DTO and (most) DLR requisitions (SUADPS Rel III), there is no charge or penalty for recording DBOF material as lost in shipment. Likewise, most TYCOMS exclude material lost in shipment from performance standards used to rate the accuracy of a unit's inventory management program. Again, there is no penalty imposed for recording shipment losses, thus providing an incentive to classify missing material as lost in shipment rather than search for it onboard.

This practice is not supported by the TYCOMS, however, and considerable efforts are expended to ensure that losses are properly recorded [Ref 7]. For example, COMNAVAIRPAC requires that all material recorded as lost in shipment be supported with documented spot inventories [Ref 11], and COMNAVAIRLANT requires that all losses of aviation repair (7R COG) material be reported as lost in inventory (vice lost in shipment) to ensure spot inventories are properly conducted, and documented, prior to recording the loss [Ref 12].

This restriction at COMNAVAIRLANT for shipment related 7R COG losses has resulted in the near elimination

of M5 (LIS) entries for 7R material at COMNAVAIRLANT activities, as almost all losses are now classified as inventory losses. Since the material is DLR, and therefore owned by the TYCOM as inventory once it enters the shipment pipeline, there is nothing wrong with this approach. However, it makes regression analysis of shipping losses nearly impossible, and therefore, COMNAVAIRLANT 7R COG data has been excluded from this analysis.

This did not significantly impact the research effort because all COMNAVAIRLANT 7R throughput values and all inventory and shipping adjustments were identified and removed from all of the data sources used in this study.

B. THE VALUE OF IMPROVED IN-TRANSIT VISIBILITY

The value of in-transit visibility was quantified during a decision conference conducted at the U.S. Transportation Command (USTRANSCOM) in July, 1993 [Ref 13]. The conference participants consisted of representative experts in the fields of transportation, logistics and operations. These experts were brought together to evaluate the specific benefits that could be derived from improved in-transit visibility and, where possible, to quantify the value of these benefits [Ref 14].

The actual purpose of this conference was to support the development of a Life Cycle Cost/Benefit Analysis for the

Global Transportation Network (GTN)³ [Ref 15]. However, the benefits of improved in-transit visibility apply regardless of the means by which the improvements are derived, and thus, many of the conclusions reached at the decision conference can be applied in general terms to evaluate the overall value of improved in-transit visibility at differing levels of operations.

The conference concluded that approximately 1.5% of all material shipped within DoD is reported as lost [Ref 16]. This figure is consistent with the analysis presented in this paper (as supported by Table 3-1 and Figure 3-2) and indicates that SAC-207 activities track material relative to the estimated DoD-wide average (1.1% vice 1.5%).

The conference also concluded that improved in-transit visibility would reduce the amount of material lost in shipment. Specifically, it was estimated that ITV improvements would eliminate 10% of the losses of low priority requisitions and 5% of the losses of medium priority requisitions. Since high priority requisitions already receive significant attention, it was determined that the direct reductions in high priority losses would be negligible. The personnel cost associated with expediting and tracking the material would be significantly reduced, but the actual losses would not be affected.

³ Author attended the decision conference and is a core team member for the GTN cost/benefit analysis.

As discussed in Chapter II, high, medium and low priority requisitions are assigned in accordance with the Uniform Material Movement and Issue Priority System (UMMIPS) standards through the use of priority designators (PDs). In the case of SAC-207 activities, high priority is normally PD 01-03, medium priority is PD 04-06, and low priority is PD 11-13. The UMMIPS also provides limitations on the use of each of these PDs depending on the Force/Activity Designator (FAD) assigned to an activity. For deployed SAC-207 activities, the number of high plus medium priority requisitions is restricted to less than 70% of total requisitions [Ref 6:p.4-49].

The GTN decision conference determined that high priority cargo represents approximately 15% of cargo shipped, medium priority cargo approximately 45% and low priority approximately 40%. While these approximations will vary according to the specific operating environment (war, regional contingency, peacetime operations, etc.), it is consistent with overall UMMIPS standards since the total of the high priority plus medium priority requisitions remains below the 70% threshold as previously discussed.

1. Direct Savings from the Transportation Pipeline

The overall findings of the conference are applied in Table 3-2 to estimate the overall savings that might have been generated by SAC-207 activities between FY90 and FY93

TABLE 3-2: ESTIMATED SAC-207 SAVINGS WITH IMPROVED ITV

	1990	1991	1992	1993
TOTAL I.T.S (M\$)	\$54,138,000	\$81,712,000	\$58,236,000	\$50,905,000
PRIORITY				
HIGH = 15%	8,120,700	12,256,800	8,735,400	7,635,750
MEDIUM = 45%	24,362,100	36,770,400	26,206,200	22,907,250
LOW = 40%	21,362,200	32,684,800	23,294,400	20,362,000
ITV SAVINGS				
HIGH = 0%	-	-	-	-
MEDIUM = 5%	1,218,105	1,838,520	1,310,310	1,145,362
LOW = 10%	2,165,520	3,268,480	2,329,440	2,036,200
TOTAL SAVINGS	\$ 3,383,625	\$ 5,107,000	\$ 3,397,750	\$ 3,181,562

through improved in-transit visibility. This analysis shows that savings are available to SAC-207 activities through improved access to logistics data concerning material in the transportation pipeline.

The savings identified in Table 3-2 would be allocated between TYCOM funds and the DBOF. The TYCOMs would benefit primarily from a reduction in shipping losses chargeable to user activities (all DTO/end-use requisitions and all DLRs charged under SUADPS Rel-III). As discussed previously, this material is normally considered the property of the requisitioning activity when it enters the transportation pipeline, and as such, they absorb all

charges for material lost in shipment (M5). The DBOF absorbs the remaining M5 charges (recorded by SAC-207 activities) and, therefore, would benefit from any savings not allocated to the TYCOMs.

It's difficult to apportion these savings. Much of the throughput of SAC-207 activities falls under the DLR/DTO heading. However, many of these requisitions are tracked much closer, and surveys signed more reluctantly, than DBOF material because these requisitions (particularly DLR's) consist mostly of high dollar value/low volume material and the ship has to absorb the loss. It's much easier to record M5 losses for DBOF material. For the most part, these requisitions consist of low dollar value/high volume material which doesn't warrant the research necessary to find it, and as discussed previously, there is little or no penalty for recording it as lost in shipment.

2. Additional Savings

While Table 3-2 demonstrates that savings are available through improved tracking within the transportation pipeline, it does not identify all of the potential savings available through improved ITV. Much of the potential savings will not be derived from reducing actual losses in transit. The most significant returns will probably come from improved receipt processing at the requisitioning activity. The fact is, material does not simply disappear.

Also, shrinkage (theft) cannot possibly account for most of the losses, and while misrouting material is a problem, it is probably not a 50 million dollar problem.

The case was made previously that material is being recorded as lost in shipment and then later recorded as a gain in inventory. Improved ITV can make a significant impact on this problem by providing a detailed trail of the material from the source of supply right to the doorstep (or very close to it) of the receiving activity. The volume of material gained in inventory is testimony to the potential savings that can be generated from improved in-transit visibility.

Unfortunately, these savings cannot be accurately estimated under the current accounting system. At the present time, TYCOMS do not collect (or summarize) data that would identify the original loss to which a current gain by inventory could be traced. As such, it's extremely difficult to identify which gains in inventory were generated from a previous "loss in inventory" and which resulted from a previous "loss in transit."

The individual ships can do it, but it would be difficult and time consuming to maintain this type of detail in a useable (and/or summarized) form. SUADPS provides the information, but it is not easily summarized. In fact, SUADPS procedure requires that causative research be

conducted to identify the original loss (inventory or shipment) and reverse it rather than record a new gain in inventory [Ref 6:p.7-146]. However, considering the volume of gains recorded in inventory, it appears that this is not always being accomplished, or the information is not available.

Although these savings cannot currently be quantified, they are most likely available in significant volume. Referring back to Table 3-1, if only half of the gains in inventory reported between FY90 through FY93 had been generated from previous shipment losses (rather than inventory losses), the potential savings would be somewhere around 20 million dollars annually. Since gains in inventory represent government funds wasted through the unnecessary procurement of replacement material (as noted previously), significant savings could be generated by improving the receiving process.

Other areas where savings could be generated from reducing unnecessary shipping losses include transportation system costs and inventory procurement costs. While the price of DBOF material includes a surcharge to cover the cost of transportation, material management and general maintenance (in addition to the actual procurement cost), this surcharge is being inflated with unnecessary charges. The transportation system must be compensated for shipping

material twice. This not only effects the cost to ship the individual item, it requires additional transportation assets to be maintained that may not otherwise be required.

Inventory procurement costs are also inflated. Since wholesale assets are maintained at levels commensurate with demand, unnecessary shipping losses (and their corresponding replacement requisitions) generate excessive inventory levels. This not only wastes limited resources by purchasing unnecessary inventory, it also adds to the overall inventory cycle costs, order processing costs, inventory holding costs, and miscellaneous personnel costs.

While all of these savings cannot be quantified in the context of this analysis, the important point to be made is that the savings are available (in the form of cost reductions) simply by improving the way the DoD tracks material. It's an unfortunate fact that the SUADPS/SNAP-1 and DBOF accounting systems neither charge abusers, nor reward protectors, of government resources. However, the purpose of this research is to identify potential savings regardless of the beneficiary and not to evaluate accounting principles. The manner in which the savings are divided is irrelevant to the fact that they are obtainable.

Of greater importance, these savings are obtainable regardless of the operating environment involved (i.e., peacetime deployments, low intensity regional conflicts,

high intensity major regional contingencies (MRCs), etc.). An argument could be made that this analysis would not be applicable during wartime or a high intensity conflict because a great deal more than 15% of the requisitions would be categorized as high priority. However, nothing could be further from the truth.

War puts an extreme burden on transportation assets and ultimately bogs down the system. As such, activities use higher priority requisitions to ensure that their material arrives on time. This problem, referred to as priority creep [Ref 15:p.5-6], eventually eliminates the benefits of higher priorities, and thus, blends most of the requisitions into one overwhelming category. Consequently, improved ITV would likely result in even larger savings during high intensity conflicts.

Only by improving the flow of material, and winning the trust of operational commanders, will UMMIPS standards be maintained throughout the various levels of operational conditions. Thus, the savings derived from improved ITV will be further enhanced through the benefits gained by operational activities, type commanders, and the overall logistics system.

This analysis strongly supports the claim that the current system is ill-equipped to track material assets and accentuates the need for improved material visibility. The

status quo system is simply inadequate to support the volume of material being transported to end-use activities. Material is being moved in a system that denies quality support and wastes funds that could be more wisely used.

IV. APPLICATION OF IN-TRANSIT VISIBILITY

A. DEFENSE TOTAL ASSET VISIBILITY (DTAV)

The Department of Defense is attempting to improve overall material visibility through implementation of the Defense Total Asset Visibility (DTAV) Plan. The DTAV is a joint system which will be utilized by all branches of the armed services to improve logistics management and reduce overall DoD inventories [Ref 17]. Specifically, the plan is expected to:

- Ensure responsive mission support by providing asset visibility to the components at all echelons within the DoD logistics system.
- Reduce wholesale and retail inventories by improving the ability of the logistics system to utilize on-hand assets better to meet customer requirements and lower costs and, therefore, instill user confidence that the logistics system will deliver the right asset at the right time.
- Improve transportation responsiveness and make the best use of transportation resources. [Ref 4:p.1-2]

The DTAV will divide asset visibility into three categories: financial, line item, and order/shipment. Financial visibility will be provided at a macro level. It will include the aggregate dollar value of material maintained at both the wholesale and retail levels (DoD-wide) and the value of assets on-hand and/or on-order at any individual stock point.

Line item visibility will be more micro in nature. It will include individual items of supply at specific

locations and will provide on-hand and on-order quantities for a particular line item as well as demand requirements and projected demand of that item.

Order/shipment visibility will be provided at the most detailed level. It will include the status of actual customer requisitions and the location of shipments within the logistics system. Order/shipment visibility will also include cargo movements by line item as well as by individual customer. [Ref 4:p.2-3]

The DTAV plan focuses primarily on line item and order/shipment visibility. While financial information will be made available (at a macro level), the emphasis of the system is on physical assets. The goal is to provide "full integration across the functional areas of supply, distribution, transportation, maintenance, and procurement."

[Ref 4:p.3-1] Visibility will be provided in a customer oriented perspective supporting operating users as well as logistics systems users.

Operating users consist of organizations responsible for operations. This includes end users (or units) such as ships and squadrons and also includes Component commanders, major commands, and weapons system/program managers. These activities require logistics information primarily to make better operating decisions. Logistics system users include retail and wholesale inventory managers, transportation

managers, and logisticians who require asset visibility primarily to support operating users.

Under the DTAV, operating users and their supporting activities are expected to have access to "real time" requisition shipment status and visibility of secondary assets (consumables, repair parts, and Depot Level Repairables [DLRs]) in transit or in retail storage. Logistics users will have access (as required) to assets in all of the functional areas including material under procurement, in transit, in storage, under repair, on hand within organizations, and/or awaiting disposal. [Ref 4:p.2-5]

1. The Goals of DTAV

The DoD is designing DTAV to provide improved asset visibility to all echelons within the DoD logistics system at the lowest possible cost to the government. The goal of the system is to provide service components and individual activities with the tools to access information (and provide operational managers and logisticians with essential visibility of material assets) while incorporating existing (off the shelf) technologies where possible. Specifically, the DoD has designed DTAV to meet the following principles:

- Emphasize customer needs and readiness improvements. Focus on the operating forces' material visibility requirements (to locate and identify material) and on providing visibility of those secondary item assets (consumables and repair parts) that can be used to fill requirements in the most responsive way.

- Reduce inventories. Focus on implementing key actions that directly support better utilization of material assets at all levels in the DoD logistics system and that will lead to reduced purchases and repairs.
- Leverage existing DoD management information systems capabilities. Focus on developing program capabilities that build on current and emerging data bases, existing asset visibility initiatives, and available data systems for managing wholesale/retail material inventories and transportation.
- Exploit available technologies and employ modular design and implementation strategies. Employ microcircuit technologies and up-to-date electronic commerce technologies. Build in phases, using rapid prototyping where appropriate. [Ref 4:p.1-1]

The DTAV will be the first DoD system capable of tracking material from original procurement at the Inventory Control Point (ICP), through the wholesale and retail supply chains, to the final destination at the requisitioning (end-use) activity. While a number of asset management systems have been developed by the individual services, these systems primarily support specific types of material (e.g., wholesale DLRs) and/or operate within a single component such as the Navy or Air Force. These systems cannot provide lateral visibility of assets held by other services and (individually) cannot track material from original procurement to the end-user.

2. The Categories of DTAV

The DTAV is expected to build on many of the existing systems (including those in production) and incorporate them into a single database that will overcome many of the

individual shortfalls. To accomplish this, the DTAV segregates assets into three categories (in-storage, in-process, and in-transit) and attempts to bring them together under one tracking system. These three categories represent the focus of DTAV and are the major areas of opportunity for improving asset visibility in the future:

- In-storage Assets. Assets in storage at retail consumer sites (in operating activity storerooms or warehouses), at retail intermediate storage sites (FISCs), in contractor Government-furnished material (GFM) inventories, at disposal activities (such as the Defense Reutilization and Marketing Office, DRMO), or in wholesale inventories.
- In-process Assets. Assets being repaired at depot-level organic or commercial repair facilities, assets being repaired at intermediate repair facilities, and assets on order from DoD vendors and not yet shipped.
- In-transit Assets. Assets in transit from external procurement/repair sources or in transit within the DoD distribution system. [Ref 4:p.2-2]

a. In-Storage Assets

In storage assets consist primarily of wholesale and retail material. Wholesale material refers to assets under the cognizance of an inventory control point (ICP) and includes material stored at DoD depots awaiting issue to retail activities and end users. Retail assets include material under the cognizance of retail activities (FISCs) and extending down to the operating unit level. It also includes material located at Defense Reutilization and Marketing Offices (DRMO) awaiting redistribution to end-users and other retail activities.

Both wholesale and retail material is targeted for visibility improvements under DTAV. Visibility of wholesale assets is expected to be improved by providing intermediate supply activities and DoD component headquarters, major commands, and weapons system managers better access to wholesale data at the integrated material manager (IMM) level. This access is authorized under the logistics asset support estimate (LASE) provisions of the Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP), but it is currently limited due to a lack of automation at some activities and by system incompatibilities between (and within) the DoD components. [Ref 4:p.3-9]

Visibility of retail assets is targeted towards all echelons. Inventory managers (IMMs) should gain better visibility of retail assets and requirements so that material can be redirected to meet current demand, and asset levels at retail activities can be maintained at desired levels. Retail supply activities (and end-users) should maintain better visibility of retail assets held at other activities (called redistributable assets) so that material can be redirected to a requisitioner instead of ordered anew. Additionally, DoD components, headquarters, and major commands are expected to gain better visibility of assets held at intermediate/retail supply activities to more effectively plan for upcoming missions and contingencies.

b. In-Process Assets

In-process assets are an extension of those in storage and consist of material either located at a repair facility or still in initial production at a commercial vendor facility. In-process assets are used to resupply material in-storage. The DoD inventory systems record it as "due in from maintenance" or "due in from procurement."

These assets are not immediately available for issue, and therefore, visibility improvements are being targeted at IMMs, intermediate/retail levels of supply, and DoD components, headquarters, and major commands where the data can be used to maintain inventory levels, redirect material, and plan for contingencies. As with wholesale assets, end-users will obtain information on in-process assets through their supporting retail supply activities and will probably not have direct access to this data.

c. In-Transit Assets

In-Transit assets consist of material in the transportation pipeline on order (or due in) to end-users, intermediate/retail activities and/or wholesale supply depots. It includes "serviceable items moving forward for issue (requisitions), unserviceable items being retrograded for repair (returns), and new assets moving to DoD activities (procurements)." [Ref 4:p.B-1]

In-transit visibility (ITV) is an integral part of the DTAV plan. Improvements in ITV will promote reductions in inventory requirements through improved asset management, reduce transportation costs by reducing duplicate shipments, and improve planning and performance at all echelons of operations and logistics by developing confidence in the transportation and supply systems, thus eliminating panic buying and the hoarding of material. The DTAV targets five specific areas for ITV improvements:

- Assets in-transit in CONUS (Continental United States). Visibility of assets moving in CONUS between contractor and DoD activities, among DoD activities, and to and from ocean and aerial ports.
- Assets in-transit intertheater. Visibility of assets moving between CONUS and overseas theaters and between overseas theaters.
- Assets in-transit intratheater. Visibility of assets moving in theater between contractor and DoD activities, among DoD activities, and to and from ports.
- Retrograde assets in-transit. Visibility of serviceable and unserviceable retrograde assets moving in CONUS and in theater or between Ports of Embarkation (POEs) and Ports of Debarkation (PODs). It also includes the ability to distinguish serviceable from unserviceable assets and identify depot level repairables (DLRs).
- Linkage of in-transit data throughout the pipeline. Linkage of transportation in-transit data with requisitions, returns, and acquisitions; and linkage of in-transit information from various nodes and sources to a single customer order number. [Ref 4:p.3-11]

Assets in-transit in CONUS refers to material that is moving between DoD activities, to and from air and ocean terminals (or ports), and between contractor

facilities and DoD activities. This category represents most of the (Navy) material in-transit at any given time. During peacetime, it represents the majority of day-to-day activity because of the large proportion of activities located stateside. In war, or during a major contingency, it retains a significant portion of the business because of the volume of material that must be relocated (staged) at air and ocean terminals for further movement overseas.

Assets in-transit intertheater represents material that is being moved from CONUS to an activity located overseas or between theaters of operations (regions). Assets in-transit intratheater refers to material that is being relocated within a theater and includes material moving between DoD activities, to and from air and ocean terminals (both located overseas), and to some extent, between contractors and DoD activities. Visibility of intertheater and intratheater assets is important in peacetime and is absolutely vital during a war or a contingency action. Once material arrives in a theater of conflict, it must quickly and efficiently be delivered to the end user, and often must be relocated and/or redirected with very little advance notice.

Retrograde assets in-transit consist of Depot Level Repairables (DLRs) and other serviceable and unserviceable material being turned in for redistribution or

repair. It includes material moving in CONUS, in theater, and between ocean and aerial ports. The DTAV will attempt to maintain the whereabouts of retrograde material while distinguishing between serviceable and unserviceable material. This should enhance the capability of IMMs and service components to redirect serviceable retrograde between intermediate/retail supply activities and help fill outstanding requisitions from existing assets instead of needlessly procuring new material. This capability will reduce overall assets by minimizing unnecessary procurements and will help inventory managers maintain the optimal mix of assets between stock-points. In addition, it will also improve customer service by filling assets more quickly and efficiently.

Linkage of in-transit data throughout the transportation pipeline links together the other four target areas. One of the major goals of the DTAV is to bridge the gap between individual data sources. It is expected to provide a standard method of tracking material through the transportation pipeline by linking together the many systems currently used within the Navy, throughout the other service components, and (to a limited extent) by commercial carriers.

This increased visibility of in-transit assets is expected to result in a large number of benefits to

operating and logistics users alike. These benefits are summarized by the DTAV as follows:

- Line items will be tracked by a standard method throughout the transportation pipeline to facilitate their being linked to the related requisitions, return, or acquisition. Commercial carrier automated in-transit systems will also have such linkage.
- Line-item manifest and packing information will be available through DoD standard electronic media to provide rapid identification of the contents of containers, pallets, and consolidation shipments.
- It will provide integrated item managers, weapon system managers, service/agency headquarters, and major commands with data reflecting performance of the transportation system throughout the pipeline. Those data will include CONUS and theater segments, commercial carriage, contractor deliveries and receipts, and retrograde movements. With this information, those user groups will have the basis for more precise calculations of in-transit times for specific items. Data will also be available to determine whether the transportation infrastructure can support activity consolidations, direct delivery, and just-in-time inventory. By combining transportation costs and in-transit performance data, decision support models will be able to optimize decisions on whether to procure or redistribute assets.
- Retail supply and maintenance activities will be able to determine the transportation status of inbound items. With that status information, they will be better able to plan and schedule reordering of items in transit and eliminate unnecessary reordering. That capability should reduce demands on both the supply and transportation systems, minimize excess stocks and cross-leveling requirements, and increase readiness. Retail supply activities will also have enough data to request reassignment and diversions.
- It will provide transportation management headquarters with more timely, accurate data to determine carrier performance and trends, validate payments, assess capabilities, and develop planning factors.
- Transportation operating activities will have better visibility of inbound shipments to support improved reception and onward movement. Wholesale and retail supply activities will obtain line-item visibility.

- It will provide commanders with more timely accurate information to support deployment and employment planning and execution. [Ref 4:p.3-12]

There are a number of available systems that provide logistics data, and currently, no determinations have been made regarding (exactly) which ones will or will not be used under DTAV. However, it appears that in-storage and in-process data will be linked through a Total Asset Visibility (TAV) system currently being developed by the U.S. Army and in-transit data will be linked through the Global Transportation Network (GTN) currently under development at the United States Transportation Command (USTRANSCOM) [Refs 17 & 18].

The GTN is expected to be the core network for ITV and will be the centralized database to access shipments world wide. According to the DTAV plan, the GTN will be an integrated transportation information system supporting global transportation management. "GTN will meet the transportation information needs of the Joint Staff and the Commanders-in-Chief (CINCs) and satisfy the DoD mandate to integrate transportation information." [Ref 4:p.3-11]

B. THE GLOBAL TRANSPORTATION NETWORK (GTN)

The GTN is being developed by USTRANSCOM as a command and control information system to facilitate the mission of global transportation management [Ref 19:p.13]. This system is being designed to collect data from existing DoD and

commercial transportation systems, integrate the data in a central database, and provide it to customers on a need to know basis. The GTN data flow is depicted in Figure 4-1 below [Ref 19:p.20].

On a macro level, "the USTRANSCOM vision is to gather the family of transportation users and providers of lift assets into a single integrated network that will provide in-transit visibility (ITV) and the command and control (C2) systems necessary to support their needs." [Ref 20:p.1]

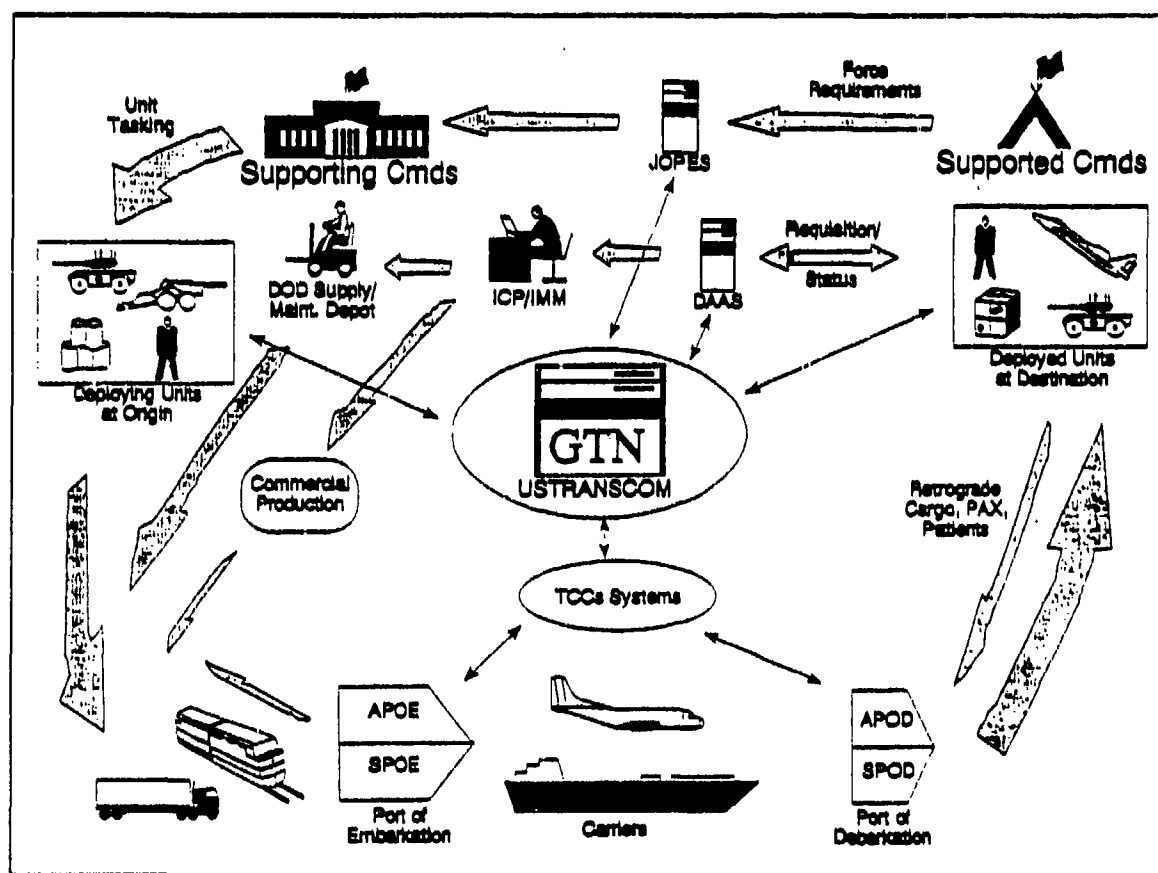


Figure 4-1: GTN Data Flow

In support of this vision, ITV becomes the process of gathering and maintaining information on the locations, status, and predicted movement of forces and sustainment, and C2 refers to the tools required by operational commanders to plan, direct, and control operations in support of assigned missions. [Ref 20:p.2]

The GTN will enable customers to access essential logistics data such as transportation schedules, itineraries, and associated manifests in order to more effectively route and track cargo, passengers, patients, units and forces. It will also furnish providers of lift assets with information on customers in order to better manage their assets and more efficiently react to the requirements placed on them by the Defense Transportation System (DTS). [Ref 20:p.1]

1. In-Transit Visibility through GTN

The GTN will support the ITV requirement by capturing the visibility of material when it first enters the transportation pipeline and maintaining this visibility throughout (and between) the different transportation modes and carriers (providers of lift) to the final destination. "In general, GTN will satisfy user's ITV requirements through user-controlled views of integrated transportation data which include combinations of mode, locations, dates, and status with a variety of unit, force, cargo, passenger, and patient identifiers." [Ref 19:p.1]

Users of GTN will be able to selectively request and retrieve data as needed and will be able to choose from a number of tracking methods and/or information databases. Selective retrieval will be possible by movement category (passenger, cargo, etc.), database type (operational, historical), mode of transportation (air, surface, both), geographic area of interest or coverage (worldwide, region, country, or specific location), specific timeframe, direction of movement (inbound or outbound), and delayed in process (awaiting further movement at a port or within an itinerary).

a. *ITV-Related capabilities*

Specific GTN capabilities of interest to Navy activities tracking material include cargo data, manifest information, itineraries, and container data. An additional area of interest might include passenger information to maintain visibility of personnel.

- **Cargo.** GTN shall provide visibility of cargo in the DoD transportation system by mode (air, land or sea), carrier type, specified countries, states or geographic areas, commodity code, National Stock Number (NSN), Transportation Control Number (TCN), requisition number, Government Bill of Lading (GBL), Unit Line Number (ULN), Unit Identification Code (UIC), service (e.g., USN), priority, container number, DoD Activity Address Code (DoDAAC), movement document number, aircraft mission number, and ship name data query parameters.
- **Manifest.** GTN shall provide visibility of manifests for air and surface missions. The detailed cargo manifest shall show, by mission or voyage number, the TCN or container/pallet identification, pieces, weight, volume,

priority, port of embarkation (POE), port of debarkation (POD), and destination locations. The detailed passenger manifests shall show UIC/ULN, name, grade, military occupational specialty, Social Security number (SSN), POE, POD, and destination locations. GTN shall provide summaries of the cargo and passenger manifests.

- Itineraries. GTN shall provide transportation schedule visibility of shipment units and carriers by mode (air, land or sea), carrier type, specified countries, states or geographic areas, passengers only, cargo only, combined passengers and cargo, UIC, ULN, and aircraft mission number, ship name, air refueling, USTRANSCOM owned and chartered transportation, patient movements, call sign, service, and priority data query parameters. This capability shall also display planned and actual arrival/departure data.
- Containers. GTN shall provide visibility of containers in the DoD transportation system by mode, carrier type, specified countries, states or geographic areas, TCN, ULN, UIC, container number, movement document number, GBL, CBL, priority, service, ship number, aircraft mission number data query parameters.
- Passengers. GTN shall provide visibility of passengers in the DoD transportation system by mode (air, land or sea), carrier type, specified countries, states or geographic areas, UIC, ULN, military occupational specialty, aircraft mission number, ship name, SSN, date/time range, and name data query parameters.
- Patients. GTN shall provide visibility of inter-theater patient movement requirements and movements by individual name and SSN, to include treatment information, medical crews, non-crew attendants, essential aero-medical equipment and supplies returning to originating medical treatment facility (MTF), and transportation asset information. [Ref 19:p.27]

The value of this information is considerable.

It will significantly improve the ability of logistic/supply personnel to support their respective activities by giving them the capability to track and/or locate material in-transit including requisitions, retrograde, bulk shipments,

partial and split shipments, containers, and equipment. They will be able to access manifests, display itineraries for individual TCNs, and track material being shipped by non-DoD (commercial) assets. The indirect benefits, such as tracking personnel, also represent significant value.

b. Primary ITV-Related Systems

The vast amount of information made available by GTN is obtained by tapping into a wide range of separate systems and consolidating the information in a well-structured database. These systems that interface with GTN are divided into two categories: source systems (which provide information to GTN) and customer systems (which receive information from GTN). Figure 4-2 depicts the relationship between these applications and the GTN system.

Most of the ITV-related systems fall under the category of source systems. These applications provide GTN with "transportation data for requirements, scheduling (itineraries and manifests), and actual movements of passengers, patients, forces, cargo, refueling assets, medical crews, equipment and supplies." [Ref 19:p.59]

Customer systems are applications that support the process of transferring data directly to a user and/or between different source systems. These applications operate under one of two methods: direct queries and/or report services. Query services refer to a predetermined set of

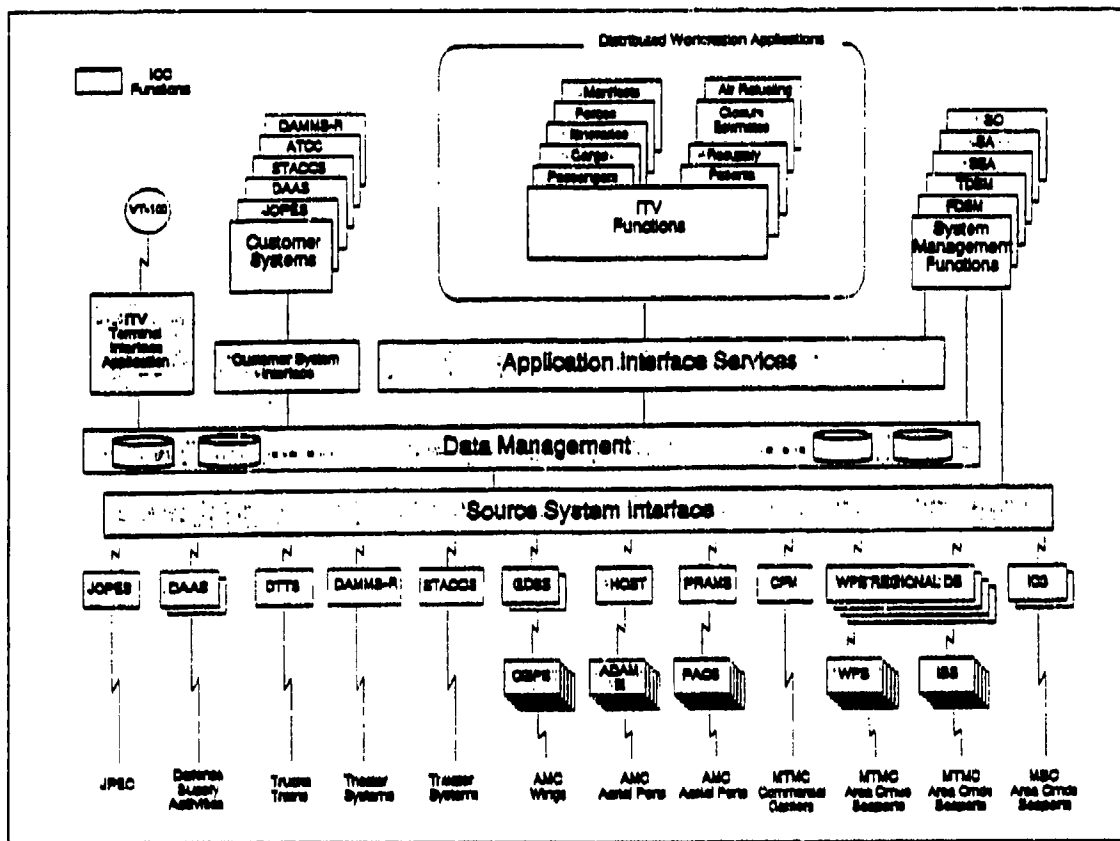


Figure 4-2: ITV Related Systems

queries available during on-line, interactive sessions with GTN or through mail, message, or electronic data interface (EDI) on a non-recurring basis. Report services refer to event-driven or recurring transmissions from GTN to customers, usually via electronic mail.

Each of the applications that interface with GTN as source systems and/or customer systems are described below along their basic interface. These definitions and

interface descriptions were summarized from the GTN System/-

Segment Specification [Ref 19:p.91]:

- Defense Automated Addressing System (DAAS) is the Defense Logistics Agency's (DLA)'s unclassified system for automatically routing Military Standard Requisition and Issue Procedures (MILSTRIP) transaction data among customers, suppliers, depots and shipping activities.

DAAS is a both a source system and a customer system. GTN will receive movement status from initial shipment to final receipt by the consignee. It will provide shipment status information to DTS customers via DAAS.

- Defense Transportation Tracking System (DTTS) is the DoD's unclassified system for near real-time tracking of Class I explosives shipments with CONUS.

DTTS is a source system. GTN will receive tracking data on each CONUS truck shipment of Class I explosives, including trip start point, in-transit location and trip end.

- Global Decision Support System (GDSS) is an Air Mobility Command (AMC) system that provides both unclassified and classified data concerning airlift mission schedules, actual departures and arrivals, aircraft status, advisory notices for exceptional events, and summary information on what an aircraft is carrying.

GDSS is a source system. GTN will receive actual arrival and departure information, planned and actual itineraries, and summary allocations and manifests for all AMC carriers, tankers and aero-medical evacuation flights.

- Headquarters On-Line System for Transportation (HOST) is an AMC unclassified system that documents airlift cargo operations worldwide and provides detailed data concerning items of cargo arriving, departing, and on-hand at aerial ports. HOST is fed data from the 23 fixed ADAM-III sites (described below) and from the Remote Consolidated Air Ports System (RCAPS) which serves small/temporary aerial ports.

HOST is a source system. GTN will receive information about manifested, airlifted cargo in-transit and cargo on-hand at AMC aerial ports.

- Aerial Port Documentation And Management System (ADAM III) is an AMC unclassified system that serves as the primary source system for HOST (above). It is a component of the AMC Consolidated Air Ports System (CAPS), and as with the HOST system, may be fed data from RCAPS.

ADAM III is a source system that interfaces with GTN only in the event HOST is not available

- Passenger Reservation And Manifesting System (PRAMS) is an AMC unclassified system that documents airlift passenger operations for DoD. It includes reservations and actual aircraft manifests on all AMC missions and commercial bookings. It is fed by the Passenger Automated Check-in System (PACS) and by all DoD passenger booking offices using PRAMS terminals. It can track individual as well as group (unit) moves.

PRAMS is a source system. GTN will receive information on passenger manifests and itineraries

- Integrated Command, Control, and Communications (IC3) System is a Military Sealift Command (MSC) system for planning, monitoring, and controlling the movement of ships owned or chartered by MSC and is operated in both classified and unclassified modes.

IC3 is a source system. GTN will receive information of ship schedules, movements, port characteristics, and ship characteristics.

- Mechanized Export Traffic System (METS II) is a Military Traffic Management Command (MTMC) unclassified system for managing ocean cargo clearance authority functions for booking cargo on MCS or commercial ships.

METS is a source system. GTN will receive specific information on cargo booked for ocean shipment (both containerized and break-bulk) and information on ship schedules moving military cargo.

- Worldwide Port System (WPS) Regional Database is a MTMC unclassified system being developed which will manage the export and import of DoD cargo at CONUS water ports. It will incorporate the Terminal Management System (TERMS) and the Department of Army Standard Port System Enhanced (DASPS-E) under one program.

WPS will be a source system. GTN will receive schedules for unit arrivals at ports, cargo arrival, cargo staging, and cargo out-loading at MTMC operated ports and on ship manifests.

- CONUS Freight Management System (CFM) is a MTMC unclassified system being developed to improve DoD domestic transportation by providing automated support for transportation processing and planning, and interfacing with commercial transportation systems utilizing Electronic Data Interchange (EDI) technology.

CFM will be a source system. GTN will receive cargo bookings, schedules, and movements on commercial land carriers.

- Joint Operation Planning and Execution System (JOPES) is a TOP SECRET system used by the joint planning and execution community (JPEC) for the development and distribution of a supported CINC's concept of operations and the time-phased movement of designated units and non-unit support of an operation.

JOPES is a source system and a customer system. GTN will receive referenced updates. It will provide status information on the movement of forces and sustainment required by the Time Phased Force Deployment Data (TPFDD).

- Standard Theater Army Command and Control System (STACCS) is a U.S. Army Europe (USAREUR) high security system which provides automated decision support tools and a data collection capability to facilitate command and control of theater forces and resources.

STACCS is a source system and a customer system. GTN will receive information from the European Command (EUCOM) theater regarding force movements. It will provide information regarding unit and non-unit movements (to STACCS) including data on carriers, bookings, departures, itineraries, schedules, and cargo and passenger manifests.

2. Command and Control through GTN

For the purpose of GTN, command and control (C2) is divided into current operations, future operations and patient information, which is consolidated with ITV data in

a single corporate database supporting the DTS as depicted in Figure 4-3 [Ref 19:p.54]. "These C2 capabilities include transportation-related activities in operations, planning, infrastructure, and medical regulation and evacuation." [Ref 20:p.7] This, theoretically, ties operational requirements with the planning and analysis tools that can be used to distribute available transportation/lift resources in the most effective and efficient manner possible.

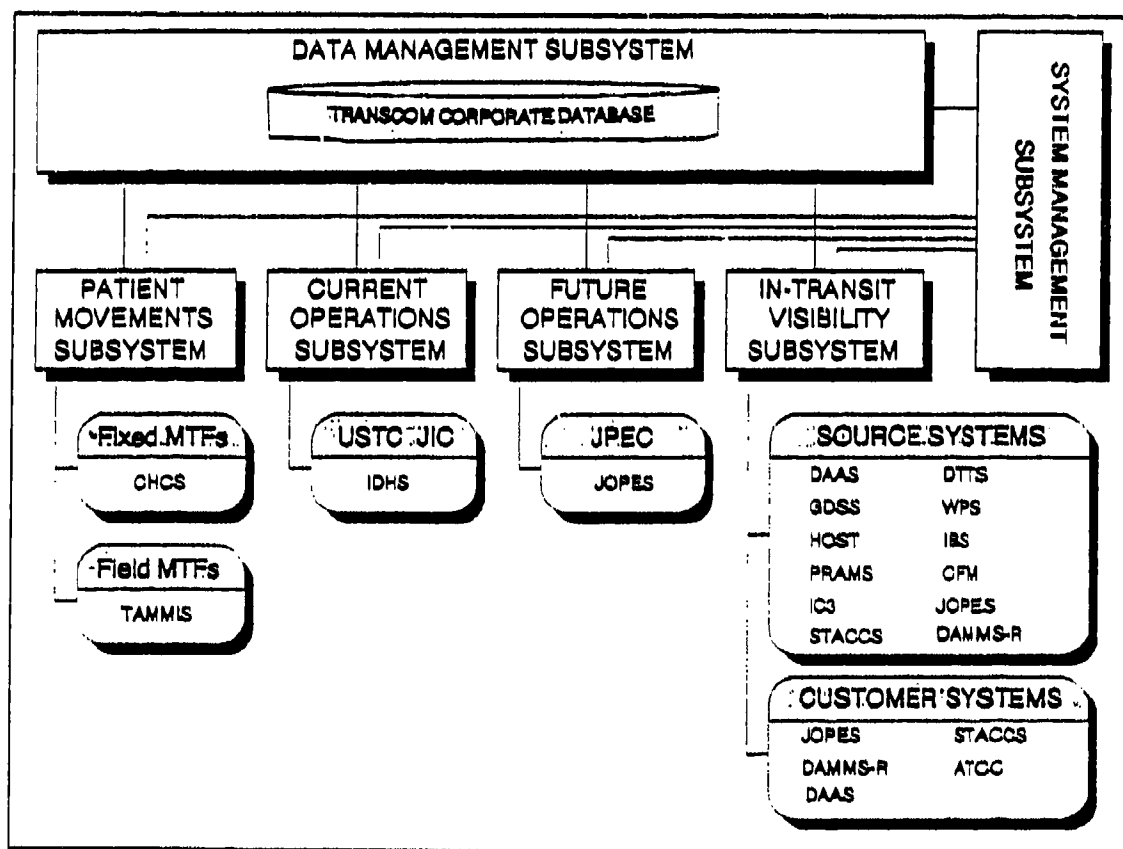


Figure 4-3: GTN Command and Control System Architecture

a. Current Operations

Current operations refers to the capability to provide information on the status and location of carriers, units, and transportation assets. It will be provided through the Intelligence Data Handling System (IDHS). This system is a Joint Intelligence Center TRANSCOM (JICTRANS) TOP SECRET and sensitive compartmented information (SCI) system which will act as a source system to GTN providing transportation infrastructure data (port status, capabilities, etc.) to GTN. Current operations C2 data will be available only to USTRANSCOM, the Transportation Component Commands, and a few selected activities. However, it will provide future operations data, which, in turn, will be available to user activities of GTN on a need-to-know basis controlled by USTRANSCOM. [Ref 18]

b. Future Operations

Future operations refers to the process of collecting, analyzing, and projecting information for transportation capability assessment. This data will be provided through the Joint Operation Planning and Execution System (JOPES, discussed previously) which will be accessible by GTN via the Global Command and Control System (GCCS). The JOPES system will serve as both a source and a customer of GTN. As a source system, JOPES will provide Time Phased Force and Deployment Data (TPFDD) to use in GTN planning

tools. It will also provide (send) resupply requirements, force modules and standard reference file information. As a customer system, it will receive transportation data from GTN which can be used to support feasibility analysis, simulation, and predictive movement analysis.

The future operations subsystem of GTN "will be capable of modifying or updating a TPFDD with transportation-related data from the GTN database." [Ref 19:p.100] Through this access, selected GTN users can gain access to information on the location, status, predicted movement and availability of units [Ref 19:p.27].

c. Patient Movement

Patient movement refers to the identification and integration of patient movement requirements. This information will be provided through the Composite Health Care System (CHCS) and the Theater Army Medical Management Information System (TAMMIS).

These systems provide status of patients, including treatment information, and medical equipment. GTN system users can utilize this data to maintain visibility of intertheater patient movements by individual name and SSN. [Ref 19:p.28]

d. Access to C2 data

Most C2 data will be used primarily by USTRANS-COM and the Transportation Component Commands. However,

some of this data will also be available to user activities (on a need to know basis) with the proper clearance and secure hardware. "While GTN is to serve as the C2 system for USTRANSCOM, it will also serve as a source of joint integrated transportation information for all Services." [Ref 20:p.17]

The ability to provide access to certain C2 data beyond the primary users is a tremendous benefit of the GTN system. In the afloat Navy, this type of information has historically been restricted to command vessels (flagships such as aircraft carriers) with access to JOPES.

Expanding this capability is accomplished through a TOP SECRET partition in the GTN database (in addition to the UNCLASSIFIED database). While the system architecture is beyond the scope of this report, in summary, it will support unclassified, sensitive unclassified, SECRET, and TOP SECRET communication over local area networks (LANs), wide area networks (WANs) including the Defense Information System Network (DISN), dial-up lines such as the Defense Secure Network (DSN), and satellite links including the International Maritime Satellite (INMARSAT) and Military Satellite (MILSAT) systems [Ref 19:p.76]. The basic communication architecture is depicted in Figure 4-4 [Ref 19:p.72].

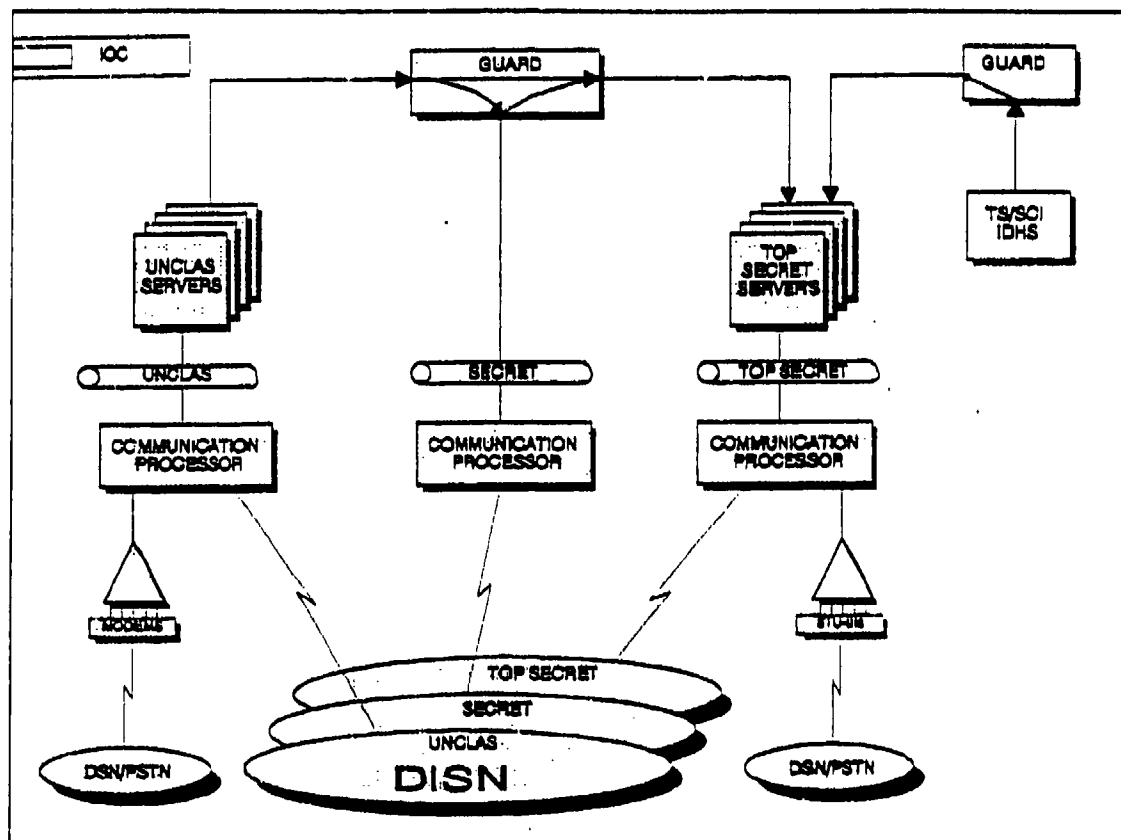


Figure 4-4: Basic Communication Architecture

When fully implemented, USTRANSCOM expects GTN to have over 5000 customers arranged in 3 functional groups (categories). The primary functional group will be made up of approximately 100 "command center" customers located within the Crises Action Teams (CATs) at USTRANSCOM and the three TCCs [Air Mobility Command (AMC), Military Traffic Management Command (MTMC), and Military Sealift Command (MSC)]. The second functional group is expected to include nearly 400 operations and planning offices located within the joint staff, unified commands, and major components.

The third, and largest, group will consist of over 4500 logistics support users stationed at logistics activities and operational units world-wide [Ref 20:p.26].

e. Implementation schedule and life cycle

The GTN is currently under development with the last prototype scheduled for a January 1994 release. "It is anticipated that the Phase A contract, a Firm Fixed Price (FFP) effort, will be awarded in April 1994, following source selection activities. The Phase B contract for system development will be a Cost Plus Award Fee (CPAF) contract to be awarded in February 1995." [Ref 15:p.1-2]

The Initial Operational capability (IOC) date is scheduled for third quarter, FY97, and the Full Operational Capability (FOC) date is scheduled for third quarter, FY00. The life cycle is planned through FY10 and will be supported by a five year hardware replacement cycle which will consist, primarily, of commercial off-the-shelf (COTS) systems. [Ref 15:p.1-3/4].

C. ACCESS TO GTN DATA

Access to the Global Transportation Network is limited to activities with a GTN user account assigned by the system administrator located at USTRANSCOM TCGT-R. Activities are provided specific access based on a need-to-know basis, and access to C2 information is strictly controlled. Once an account has been established, users can access the system by

one of the six available methods depicted in Figure 4-5

[Ref 21:p.3-13] and described below:

- [1] Local users via interconnected LANS's at Scott AFB, referred to as the Scott AFB Metro Area Network (MAN).
- [2] Remote users via the Defense Simulation Internet (DSI)
- [3] Remote users connecting to the Military Network (MILNET) via dial-in access to a Terminal Access Controller (TAC).
- [4] Remote users connected to LANs with access to Military Network (MILNET).
- [5] Remote users directly connected to a host computer with access to MILNET.
- [6] Remote users dial-in via the Defense Switched Network (DSN) or the commercial telephone system.
[Ref 21:p.3-11]

Most afloat Navy activities will access the system through the Defense Switched Network (DSN) and/or the MILNET. However, unlike shore activities which can establish a fixed method of communications, afloat activities must utilize a number of communication methods to send and receive information. For logistics information, these methods can be summarized into four basic categories:

- Landline communications (DSN/Commercial)
- Cellular phone (Commercial)
- Satellite link (MILSAT/INMARSAT).
- The Streamlined Automated Logistics Transmission System (SALTS)

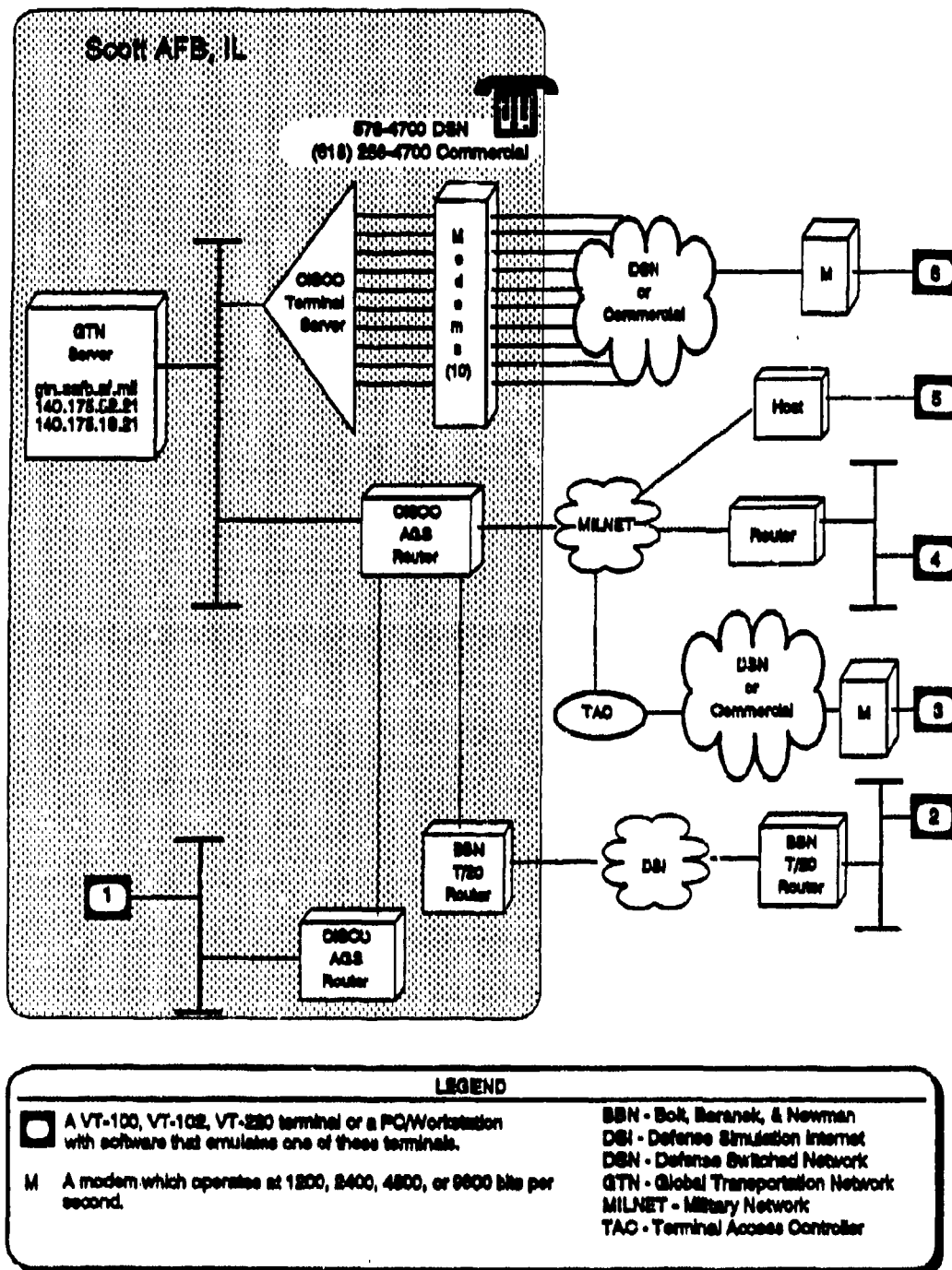


Figure 4-5: GTN User Access Methods

1. Landline Communications

Landline provides an inexpensive and easy to use method of accessing GTN data. This method is always available to a ship when it is in port since ships receive the same telephone services as any shore facility via service connections available at the pier. Through a simple modem interface, afloat commands can track individual requisitions throughout the transportation pipeline using DSN/commercial telephone services at a minimal cost to the DoD and literally no cost to individual activities.

Landline communications are obviously the cheapest and most readily available means to communicate with GTN. As such, all SAC-207 activities (and all Navy activities) should be provided direct, unlimited, access to GTN via landline to take advantage of the potential savings, improved logistics and advanced C2 services that this system has to offer. In addition, all Navy activities large enough to maintain a shore detachment (DET) when underway should be provided with an additional account to enable the DET to maintain continued access with the GTN. This additional account is recommended to ensure that the ship and the shore detachment can access GTN simultaneously.

2. Cellular Phone Nets

Cellular phones provide an alternative method for ships to access the GTN during periods of coastal operations

(called local ops). Most Navy activities perform a significant amount of training and/or exercises within reach of commercial cellular nets. As such, this service provides an extension to their landline communication capabilities.

While this method can be an expensive alternative compared to landline communications, it is significantly cheaper than satellite communications and, thus, provides an easily accessible method to track high value and/or mission essential material. Less significant items that do not warrant high communication costs can be tracked (more economically) by utilizing the batch-mode capabilities provided by the Streamlined Automated Logistics Transmission System (SALTS). This is discussed in more detail below.

3. Satellite Communications

During extended underway periods (such as deployments), afloat activities send and receive information via satellite link. Until recently, logistics information was restricted to Military Standard Requisitioning and Issue Procedures (MILSTRIP) message traffic because of limited communication resources. However, new generation technology is providing underway supply departments with access to satellite communication for logistics purposes. Most Navy activities currently have the capability to transfer logistics data via the International Marine Satellite (INMARSAT) system and large afloat activities have (or will soon have)

the ability to utilize the Military Satellite (MILSAT) system for logistics.

The advantage of the MILSAT over INMARSAT is a factor of cost. The INMARSAT system is capable of transferring data and voice communications, but it is a commercial satellite with extremely high access cost. As such, logistics data is usually restricted to batch-mode transfer via SALTS (see below).

The MILSAT, on the other hand, is owned by the DoD and is much less expensive to operate (at least at the service level). In fact, it is provided virtually free to the TYCOMS and individual activities. However, its capacity is not unlimited, and therefore, it has historically been restricted to tactical traffic. To alleviate this problem, larger afloat activities are being fitted out with Super High Frequency (SHF) capabilities to improve the efficiency of the MILSAT system. This modification increases the rate at which data can be transferred, and thus allows the transmission and receipt of general class traffic (such as logistics data and voice communication) in addition to regular tactical traffic.

Through SHF transmissions, afloat activities fitted with MILSAT communication capabilities can transmit logistics data to GTN via the nearest (servicing) Naval Computer and Telecommunication Area Master Station (NCTAMS). The

NCTAMSS serve as ground-site communication hubs which patch the transmission directly into a DSN line, thereby completing the connection to GTN.

Smaller activities without MILSAT capabilities can also utilize these capabilities through use of a battle group cellular system which allows them to link with a larger (capital) ship outfitted with MILSAT capabilities. This system allows smaller activities to access the larger ship's switchboard and transmit SHF data through a special modem called a STEL (Stanford Telecommunications). Essentially, it allows the smaller ship to link with a base station aboard the larger ship which, in turn, accesses the larger ship's switchboard and provides SHF capabilities to the linked ship. [Ref 22]

Through the MILSAT/NCTAMS link, underway logisticians can gain direct access to the GTN as if they had used a land-line telephone. Of equal importance, they can utilize this capability at no added cost to the DoD, TYCOM, or individual activity. For the logistician, this service is financially equivalent to using Naval message traffic for sending and receiving status messages.

The MILSAT/NCTAMS is not part of a logistics system, it is a C2 configuration that logistics users can take advantage of when its capacity is not being fully utilized for operational purposes. As such, this study considers the

enhanced logistics capabilities provided by this service to be a value-added product. Essentially, it is a product that logistics users can utilize at no added (marginal) cost.

However, since the MILSAT/NCTAMS interface is not a logistics system, there is no guarantee that it will always be available for logistics purposes. In fact, it will likely be overwhelmed with tactical traffic during conflicts or major operations [Ref 22]. In addition, most smaller activities (not accompanying a capital ship) will not be able to access it unless their communications suite is outfitted with MILSAT capabilities. Under these conditions, access to GTN could become difficult for many underway activities, and consequently, access to real-time logistics data could become unavailable.

A back-up system (or plan) must be available for logistics users. Logisticians cannot (should not) consider any system as a panacea for their communications needs, particular those designed primarily for operational support. When communication systems are at a premium, logistics will ultimately be given the lower priority when compared with operational data. Fortunately, a back-up may already be available in the form of batch-processing through the Streamlined Automated Logistics Transmission System (SALTS).

4. Streamlined Automated Logistics Transmission System (SALTS)

SALTS was originally developed during Operation Desert Shield/Storm to provide an alternate method of transmitting unclassified non-technical data [Ref 23:p.1]. During these operations, the Navy telecommunication system was overwhelmed with message traffic. In order to ensure that high priority tactical message traffic would be delivered without delay, field commanders imposed "condition minimize" which severely limited the ability of logistics communities to exchange information. SALTS was developed to circumvent these restrictions.

SALTS provides an extremely fast data interchange and allows extensive batch processing. In fact, the average SALTS interface takes only 2.5 minutes (approx.) to complete [Ref 24]. Using SALTS to access GTN data dramatically reduces access time and, consequently, lowers communication costs by minimizing long distance tolls, cellular phone charges, and INMARSAT satellite charges (currently \$6.25/minute). A transmission cost comparison is provided in Table 4-1 [Ref 25]. This is particularly important for afloat activities which do not have MILSAT access and, consequently, must rely on INMARSAT as their only "real-time" access to GTN while underway. Minimizing access time for these activities can result in considerable savings.

TABLE 4-1: TRANSMISSION COST COMPARISON

	Long Distance (San Diego - ASO)	Cellular Telephone	INMARSAT
1 Minute	\$ 0.25	\$ 0.70	\$ 6.25
2 Minutes	0.52	1.40	12.50
2.5 Minutes	0.63	1.75	15.63
4 Minutes	1.03	2.80	25.00
6 Minutes	1.55	4.20	37.50
8 Minutes	2.06	5.60	50.00
10 Minutes	2.58	7.00	62.50

When the SALTS/GTN interface is complete, user activities will be able to enter TCNs into a holding file and transmit them in a "batch" via INMARSAT to SALTS Central in Philadelphia. SALTS will electronically access the GTN database, extract the available information on each TCN, and place it in the user's electronic e-mail file for later retrieval. The GTN data will be downloaded with other logistics traffic, automatically, during the next SALTS interface with the user [Ref 26].

This service is also particularly useful for low dollar value/low priority requisitions which do not warrant individual tracking. Large underway Navy activities with access to MILSAT can utilize SALTS to track all medium to low priority requisitions. Direct contact with GTN can be limited to requisitions of critical importance or extremely high dollar value, thus minimizing personnel costs devoted

to logistics tracking and focusing their expertise on a few high visibility items. Other (usually smaller) activities without access to MILSAT can utilize SALTS to track all of their requisitions. The GTN/SALTS interface will significantly increase their current access to ITV information at a reasonable cost to the government and the TYCOMs.

D. SUMMARY

The Defense Total Asset Visibility Plan (DTAV) is a joint system which will be utilized by all of the service components to improve logistics management and reduce DoD inventory. The goal of the plan is to improve the way DoD manages material by improving visibility over that material. The Global Transportation Network (GTN) is an application being designed and implemented to meet that goal while also providing significant new command and control (C2) capabilities. The GTN improves the visibility of material assets by tying together the primary logistics databases currently being used throughout the DoD and provides access to them through a single point of entry.

The mobile nature of Naval activities complicates access to the GTN. There are very few communication systems capable of transmitting data (by modem) between an isolated moving platform and a shore based activity. Moreover, most of those that are available are designed to transmit operational and tactical information, and not logistics data.

Field logisticians must be able to adapt to the ever changing operational environment by maintaining access to multiple forms of communication.

V. CONCLUSION

Effective transportation and accurate logistics information are absolutely necessary to ensure that the material, provisions, equipment, and repair parts needed to sustain operations are quickly and efficiently delivered to awaiting activities. It is not enough to simply ship material and assume it will arrive on time at the correct location. Material must be continuously tracked, and status information must be quickly and accurately reported.

Effective logistics requires that requisitioning activities be able to identify the location of material in transit and obtain a close approximation of when the material should be delivered. In today's environment of high-tech warfare, operational commanders must be able to maintain equipment at the highest possible state of readiness. The consequences associated with lost or delayed material are too great to rely on inaccurate or slow status information.

The current system for providing this status, however, is antiquated and incapable of fulfilling this critical function. Field logisticians are forced to rely on status information that is neither timely nor particularly accurate. This deficiency results in the premature and unwarranted classification of material as lost in shipment which, subsequently, leads to unnecessary reorders in support of maintenance schedules, equipment repairs, and stock

requirements. Consequently, large quantities of government funds are tied up in useless (and unproductive) requisitions, and unnecessary surveys are prepared to write off material that could have otherwise been located with real-time logistics data.

To understand the relationship between poor logistics information and unnecessary requisitions, one needs only to understand the primary purpose of having field logisticians aboard naval vessels in the first place: to support and maintain the ship. Anyone who has had the displeasure of explaining to the commanding officer of a Navy ship that the whereabouts of his critical material is unknown will testify to the fact that the first priority in the field is to support the ship. It is unrealistic (and unreasonable) to expect field logisticians, under pressure to support the ship, to patiently wait for material to arrive without providing them with the tools to track the material while it is in transit. Only through accurate and easily accessible logistics information will field logisticians (and their operational commanders) learn to trust the supply system and resist the urge to survey and reorder material at the first sign of delay.

The Navy is not unique in its problems with in-transit visibility. In fact, this deficiency is common throughout the armed services, and the Department of Defense is

assertively pursuing a solution through the Defense Total Asset Visibility (DTAV) plan. The DTAV will be utilized by the DoD to improve material management, reduce inventories, and help track material from its original procurement, through the supply and transportation pipelines, to the requisitioning (end-use) activity.

For Navy logisticians, the primary advantage to be derived from DTAV will be improved visibility of in-transit assets. This is an integral part of DTAV and will be provided through the development of the Global Transportation Network (GTN). This system is being designed to collect data from existing DoD and commercial transportation systems, integrate the data in a central database, and provide it to customers on a need-to-know basis.

In addition to providing significantly improved command and control information to the United States Transportation Command, the transportation component commands (AMC, MSC and MTMC) and selected operational and logistics users, GTN will be the core network for in-transit visibility. It will capture the visibility of material when it first enters the transportation pipeline and maintain this visibility throughout (and between) the different transportation modes and carriers to the final destination.

Users of GTN will be able to selectively request and retrieve data as needed from a large number of available

databases throughout the DoD and will be able to choose from a variety of tracking methods. They will be able to access information on the type of material being transferred (including personnel), mode of transportation, geographic area of movement, shipment timeframe, direction of movement (inbound or outbound), and the reason for delays in process.

The value of this information is considerable. It will significantly improve the ability of logistic/supply personnel to support their respective activities by giving them the capability to track and/or locate material in transit at various locations. They will be able to access information regarding requisitions, retrograde, bulk shipments, partial shipments, containers and equipment. In addition, they will have access to shipment manifests, itineraries for individual TCNs, and to a limited extent, to shipment information from non-DoD (commercial) assets.

The benefits to be derived from improved in-transit visibility are both operational and financial. Operationally speaking, improved ITV will result in better support for fleet units by improving the flow of material. It will also help improve receipt processing by allowing field logisticians to quickly determine which material may have reached their local geographic area and which items may have actually been delivered to their unit and possibly stored without a receipt being posted. It will also reduce the overall

burden on the transportation system by helping to eliminate unnecessary shipments of material that have already been delivered in theater, thus allowing limited resources to be utilized more efficiently.

Financially, the benefits come from the elimination (or partial elimination) of unnecessary requisitions. Large amounts of DoD funds are wasted annually repurchasing the same material. Improved ITV can make a significant impact on this problem by providing a detailed trail of material from the source of supply, through the transportation pipeline, directly to the requisitioning activity. This will help field logisticians determine which material charges should be challenged to the issuing activity and which are actual losses in transit. In addition, shipment delays and misdeliveries can be identified and informed decisions can be made by field logisticians and operational commanders on whether to reorder material or to wait for its arrival. Essentially, improved ITV will take the guesswork out of logistics.

The available benefits of improved ITV are limited only by the availability of communication systems capable of accessing it. Most communication systems are developed to support operations and any logistics use is simply complementary. However, field logisticians have access to an assortment of communication systems and techniques, from

telephone to satellite, that could enable them to access logistics information. Thus, technical versatility will continue to be a necessary skill in providing effective logistics support.

The recommended method (and type) of access to GTN while at sea is a combination of direct access and batch processing (via SALTS) using a mix of MILSAT, INMARSAT, and cellular phone communications. The method will depend on the value and priority of material in transit. Direct access to GTN should be limited to high dollar value/high priority material. Although this is a judgement call for field logisticians, it is unlikely that either the manpower or equipment will be available to support continued direct contact with GTN. All other requisitions should be tracked by means of batch processing through the Streamlined Automated Logistics Transmission System (SALTS) interface. This system provides an inexpensive and well-structured alternative to direct access and allows large quantities of requisitions to be tracked simultaneously.

The type of access will depend on the configuration of individual ships and the availability of installed communication equipment. Activities fitted out with MILSAT (Military Satellite) capabilities should utilize this system whenever possible because of the low cost associated with its use. When access to this system is limited or it is

unavailable, activities should use a combination of cellular phone and INMARSAT (International Marine Satellite) as backups. Cellular phones provide the same access as INMARSAT at a much lower usage charge, however, their range is extremely limited. Therefore, the choice depends on the geographic location of the activity relative to its homeport.

In-transit visibility is a rich subject with a great deal of research potential. It is recommended that continued research be conducted to evaluate new systems being utilized in the civilian community to determine if they are applicable for military applications. Since the GTN is being designed to access other databases, the application of new, and more efficient, systems should serve to improve GTN support and not, necessarily, date or antiquate it.

It is further recommended that a study be conducted to stratify DoD inventory (all service components) and attempt to determine the optimal financial investment for in-transit visibility. This report presents the argument that a great deal of resources can be saved throughout the DoD by improving in-transit visibility. However, it remains to be seen exactly how much that is. Through the stratification of DoD inventory, and the application of modeling and forecasting techniques, analysts may be able to determine the optimal amount of resources to invest in equipment and communication

to ensure that the DoD and the American taxpayers are best served by DoD supply systems, transportation commands, and field logisticians.

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APPENDIX A: ACRONYMS

ADAM III	Aerial Port Documentation And Management System
ADP	Automated Data Processing
AMC	Air Mobility Command
APA	Appropriation Purchases Account
AUTODIN	Automated Digital Network
CAPS	Consolidated Air Ports System
CAT	Crisis Action Team
CFM	CONUS Freight Management System
CHCS	Composite Health Care System
CINCS	Commanders-in-Chief
CLF	Combat Logistics Force
COMNAVAIRLANT	Commander Naval Air Force, U.S. Atlantic Fleet
COMNAVAIRPAC	Commander Naval Air Force, U.S. Pacific Fleet
COMNAVSURFLANT	Commander Naval Surface Force, U.S. Atlantic Fleet
COMNAVSURFPAC	Commander Naval Surface Force, U.S. Pacific Fleet
COMSUBLANT	Commander Submarine Force, U.S. Atlantic Fleet
COMSUBPAC	Commander Submarine Force, U.S. Pacific Fleet
CONUS	Continental United States
COTS	Commercial Off-The-Shelf
CPAF	Cost Plus Award Fee
DAAS	Defense Automated Addressing System
DASPS-E	Department of Army Standard Port System-Enhanced
DBOF	Defense Business Operations Fund
DISN	Defense Information System Network
DLR	Depot Level Repairables
DoD	Department of Defense
DoDAAC	DoD Activity Address Code
DRMO	Defense Reutilization and Marketing Offices
DSN	Defense Secure Network
DTAV	Defense Total Asset Visibility
DTO	Direct Turn-Over
DTTS	Defense Transportation Tracking System
EDI	Electronic Data Interchange
EUCOM	European Command
FAD	Force/Activity Designator
FFP	Firm Fixed Price
FIR	Financial Information Report
FISC	Fleet Industrial Supply Center

FOC	Full Operational Capability
GBI	Gained By Inventory
GBL	Government Bill of Lading
CCS	Global Command and Control System
GDSS	Global Decision Support System
GFM	Government-furnished Material
GIS	Gained In Shipment
GTN	Global Transportation Network
HOST	Headquarters On-Line System for Transportation
ICP	Inventory Control Point
IC3	Integrated Command, Control, and Communications System
IDHS	Intelligence Data Handling System
IMM	Integrated Material Manager
INMARSAT	International Maritime Satellite
IOC	Initial Operational Capability
ITV	In-Transit Visibility
JICTRANS	Joint Intelligence Center TRANSCOM
JOPEB	Joint Operation Planning and Execution System
JPEC	Joint Planning and Execution Community
LAN	Local Area Network
LASE	Logistics Asset Support Estimate
LB1	Loss By Inventory
LBS	Loss by Survey
LIS	Lost In Shipment
MALS	Marine Aviation Logistics Squadron
METS III	Mechanized Export Traffic System
MILNET	Military Network
MILSAT	Military Satellite
MILSTRAP	Military Standard Transaction Reporting and Accounting Procedures
MILSTRIP	Military Standard Requisitioning and Issue Procedures
MRC	Major Regional Contingency
MSC	Military Sealift Command
MTF	Medical Treatment Facility
MTMC	Military Traffic Management Command
NC	Not Carried
NCTAMS	Naval Computer and Telecommunication Area Master Station
NIS	Not in Stock
NSA	Navy Stock Account
NSN	National Stock Number
OPTAR	Operating Target
PACS	Passenger Automated Check-In System
PD	Priority Designator
POD	Port of Debarkation

POE	Port of Embarkation
PRAMS	Passenger Reservation And Manifesting System
RCAPS	Remote Consolidated Air Ports System
ROD	Report of Discrepancy
RPS	Remote Processing Systems
SAC	Service Application Code
SALTS	Streamlined Automated Logistics Transmission System
SCI	Sensitive Compartmented Information
SHF	Super High Frequency
SIMA	Shore Intermediate Maintenance Activities
SNAP-1	Shipboard Non-Tactical Automated Data Processing Program
SPCC	Ships Parts Control Center
STACCS	Standard Theater Army Command and Control System
STEL	Stanford Telecommunications
SUADPS-RT	Shipboard Uniform Automated Data Processing System-Real Time
TAC	Terminal Access Controller
TAMMIS	Theater Army Medical Management Information System
TAV	Total Asset Visibility
TCC	Transportation Component Command
TCN	Transportation Control Number
TERMS	Terminal Management System
TPFDD	Time Phased Force Deployment Data
TYCOM	Type Commander
UIC	Unit Identification Code
ULN	Unit Line Number
UMMIPS	Uniform Material Movement and Issue Priority System
USAREUR	U.S. Army Europe
USTRANSCOM	U.S. Transportation Command
WAN	Wide Area Network
WPS	Worldwide Port System
WSF	Weapon Systems File

**APPENDIX B: SHIPPING AND INVENTORY ADJUSTMENTS
AT SAC-207 ACTIVITIES**

TYCOM 1

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 9,649,000	\$ 8,923,000	\$ 11,312,000	\$ 7,554,000
LOST IN SHIPMENT	M5	18,065,000	13,286,000	8,059,000	10,139,000
LOSS BY SURVEY	M6	16,719,000	7,892,000	4,283,000	7,689,000
GAIN BY INVENTORY	D4	(11,700,000)	(9,113,000)	(8,424,000)	(7,391,000)
GAIN IN SHIPMENT	D5	(8,701,000)	(655,000)	(556,000)	(1,096,000)
NET LOSS (GAIN)...		31,863,000	20,333,000	14,674,000	16,895,000
THROUGHPUT		1,211,730,000	1,425,511,000	1,638,040,000	1,386,193,000
NET LOSS (GAIN)		31,863,000	20,333,000	14,674,000	16,895,000
NET LOSS AS A % OF THROUGHPUT		2.63%	1.43%	0.90%	1.22%
THROUGHPUT		1,211,730,000	1,425,511,000	1,638,040,000	1,386,193,000
NET LIS (M5-D5)		17,195,000	12,631,000	7,503,000	9,043,000
NET LIS AS % OF THROUGHPUT		1.42%	0.89%	0.46%	0.65%
THROUGHPUT		1,211,730,000	1,425,511,000	1,638,040,000	1,386,193,000
GROSS LIS (M5 ONLY)		18,065,000	13,286,000	8,059,000	10,139,000
GROSS LIS AS % OF THROUGHPUT		1.49%	0.93%	0.49%	0.73%
RECEIPTS (FIR A3 + F4)		511,742,000	618,435,000	527,335,000	462,182,000
GROSS LIS		18,065,000	13,286,000	8,059,000	10,139,000
GROSS LIS AS % OF RECEIPTS		3.53%	2.15%	1.53%	2.19%

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

TYCOM 2

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 8,411,000	\$ 16,199,000	\$ 36,515,000	\$ 13,453,000
LOST IN SHIPMENT	M5	23,332,000	42,715,000	25,580,000	19,519,000
LOSS BY SURVEY	M6	10,384,000	10,067,000	3,500,000	814,000
GAIN BY INVENTORY	D4	(22,405,000)	(16,080,000)	(38,141,000)	(9,444,000)
GAIN IN SHIPMENT	D5	(667,000)	(380,000)	(804,000)	(1,348,000)
NET LOSS (GAIN)...		19,055,000	52,521,000	26,650,000	22,994,000
THROUGHPUT		1,789,682,000	2,483,113,000	2,213,976,000	2,782,845,000
NET LOSS (GAIN)		19,055,000	52,521,000	26,650,000	22,994,000
NET LOSS AS A % OF THROUGHPUT		1.06%	2.12%	1.20%	0.83%
THROUGHPUT		1,789,682,000	2,483,113,000	2,213,976,000	2,782,845,000
NET LIS (M5-D5)		22,665,000	42,335,000	24,776,000	18,171,000
NET LIS AS % OF THROUGHPUT		1.27%	1.70%	1.12%	0.65%
THROUGHPUT		1,789,682,000	2,483,113,000	2,213,976,000	2,782,845,000
GROSS LIS (M5 ONLY)		23,332,000	42,715,000	25,580,000	19,519,000
GROSS LIS AS % OF THROUGHPUT		1.30%	1.72%	1.16%	0.70%
RECEIPTS (FIR A3 + F4)					
GROSS LIS		NOT	AVAILABLE		
GROSS LIS AS % OF RECEIPTS					

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

TYCOM 3

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 5,180,000	\$ 1,223,000	\$ 4,751,000	\$ 8,503,000
LOST IN SHIPMENT	M5	5,926,000	13,320,000	9,242,000	6,331,000
LOSS BY SURVEY	M6	2,000	(103,000)	1,680,000	2,648,000
GAIN BY INVENTORY	D4	(4,230,000)	436,000	(6,792,000)	(14,471,000)
GAIN IN SHIPMENT	D5	(565,000)	(3,340,000)	(1,830,000)	(158,000)
NET LOSS (GAIN)...		6,313,000	11,534,000	7,051,000	2,853,000
THROUGHPUT		447,004,000	704,369,000	584,155,000	570,288,000
NET LOSS (GAIN)		6,313,000	11,534,000	7,051,000	2,853,000
NET LOSS AS A % OF THROUGHPUT		1.41%	1.64%	1.21%	0.50%
THROUGHPUT		447,004,000	704,369,000	584,155,000	570,288,000
NET LIS (M5-D5)		5,361,000	9,980,000	7,412,000	6,173,000
NET LIS AS % OF THROUGHPUT		1.20%	1.42%	1.27%	1.08%
THROUGHPUT		447,004,000	704,369,000	584,155,000	570,288,000
GROSS LIS (M5 ONLY)		5,926,000	13,320,000	9,242,000	6,331,000
GROSS LIS AS % OF THROUGHPUT		1.33%	1.89%	1.58%	1.11%
RECEIPTS (FIR A3 + F4)		205,112,000	305,600,000	232,562,000	222,473,000
GROSS LIS		5,926,000	13,320,000	9,242,000	6,331,000
GROSS LIS AS % OF RECEIPTS		2.89%	4.36%	3.97%	2.85%

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

TYCOM 4

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 2,149,000	\$ 4,926,000	\$ 5,466,000	\$ 7,036,000
LOST IN SHIPMENT	M5	3,681,000	7,483,000	6,712,000	8,078,000
LOSS BY SURVEY	M6	1,872,000	5,319,000	3,640,000	5,192,000
GAIN BY INVENTORY	D4	(1,742,000)	(4,418,000)	(7,101,000)	(3,330,000)
GAIN IN SHIPMENT	D5	(204,000)	(449,000)	(327,000)	(847,000)
NET LOSS (GAIN)...		5,756,000	12,861,000	8,190,000	16,129,000
THROUGHPUT		362,077,000	692,252,000	520,381,000	587,954,000
NET LOSS (GAIN)		5,756,000	12,861,000	8,390,000	16,129,000
NET LOSS AS A % OF THROUGHPUT		1.59%	1.86%	1.61%	2.74%
THROUGHPUT		362,077,000	692,252,000	520,381,000	587,954,000
NET LIS (M5-D5)		3,477,000	7,034,000	6,385,000	7,231,000
NET LIS AS % OF THROUGHPUT		0.96%	1.02%	1.23%	1.23%
THROUGHPUT		362,077,000	692,252,000	520,381,000	587,954,000
GROSS LIS (M5 ONLY)		3,681,000	7,483,000	6,712,000	8,078,000
GROSS LIS AS % OF THROUGHPUT		1.02%	1.08%	1.29%	1.37%
RECEIPTS (FIR A3 + P4)					
GROSS LIS		NOT	AVAILABLE		
GROSS LIS AS % OF RECEIPTS					

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

TYCOM 5

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 6,739,000	\$ 5,360,000	\$ 3,067,000	\$ 1,486,000
LOST IN SHIPMENT	M5	2,340,000	4,232,000	6,048,000	5,150,000
LOSS BY SURVEY	M6	4,192,000	3,825,000	2,531,000	(145,000)
GAIN BY INVENTORY	D4	(2,641,000)	(5,188,000)	(2,142,000)	(4,503,000)
GAIN IN SHIPMENT	D5	(934,000)	(491,000)	(609,000)	(539,000)
NET LOSS (GAIN)...		9,696,000	7,738,000	8,895,000	1,450,000
THROUGHPUT		510,308,000	598,235,000	533,347,000	436,669,000
NET LOSS (GAIN)		9,696,000	7,738,000	8,895,000	1,450,000
NET LOSS AS A % OF THROUGHPUT		1.90%	1.29%	1.67%	0.33%
THROUGHPUT		510,308,000	598,235,000	533,347,000	436,669,000
NET LIS (M5-D5)		1,406,000	3,741,000	5,439,000	4,611,000
NET LIS AS % OF THROUGHPUT		0.28%	0.63%	1.02%	1.06%
THROUGHPUT		510,308,000	598,235,000	533,347,000	436,669,000
GROSS LIS (M5 ONLY)		2,340,000	4,232,000	6,048,000	5,150,000
GROSS LIS AS % OF THROUGHPUT		0.46%	0.71%	1.13%	1.18%
RECEIPTS (FIR A3 + F4)					
GROSS LIS		NOT	AVAILABLE		
GROSS LIS AS % OF RECEIPTS					

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

TYCOM 6

	FIR	FY-90	FY-91	FY-92	FY-93
LOSS BY INVENTORY	M4	\$ 648,000	\$ 703,000	\$ 1,570,000	\$ 1,444,000
LOST IN SHIPMENT	M5	794,000	676,000	2,595,000	1,688,000
LOSS BY SURVEY	M6	826,000	1,120,000	719,000	406,000
GAIN BY INVENTORY	D4	(1,397,000)	(331,000)	(1,464,000)	(1,207,000)
GAIN IN SHIPMENT	D5	(260,000)	(179,000)	168,000	58,000
NET LOSS (GAIN)...		611,000	1,789,000	3,588,000	2,389,000
THROUGHPUT		160,534,000	174,415,000	152,651,000	171,878,000
NET LOSS (GAIN)		611,000	1,789,000	3,588,000	2,389,000
NET LOSS AS A % OF THROUGHPUT		0.38%	1.03%	2.35%	1.39%
THROUGHPUT		160,534,000	174,415,000	152,651,000	171,878,000
NET LIS (M5-D5)		534,000	497,000	2,763,000	1,746,000
NET LIS AS % OF THROUGHPUT		0.33%	0.28%	1.81%	1.02%
THROUGHPUT		160,534,000	174,415,000	152,651,000	171,878,000
GROSS LIS (M5 ONLY)		794,000	676,000	2,595,000	1,688,000
GROSS LIS AS % OF THROUGHPUT		0.49%	0.39%	1.70%	0.98%
RECEIPTS (FIR A3 + F4)					
GROSS LIS		NOT	AVAILABLE		
GROSS LIS AS % OF RECEIPTS					

(Source: FY90-FY93 SUADPS DI-100 Financial Statements)

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