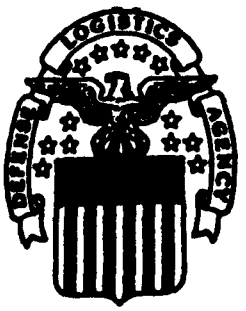
DLA-93-P20339

EMERGENCY SUPPLY EXPERT SYSTEM

April 1993



DEPARTMENT OF DEFENSE
DEFENSE LOGISTICS AGENCY
Executive Director (Plans & Policy Integration)
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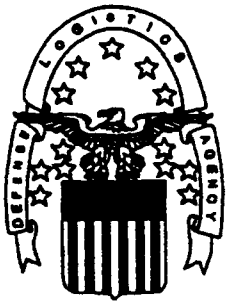

Defense Logistics Agency

Emergency Supply Expert System

Final Economic Analysis
April 1993

KPMG Peat Marwick

Management Consultants

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April 9, 1993

Ms. Jan Rider
Defense Logistics Agency
Building 3 Cameron Station
Alexandria, VA 22304-6100

Dear Ms. Rider:

KPMG Peat Marwick is pleased to submit our final report in accordance with task order F7-04 and Contract F33600-90-D-0223. This report details our analysis, assumptions, methodology, and results. All comments on the draft economic analysis have been addressed; the final economic analysis replaces the draft economic analysis.

We enjoyed performing the economic analysis on this very important topic and look forward to future efforts with DLA. A briefing, as required on the delivery order, can be scheduled at your convenience. If you have any questions or comments, please contact me at (202) 467-3015.

Very truly yours,

KPMG Peat Marwick

Laurence D. Huff, for
S. Daniel Johnson, Principal

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

CONTENTS

ACRONYMS

ACS	Automatic Call Sequencer
AVRS	Automated Voice Response System
C&T	Clothing and Textile
CBU	Commodity Business Unit
CICS	Customer Information Control System
CIT	Consumable Item Transfer
DCSC	Defense Construction Supply Center
DESC	Defense Electronics Supply Center
DESEX	Defense Supply Expert System
DGSC	Defense General Supply Center
DISC	Defense Industrial Supply Center
DLA	Defense Logistics Agency
DLA-LO	DLA Operations Research and Economic Analysis Office
DMINS	Distributed Minicomputer System
DoD	Department of Defense
DPSC	Defense Personnel Support Center
DPSC (C&T)	DPSC-Clothing and Textile
DPSC (Med)	DPSC-Medical
DSC	Defense Supply Center
ESEX	Emergency Supply Expert System
ESOC	Emergency Supply Operations Center
FIFO	First-In, First-Out
FTE	Full Time Equivalent
FY	Fiscal Year
GFM	Government Furnished Material
GS	General Schedule
IG	Inspector General
IM	Item/Inventory Manager
IPU	Integrated Processing Unit
JLSC	Joint Logistics Support Command
LAN	Local Area Network
NARF	Naval Aviation Repair Facilities
NPV	Net Present Value
NSN	National Stock Number
OMB	Office of Management and Budget
PTS	Programmable Transfer Switch
RFP	Request for Proposal
SAMMS	Standard Automated Materiel Management System
SARD	System Analysis Requirements Document
UPS	Uninterruptible Power Supply
VRU	Voice Response Unit

List of Exhibits

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

CONTENTS

EXECUTIVE SUMMARY

This economic analysis of the Emergency Supply Expert System (ESEX) is one of three studies being provided to the Defense Logistics Agency (DLA) under KPMG Peat Marwick delivery order F7-04 of Contract F33600-90-D-0223.

Our report is in accordance with the concepts of DLAM 7041.1 *Economic Analysis* of May 1985 and *PA&E Draft Guidelines*, but is tailored to meet the following client requirements:

- document the original estimate (premodernization) for investment cost and anticipated benefits of implementing ESEX. The sources of this data included an ESEX Executive Summary Report/Business Case dated February 1992, historical budget data, and informal program plan and cost estimates prepared in the 1987-1992 time period.
- analyze and aggregate, actual costs incurred through fiscal year 1992 for development and implementation, and estimate benefits where the system has been in place for sufficient time to have an impact.
- project remaining ESEX implementation and maintenance costs for the period fiscal year 1993 through 2001 and estimate accrued benefits for the same period.

Following these steps, we then provide appropriate before and after comparisons and return on investment/payback calculations.

Introduction and background

ESEX development began in 1990 to improve customer service at the Emergency Supply Operation Centers (ESOC) within the DLA Defense Supply Centers (DSC). Each ESOC responds to worldwide customer telephone inquiries, initiated by Department of Defense (DoD) military services and other agencies who order equipment, parts, and consumables from the DLA logistics infrastructure. Telephone inquiries typically are made to submit a requisition, check on a requisition status, modify a requisition, or check the availability of a stock item. ESEX automates the process of answering routine customer service requests that come into the ESOC each day, and provides quick, accurate, customer information with minimal time spent on hold. In May 1992, ESEX was chosen by the Joint Logistics Systems Center (JLSC) as the DoD standard system for ESOC operations. As a result, ESEX is now also called Defense Supply Expert System (DESEX).

The system was introduced in 1990 at the Defense Industrial Supply Center (DISC) where it has been in operation since July 1991. ESEX was installed at the Defense Electronics Supply Center (DESC) in September 1992 (operational on October 8, 1992) and at the Defense General Supply Center (DGSC) in October 1992. These sites were the sources of actual ESEX performance statistics.

ESEX is comprised of automated voice response system (AVRS) engines, system software, a programmable transfer switch (PTS), and an Ethernet local area network (LAN). The LAN connects the logistics data mainframe computer to the AVRS. The AVRS translates touch tone pulses into data that the mainframe can understand and manipulate and return requested information to the customer in English language words. The Programmable Transfer Switch (PTS) distributes call workload between the individual AVRS engines.

Methodology

The study team gathered statistical data from the three sites currently operating ESEX within DLA. Through trips to two ESOCs, the Peat Marwick team was able to participate in a system demonstration, view the system hardware configuration, and analyze actual managerial

statistical reports. Workload data were readily available within the ESEX statistical reports and were used for benefit determination. Data were accumulated from sites not visited through extensive telephone interviews.

Premodernization scenario

The premodernization scenario in this analysis was defined to include original estimates of system functionality and associated cost and benefit estimates as defined in planning documents prepared early in the program life. The idea to implement an automated system to answer routine calls originally stemmed from a DLA employee suggestion. The original system analysis and requirements document (SARD) was prepared in November 1986 and included specific system requirements. Based on the SARD, a request for proposal (RFP) for development of an AVRS was released for solicitation in 1989. The RFP requirements were a further enhancement to the requirements presented in the SARD.

No extensive program cost estimates or economic studies were conducted at ESEX program initiation. In 1987, an informal estimate to procure one limited variant AVRS was found to be approximately $58,000 (fiscal year 1987 dollars). A similar document was found indicating a potential savings of 3 GS-5 supply clerks at a total savings of $46,050 per year (fiscal year 1987 dollars - DISC only) was possible with implementation of a voice response system. In February 1992, DLA prepared an executive summary report, which on a very high level documented costs and benefits associated with ESEX implementation. The report estimated remaining equipment costs to be $1.1 million, but it did not include sunk software development costs or implementation costs prior to March 1992 . Maintenance costs were estimated at $85,500 a year beginning one year after the equipment was purchased. Benefits on a DLA-wide level were estimated to be $510,000 annually, resulting from a 17 employee reduction. Exhibit 1-1 summarizes the two original estimates.

Exhibit 1-1
Original Estimates of Costs and Benefits (000$)

	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	TOTAL
1 1987 Economic Analysis (FY 87$)											
Investment	$58	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58
Savings	46	46	46	46	46	46	46	46	46	46	461
Net Savings/(Cost)	(12)	46	46	46	46	46	46	46	46	46	403
Net Savings/(Cost) (FY 93 $$)	($15)	$55	$53	$51	$49	$48	$46	$44	$43	$41	$415

	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
2 Executive Summary Report (FY 93$)											
Investment	N/A	$1,160	$0	$0	$0	$0	$0	$0	$0	$0	$1,160
Operation	0	0	86	86	86	86	86	86	86	86	684
Savings	0	510	510	510	510	510	510	510	510	510	4,590
Net Savings/(Cost)	$0	($650)	$425	$425	$425	$425	$425	$425	$425	$425	$2,746

Notes
1 Estimate for one site only
2 Estimate for all DLA sites

Incurred costs and accrued benefits

ESEX was designed to perform the same top level functions the operators performed without automation. However, ESEX has allowed the ESOCs to be more efficient. Since ESEX was contractor developed, functionality and actual costs for design, procurement, implementation, and maintenance were documented through executed fixed price delivery orders. Actual expenditures began in March 1990, and through September 1992 totaled $1,546,095. This includes development, procurement, and installation of the ESEX system at DISC, DESC, and DGSC.

As discussed previously, initial ESEX installation occurred at DISC in July 1991, followed by DESC in September 1992, and DGSC in October 1992. As of the time of this study, the following impacts have been observed as a result of ESEX.

- DISC ESOC is reducing its customer service staff by three personnel effective January 1993. Extrapolation of this savings correlates with DESC and DGSC planned or actual savings, and is used in projecting the balance of savings across the three remaining DSCs. These savings begin to appear in fiscal year 1993 and are quantified and shown in the Future Costs and Benefits section of this study.

- ESOCs with ESEX are now meeting previously unserviced demand. DISC workload has increased from an average of 12,715 to 33,820 monthly calls. DGSC has increased its average monthly calls from 13,214 to 21,739 over a two month period, and DESC has realized an increase from 15,539 calls to 23,358 over three months of operation. Cost avoidances associated with personnel required to meet this increased workload (unrealized customer demand) equate to approximately 19.9 workyears at DISC. A time-phased build up of these projected savings are shown in this section for DISC (through fiscal year 1992), and for all centers, fiscal year 1993 and beyond, in the following section.

A summary profile from program inception through fiscal year 1992 is shown in Exhibit 1-2. Due to the nature of the development contract, an immaterial amount of system maintenance has been incurred as of the end of fiscal year 1992.

Exhibit 1-2
Incurred Costs and Benefits (Through FY 92)
(Actual Year Dollars)

	FY 90	FY 91	FY 92	TOTAL
Investment				
Hardware	$0	$419	$329	$748
Software	205	252	226	683
Other	0	36	79	115
Total Investment	$205	$707	$634	$1,546
Hardware Maintenance	0	0	0	0
Total Cost	$205	$707	$634	$1,546
Total Cost (FY 93$)	229	750	657	1,637
Cash savings	0	0	0	0
Net cash savings/(cost)	($229)	($750)	($657)	($1,637)
Cost Avoidance	0	150	602	752
Net total savings/(cost)	($229)	($600)	($56)	($885)

Future costs and benefits

Future ESEX costs to be incurred include the costs associated with ESEX implementation at three remaining sites: the Defense Personnel Support Center - Medical (DPSC-Med), the Defense Personnel Support Center - Clothing and Textile (DPSC-C&T), and the Defense Construction Supply Center (DCSC). Annual maintenance expenses for ESEX equipment are also included in this section. Benefits are presented in two categories:

- cash flow (personnel) savings: Using DISC, DESC, and DGSC actual experience and extrapolating for the balance of the centers, it is estimated approximately 15.7 workyears at a cost of $457,088 will be saved annually DLA wide.

- cost avoidance: Assuming workload increases similar to those observed at DISC, DESC, and DGSC will occur at the remaining 3 centers, approximately 53 workyears per year are being avoided to meet the projected workload.

Exhibit 1-3
Future Costs and Benefits (FY 93 and beyond)
(FY 93 000$)

	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Total Investment	$694	$0	$0	$0	$0	$0	$0	$0	$0	$694
Hardware Maintenance	32	117	117	117	117	117	117	117	117	968
Total Cost	$725	$117	$117	$117	$117	$117	$117	$117	$117	$1,661
Cash savings	272	457	457	457	457	457	457	457	457	3,928
Net cash savings/(cost)	($453)	$340	$340	$340	$340	$340	$340	$340	$340	$2,267
Cost Avoidance	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	13,695
Net total savings/(cost)	$730	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$15,962

Summary

A summary comparison of the original economics of ESEX (the fiscal year 1992 Executive Summary Report) and actual history plus future projections is shown in Exhibit 1-4. Financial ratios are shown in Exhibit 1-5.

Exhibit 1-4
Summary Comparison of Costs and Benefits

Incurred and Future Costs and Benefits (FY 93 $000)

	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Total Investment	$205	$707	$634	$694	$0	$0	$0	$0	$0	$0	$0	$0	$2,240
Hardware Maintenance	0	0	0	32	117	117	117	117	117	117	117	117	968
Total Cost	$205	$707	$634	$725	$117	$117	$117	$117	$117	$117	$117	$117	$3,207
Total Cost (FY 93$)	229	750	657	725	117	117	117	117	117	117	117	117	3,298
Cash savings	0	0	0	272	457	457	457	457	457	457	457	457	3,928
Net cash savings/(cost)	($229)	($750)	($657)	($453)	$340	$340	$340	$340	$340	$340	$340	$340	$631
Cost Avoidance	0	150	602	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	14,446
Net savings/(cost)	($229)	($600)	($56)	$730	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$15,077

1992 Executive Summary Report Costs and Benefits (FY 93 $000)

	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Executive Summary Report (FY 93$)											
Investment	N/A	$1,160	$0	$0	$0	$0	$0	$0	$0	$0	$1,160
Operation	0	0	86	86	86	86	86	86	86	86	684
Savings	0	510	510	510	510	510	510	510	510	510	4,590
Net Savings/(Cost)	$0	($650)	$425	$425	$425	$425	$425	$425	$425	$425	$2,746

Exhibit 1-5
Financial Ratios

	Personnel Only	Total Savings	DLA EA
Net Present Value ($000)	$1,298	$10,385	$1,540
Discounted Payback	2.51	0.50	2.80
Savings Investment	2.96	16.70	2.55
Notes:	- Excludes investment incurred prior to FY93 - Total savings includes 53 FTE cost avoidance - Equates to 15.5 FTE cash savings annually - Sunk costs not included in financial ratios		- DLA 1992 Executive Summary Report - Excludes investment cost incurred prior to FY93 - Does not address cost avoidance to meet workload - Equates to 17 FTE cash savings annually - Sunk costs not included in financial ratios

In summary, the 1992 DLA executive summary economic analysis estimated a 17 person savings valued at $510,000 annually. Current estimates of annual cash savings stem from personnel reductions (excluding cost avoidances) of 15.7 full time equivalents. The current analysis contains costs from program inception through fiscal year 2001. These costs total $3,298,000 in fiscal year 1993 dollars. Excluding sunk costs, total investment and operations costs were estimated at $1,661,000. The DLA executive summary economic analysis only included costs occurring in fiscal year 1993 or later. Therefore, the DLA report should be comparable to this analysis when sunk costs are excluded. In fact, the DLA cost estimate of $1,844,000 does correlate to the current estimate that excludes sunk costs. Combining the personnel cash savings with these investment and maintenance costs yields the net values and basis for the financial analyses presented in Exhibit 1-5.

When cost avoidances associated with processing an increased work load are included, the current estimates change dramatically. The net present value increases to $10.4 million, the discounted payback decreases to one half of one year, and the savings investment ratio increases to more than sixteen. All discounted costs and benefits are presented in the report summary, Section 7.

In addition, the following non-quantifiable benefits are the result of ESEX:

Improved Customer Service. The significant increase in customer usage of the ESOC resource since the introduction of ESEX is a clear indication of improved customer service. Customer productivity has been enhanced through decreases in time wasted waiting on hold for a customer service person, or being inadvertently disconnected and having to repeat the inquiry cycle.

Improved Material Readiness. ESEX provides a tool for anticipating and avoiding priority system supply problems.

Better Application of Resources. ESEX has enabled DLA management to focus dwindling personnel resources on value added knowledge work as opposed to routine tasks. In particular, DLA has been able to shift resources from the phone operator sections to Intensive Management sections and special projects related to priority item backlogs.

Improved Data for Management Decisions. ESEX generates automated reports on the nature of customer requests, type, source frequency, time, and many other parameters which provide insight to DLA managers.

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

CONTENTS

INTRODUCTION AND BACKGROUND

The purpose of this economic analysis for DLA is to analyze the life cycle costs and benefits for the development and implementation of ESEX. In our report, we analyze the original estimates of costs and benefits made early in ESEX development. We next document the actual costs and benefits that have accrued through the end of fiscal year 1992. Finally, we estimate additional life cycle costs for full implementation and additional benefits to be accrued through fiscal year 2001.

ESEX was developed in 1990 and 1991 to improve customer service at ESOCs within DLA. The system automates the process of responding to routine customer service requests at the ESOC each day, and provides quick, accurate information to the customer.

Emergency supply operations centers

The ESOCs are designed and staffed to be service-oriented organizations capable of expeditiously responding to urgent requirements. DLA currently operates six field ESOCs. The four hardware DSCs are: DCSC in Columbus, Ohio; DESC in Dayton, Ohio; DGSC in Richmond, Virginia; and DISC in Philadelphia, Pennsylvania. DPSC in Philadelphia, Pennsylvania, houses two ESOCs: DPSC-C&T and DPSC-Med. Each ESOC manages a particular class of National Stock Numbers (NSN). Exhibit 2-1 gives a brief overview of the variety of commodities serviced at each center. The centers perform general inventory management, procurement, and quality assurance functions for their assigned commodities. DLA currently manages approximately 3.2 million NSNs through its supply centers. Although not the primary managers of the items, the ESOCs are directly involved when emergencies arise.

Each ESOC must respond to worldwide customer telephone inquiries initiated by DoD military services and other agencies, regarding requisition submission, status, modifications, and stock availability. Each ESOC has staff available to assist customers 24 hours a day, 365 days a year. Although each center is organized slightly differently, each ESOC generally devotes a section to customer service. The size of the customer service section varies with the size of the supply center, but on average there are approximately six to eight operators available to handle ESOC customer calls; a smaller staff is available during off-peak hours.

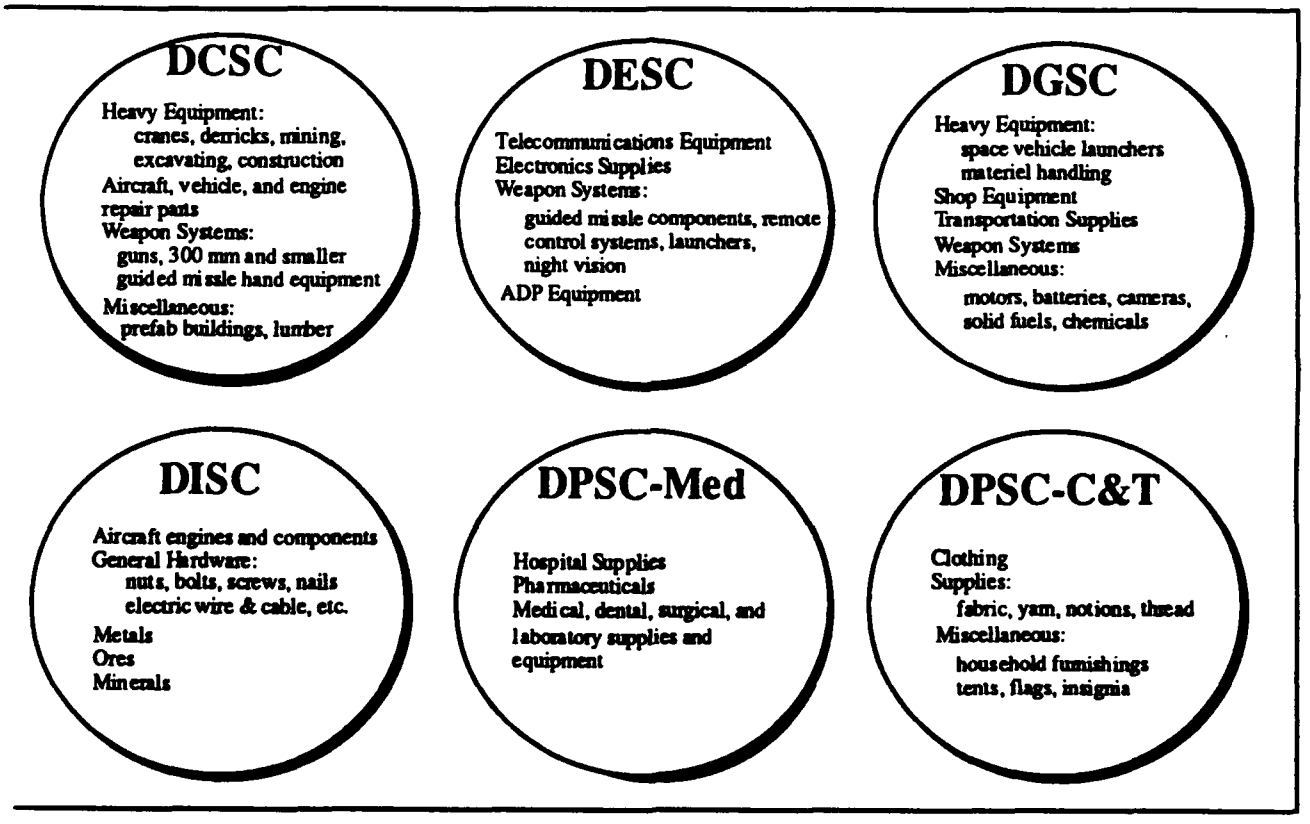
Our study was conducted at a time when several reorganization and realignment initiatives were ongoing at the supply centers. A number of these initiatives are affecting the current structure of the ESOCs. For example, DISC is transitioning to a Commodity Business Unit structure which is a departure from a traditional functional orientation to a product orientation. Such a product orientation will be comprised of teams which include inventory managers, contracting specialists, ESOC personnel, and others focused on commodity groups. Other supply centers are considering similar realignments. The impact of these organizational changes on our study is added complexity in assessing personnel savings as compared to organizational staffing movement.

ESOC missions and functions

The missions and functions of the ESOCs are described in the following documents. DLAM 5810.10, *Organization of DLA Field Activities* (December 1986), requires that the ESOC Customer Assistance Section "process high priority requisitions and follow-ups received by telephone and written means, and that the section provide status and stock information." According to DLAM 4140.2, *Supply Operations Manual*, Volume II, *Defense Supply Center Operating Procedures* (June 1982), "ESOC personnel will react promptly to urgent follow-

ups, status and/or supply assistance requests received by telephone, message, and so forth during normal or other than normal duty hours. To ensure this capability, DSCs will assure that existing computer and/or information systems are operational and scheduled to provide a daily flow of information and/or status to either ESOC or the customer as applicable." In DoD 4000.25-1-M, *Military Standard Requisitioning and Issue Procedures* (May 1987), it is stated that priority 01 (mission critical), 02 (emergency), and 03 (routine) documents will be processed when "data patterns and narrative message facilities are not available" and "exception data are absolutely necessary to convey the true urgency of the requirement and the exception data cannot be transmitted in an exception document."

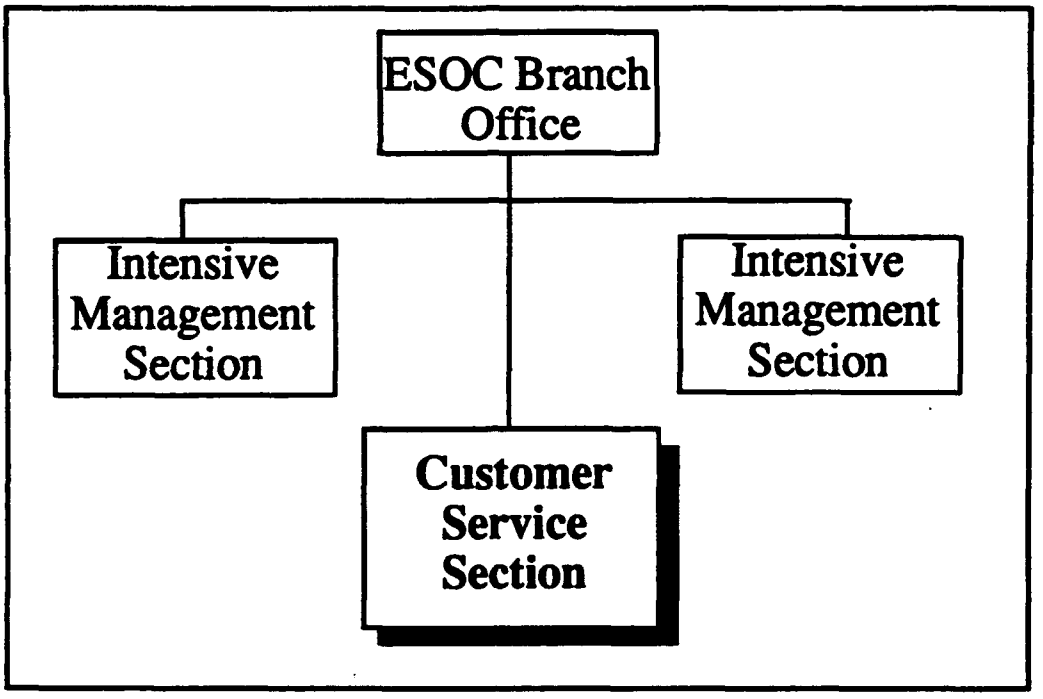
Exhibit 2-1
Defense Supply Center General Commodity Descriptions



The role of the ESOC at each DSC is outlined in the "*Organization, Missions, and Functions*" manual for that particular DSC. This document is the individual DSC's version of DLAM 5810.10. It details the missions and functions of the supply center by directorate, branch, and section. The ESOC acts as the central point for customer problems, complaints, reconciliation, and follow-up for issue priority group one requisitions. ESOCs are generally divided into two major sections: the Intensive Management Section and the Customer Service Section. An illustration of the general layout of staffing at a DSC ESOC is provided in Exhibit 2-2. This illustration serves only to outline how staff is allocated at the ESOC. At each DSC ESOC there may be any number of sections for intensive management or customer service.

Intensive Management Section. The Intensive Management Section resolves critical supply problems that have an impact on the worldwide materiel readiness of the United States Armed Forces. This section manages and controls high priority supply projects and materiel obligations. Critical supply problems are handled in this section. This area may direct that

Exhibit 2-2
ESOC Branch Sections



new or additional procurements be made or inventories be consumed, or it may order the recoupment of materiel from property disposal. The Intensive Management Section is also responsible for developing and maintaining records of recurring supply trends, conducting studies to establish causes of these trends, and identifying and recommending corrective actions.

Customer Service Section. The Customer Service Section handles the majority of customer inquiries and is the primary focus of this analysis. The customer service operators receive and monitor telephonic and message requisitions and requests for status for all issue priority groups. This section responds to all supply assistance messages, requests for foreign military sales price and availability, and inquiries concerning requisition status. The Customer Service Section also acts to ensure that assets are found to fill high priority requisitions during both regular and off-duty hours. This section is directly affected by the implementation of ESEX.

Size and scope of ESOCs

Owing to the urgent nature of the requisitions processed at each ESOC, it is necessary to have staff available to handle customer inquiries around the clock, 365 days a year. The majority of customer inquiries occur during regular business hours; however, calls can come in to the center at any time. Prior to the implementation of ESEX, the typical ESOC was capable of handling approximately 8,000 to 10,000 calls per month, but even processing this large volume of calls, customers were routinely required to wait up to 20 or 30 minutes during peak periods before reaching a human operator. With ESEX, the ESOCs have been able to process up to three times the workload with greater efficiency and no increase in staffing.

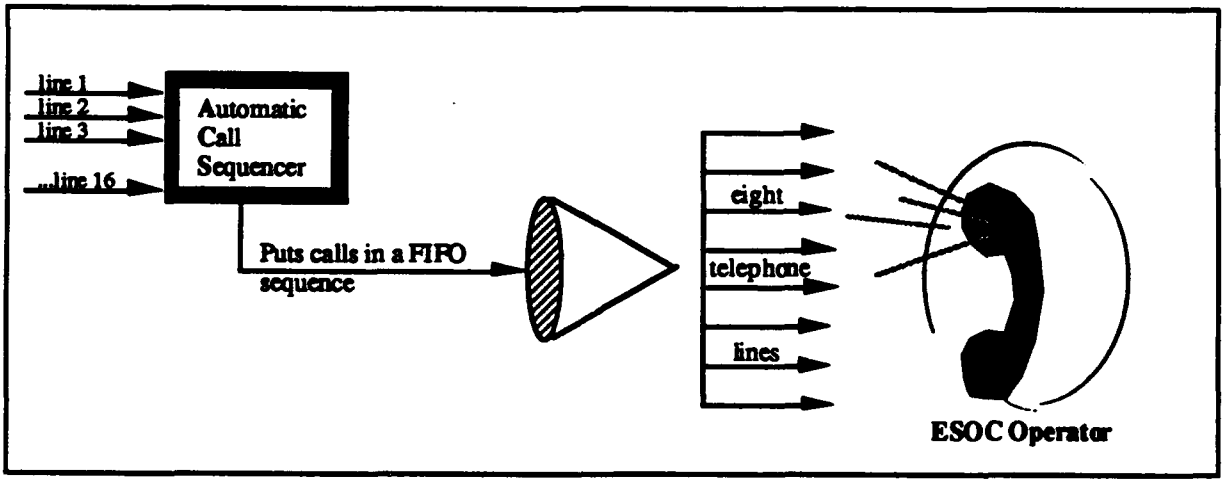
ESOC customers

The typical ESOC serves a variety of customers including the military services and DoD agencies. For example, the ESOC at DISC serves approximately 13,000 military customers, with the vast majority of the calls coming in from the top three or four customers each month. Some of DISC's larger customers include the Air Force Logistics Command with bases at Robbins, Hill, and McClelan Air Force bases, and Naval Aviation Depots (formerly known as Naval Aviation Repair Facilities (NARF)) with bases at Jacksonville and Pensacola. Approximately 10 percent of all transactions are for sales to foreign military such as Saudi Arabia and Israel, who purchase aircraft parts through the ESOC at DISC. Each ESOC has different customers based on the NSN class that it services.

Existing methods prior to ESEX

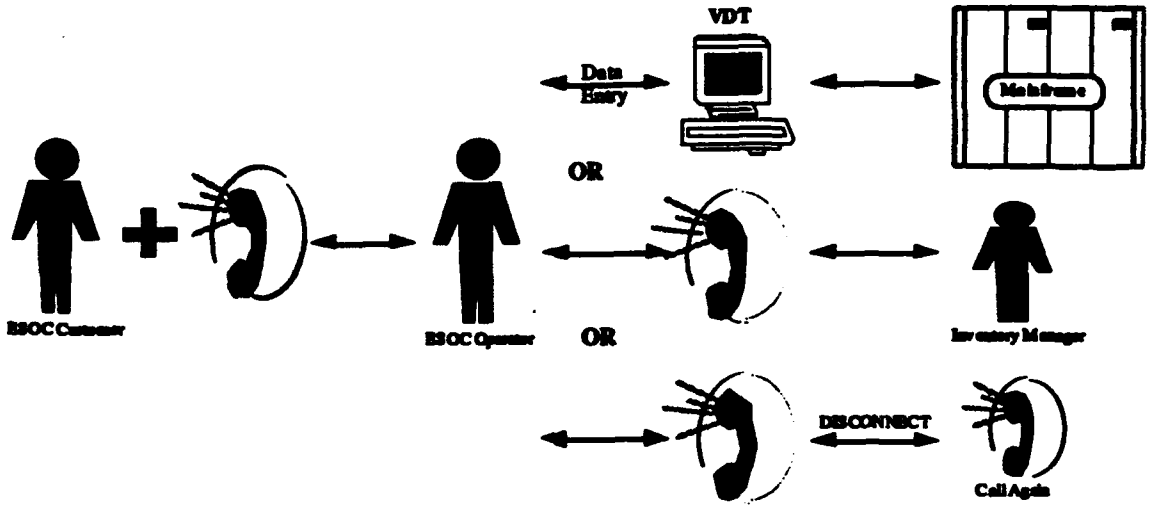
Prior to the implementation of ESEX, the Customer Service Section processed inquiries in a largely manual fashion. An Automatic Call Sequencer (ACS) took the incoming calls and placed them in a first-in, first-out (FIFO) sequence. Calls would wait in a queue until an ESOC operator's telephone line became available. Since there were generally more lines coming into the ACS then there were lines going out to the ESOC operators, callers had very little chance of avoiding a wait. Each operator's phone had a two-position switch. When the switch was in the active position, the handset would appear "busy" to the ACS and the customer would remain in the FIFO sequence until a line became available. Exhibit 2-3 illustrates this process.

Exhibit 2-3
Pre-ESEX Call Sequence



When the ESOC customer did finally get in touch with an operator, the inquiry could begin. The operator manually answered the telephone, then input the customer data on a requisition inquiry via computer terminal to the mainframe. After the necessary data were retrieved, the ESOC operator relayed the requested information back to the customer. This process continued until the customer had completed all required transactions. In some instances, customers waited in the queue to speak to the ESOC operator only to find out that the ESOC operator couldn't help them, and that it would be necessary to transfer them to an inventory manager (IM). The actual transfer could result in a variety of actions. The customer could reach an IM on the first try, be transferred only to get placed on hold again, or, in the worst case, be disconnected during the transfer and have to place another call to the ESOC to begin the process again. The various steps in this process are shown in Exhibit 2-4.

Exhibit 2-4
Pre-ESEX Customer Service Process



This process was cumbersome and did not satisfy the ESOC's mission as outlined in DLAM 4140.2, *DSC Operating Procedures* (June 1982) to "react promptly to urgent follow-ups, status and/or supply assistance requests received by telephone ... during normal or other than normal hours." The DoD Inspector General (IG) noted these shortcomings in a report on DSC ESOCs.

Inspector General findings

A DoD IG report dated March 5, 1986, found that there were significant requisition backlogs at all ESOCs. The IG finding essentially gave DLA two options: hire additional staff and install new/upgraded equipment or install an automated system. The IG reported that "the foregoing situation results in a degradation in meeting the military issue priority time frames as well as the war readiness condition of weapon systems of the military services." In the same report, the DoD IG tasked DLA to obtain and maintain adequate and skilled personnel, accelerate the delivery of high speed electronics equipment, and provide necessary command attention commensurate with the ESOC mission of high priority support of customer requirements and the ever increasing backlog of order/information processing. ESOC staffing at that time was inadequate to handle the large volume of customer calls coming into the center; they could not adequately fulfill the mission of ESOCs as stated by the DoD IG inspection. Many customer requests were not being answered when the system was manual for the sole reason that there was not any adequate means of meeting the huge demand for service. Additionally, as proven by the significant increase in inquiries after ESEX implementation (approximately 165 percent at DISC), considerable unserviced demand existed which was not evident to GAO or DLA.

The development of an electronic AVRS was DLA's response to the IG's findings. The system was originally planned to be no more than an elaborate answering machine; functionality was limited to a few basic operations.

Original plan for voice response system

A DLA employee provided the original idea for voice automation. The original system configuration consisted of a minicomputer, voice-response unit (VRU), software to access the mainframe, and application software. The customer would call the ESOC customer service

telephone number and an automated voice would respond with a welcome message followed by a question asking the caller if he/she required stock availability information. If the customer did require this information, he/she would be directed to depress the number "1" on the telephone keypad. The caller would then be directed to key in the NSN. After the requested data was entered, the system would reply "yes" or "no," depending on whether there was stock on hand. The caller could also make an inquiry concerning the status of specific document numbers by depressing the number "2" on the keypad. (Since this would require the use of both alpha and numeric characters, this capability would have to be incorporated.) The third and final option would be to press "3" and be connected to a supply clerk in the Customer Service Section. These original plans, over time, evolved into ESEX.

ESEX

The original functional requirements gradually expanded in scope to cover much broader functionality and to make ESEX a system that could easily be expanded in the future. System functions now include features to allow the user to make stock availability and/or requisition status checks, place new requisitions, and modify existing requisitions. (The ability to transfer to an inventory manager from within ESEX has been defined as a requirement by the Navy. The inclusion of this feature will require future modifications to ESEX.) Upon connecting with ESEX, the user is greeted by a friendly, human voice that guides them through a series of menu selections, and prompts which assist the user in navigating through the system. ESEX was designed so that the expert user can skip through the recorded explanations if they already know the path to the selections they want to use.

Industry use of similar technology

Automated voice response technology similar to that used at the DSC ESOCs is becoming increasingly popular in industries ranging from banks and electric companies to restaurants and automotive repair shops. According to Rob Reid of Information Access Company, "Voice information processing technology can help companies reduce labor costs by automating tedious telephone answering and basic message response." [1] Boston Edison, an electric company in Boston, Massachusetts, implemented a voice response system in its call center.

Boston Edison

Boston Edison provides electricity for over 645,000 customers, mostly residential, for the greater Boston area, which encompasses a 30 mile radius and includes over 40 cities. The customers dial a customer service call center with questions concerning billing, service interruptions, new service applications, power loss, conservation requests, and meter readings. Prior to implementing an AVRS, the staff of 56 agents was manually processing over 20,000 calls a week. The full staff is available between 8:00 AM and 5:00 PM, Monday through Friday, with some staff members working extra hours and Saturdays to assist customers. There is also a special crew available 24 hours a day to take emergency calls. Owing to the extremely high volume of customer inquiry calls, Boston Edison realized there was a great need to improve efficiency at the call center.

During the 1987/1988 time frame, volume was increasing at a 10 to 15 percent rate per year and wait times were approaching six minutes per call. Only 80 percent of the calls were being answered; the remainder of the callers hung up while waiting on hold. It was becoming increasingly difficult to provide an adequate level of customer service at the call center. Boston Edison was hard pressed to find a cost-effective way to improve service and increase

[1] Reid, Rob, "New Emerging Application for Voice Information Processing," *Information Access Company*, volume 25, number 12, page 43.

productivity without increasing staff. Because of regulations prohibiting a rate increase for three years, it was critical that Boston Edison meet these constraints. Voice processing technology was the solution. After tallying the types of calls that were coming into the center, removing routine questions from the queue seemed to be the answer.

In 1990 Boston Edison installed their voice response system, Information Express. Information Express has improved the call center answer rate by almost 13 percent, reduced the number of abandoned calls from 20 percent to 7 percent, and enabled agents to spend more time with customers handling complex inquiries. Since implementation, the number of incoming calls has increased 20 percent; however, wait times have been dramatically reduced. Customers are now able to use the system to check account balances, track payments, or find out when their next meter reading is scheduled. Eighty percent of calls are answered within 30 seconds and 92 percent are answered within one minute. "There's no doubt that the strategic use of technology has helped us to improve customer service. From virtually every vantage point, the benefits of technology at Boston Edison are evident. Our service results speak for themselves - and the word is efficiency." [2]

LL Bean

Other companies are also exploring the advantages of linking telephones to mainframe computers using different types of technology. LL Bean, a Maine-based mail order house for outerwear and camping supplies recently installed a new system in their customer service department. When a customer calls LL Bean, the system automatically detects the caller's number using a caller ID function. If the caller has called LL Bean before, the system automatically pulls up a record of prior purchases and displays that information on the computer screen before the operator. Clerks can answer the call by saying, "Hello, Mr. Smith, are you enjoying your new tent you bought last month?" LL Bean reports that customers are impressed with the service, in addition to that benefit, the need for customers to provide operators with their name and address is eliminated. If a caller is calling for a second time about a problem, the call is automatically routed to the same agent who handled the call previously. This type of functionality, while not "voice response technology", also improves customer service.

New technology is being developed

The basic features of a voice response system are becoming fairly standardized; customers key in necessary data via their touch-tone phone, and information is relayed back to them by a human voice. However, new technology is being explored throughout the industry that may even further expand the benefits of a voice response system. Two of those newer features are "Whisper Service" and interactive fax capabilities.

Whisper Service. This feature, used by Boston Edison in conjunction with their AVRS, is designed to improve efficiency in assisting customers after they have been transferred from the voice response system to an operator. Callers who wish to speak to an operator can press 0 at any time to be transferred. Transfers activate the "Whisper Package" software, which enables the operator to know who the next caller will be before answering the call. The software retains the customer's account number and whispers the number into the operator's headset before the call is transferred. This allows the operator to access the customer's account before picking up the phone. This feature streamlines service, is personalized, and eliminates the need for customers to repeat their account numbers.

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[2] Toledo, Philip A., "Speaking of Efficiency, Say Hello to Voice Technology," *Science and Technology*, volume 129, number 11, page 38.

Interactive Fax. An interactive fax program integrates a company's automated voice response system with a fax server. Michael Sisselman, director of sales and marketing for Menu Fax, an interactive voice response restaurant hotline serving the New York City area, said, "It's hard for the average caller to both process and scribble information down. By sending callers a hard copy via fax, callers can visibly have the information in front of them." Other companies have used interactive fax capabilities to fill out electronic forms, order, receive, and view hard copies of data and images requested and/or processed via telephone and received via fax machine.

Based on discussions with DLA personnel, hardware associated with ESEX has fax capability; however, additional hardware would be required to actually utilize this feature. Because the current contract does not include the additional equipment required for fax capability, DLA would have to investigate what contracts exist that would satisfy its requirements. Therefore, as ESEX stands today, fax capability is not available to DLA.

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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ANALYSIS METHODOLOGY

This analysis provides an economic perspective of ESEX as it was originally planned, as it has actually been implemented through 1992, and as it is projected to operate through the end of fiscal year 2001. To meet these objectives, separate evaluations of the costs and benefits during the three different time periods are necessary. The first period, referred to as the premodernization scenario, includes the original estimates of costs and benefits made prior to fiscal year 1992. The second period, called incurred costs and accrued benefits, analyzes costs and benefits that have actually been accrued through fiscal year 1992. The final period, called future costs and benefits, begins with fiscal year 1993 and extends through fiscal year 2001, and projects estimates of additional costs and benefits.

Within the context of the system development life cycle, the ESEX system is in the later portion of the implementation phase. Exhibit 3-1 illustrates the phases of the system development life cycle and their relation to ESEX. These segments illustrate the concept, development, implementation, and post implementation phases of the ESEX system. The three sections of this analysis – premodernization scenario, incurred costs and accrued benefits, and future costs and benefits – focus on portions of phases in the life cycle process.

Exhibit 3-1
Life Cycle Development Phases

Phase 1	Concept	1987-90
Phase 2	Development	1990-91
Phase 3	Implementation	1991-93
Phase 4	Post Implementation	1993

Existing documentation

Because all scenarios in this economic analysis were predefined, existing documentation regarding each scenario became the key to performing this analysis. The ESEX system has been documented from the development stage through implementation; however, the documentation of the initial concept phase of ESEX was both the oldest and most difficult to obtain. Because the design and implementation of ESEX were performed by a contractor, cost data were available through analysis of the basic contract and subsequent delivery orders. In contrast, because the processes ESEX automated were unique, typical documentation such as labor standards and workload flow metrics were unavailable. Documentation reviewed included numerous briefings and memos as well as contractor proposals, system specifications, and user's manuals. Appendix A contains a list of all existing documentation reviewed during the course of this study. Through the assimilation of existing ESEX documentation, we were able to gain a thorough understanding of the evolution of ESEX from a system that performs a few basic operations to the completed ESEX that DLA operates today.

A variety of sources of data were tapped to prepare this analysis. As a final source of information, we were able to obtain and analyze actual management level statistical reports that ESEX provides. As discussed later in this report, ESEX provides more accurate management data in a more timely manner when compared to the manual method of estimating workload.

Documentation supplemented with interviews and research

To provide a complete analysis, written documentation was supplemented by conducting interviews with personnel both at headquarters and at individual ESOCs. This was done to ensure accurate interpretations of documentation and to provide depth to our overall understanding of ESOC functions and ESEX's capabilities. Personnel with an understanding of ESEX's development and/or current usage were sought. The study team made several visits to DISC and DGSC and spoke to ESOC personnel at each DSC. Appendix B lists all personnel

interviewed during the course of this analysis. These interviews allowed the team to get first hand information regarding how the implementation of ESEX changed the way of doing business at the ESOCs. The Peat Marwick team was also able to actually observe ESEX in operation and witness a demonstration of its features.

ESEX statistics

ESEX was designed with functions that allow ESOC management to compare the performance of ESEX at different points in time and obtain a profile of the organizations that are calling ESEX. Statistics are gathered for system information (including per call data, usage data, system totals), maintenance information on a per line basis, and customer information (details of who is calling ESEX and what kinds of transactions are performed). These statistical reports were obtained and thoroughly analyzed by the study team to aid in the quantification of system workload and benefits.

Benefit estimation

User interviews and extensive analysis of workload statistics were employed in order to develop an estimate of the accrued and potential benefits associated with implementation of ESEX. The interviews generally focused on how the implementation of ESEX changed the way ESOC personnel performed their work. Initial investigation focused on DISC, since ESEX was in operation for over one year at this ESOC. However, workload data used in the analysis was gathered from all sites.

Review of initial findings

Information gained from separate interviews was compiled, organized, and summarized. This information was then reviewed with ESOC personnel for adequacy and reasonableness. The results were presented both verbally and in written form to ESOC personnel. Further investigation was conducted as necessary to address issues raised during the discussion. In an attempt to verify information to the widest degree possible, our findings were then circulated to other ESOC personnel and supply personnel knowledgeable about ESEX. In addition to reviews by functional personnel, data gathered during this analysis were also reviewed by representatives from DLA Headquarters.

Major assumptions

Throughout the course of this analysis assumptions were made to properly define the scope of our investigation and permit the comparison of relevant costs and benefits at three different points in time. The following subsections provide background information and justification regarding these assumptions. Assumptions can be grouped into four broad categories:

- global considerations
- personnel assessment
- cost avoidance
- incurred costs

Global considerations

Assumptions concerning the general parameters of this analysis are categorized as global considerations. Effective dates of the analysis are presented followed by a discussion of sunk costs, incremental costs, and a workload extrapolation methodology. Finally, financial presentation assumptions are described.

Effective dates. Premodernization cost and benefit estimates include preliminary DLA estimates made prior to fiscal year 1992. This analysis was completed in the first quarter of fiscal year 1993; therefore the date of this study for analytical purposes is the first day of fiscal year 1993, i.e., October 1, 1992. This date also serves as the ending point for the collection of accrued cost and benefit data. Our analysis ends with fiscal year 2001, approximately eight years after full system deployment and contains cost and benefit estimates for fiscal years 1993 through 2001.

Sunk cost evaluated. This analysis evaluates the costs and benefits of ESEX at three time periods, two from a historical perspective. Because of the nature of this analysis, sunk costs are included to enable comparison of original estimates and actual costs incurred, however per DLAM 7041.1, *Economic Analysis*, they were not used in calculating net savings or investment indicators.

Only incremental costs considered. Also in accordance with DLAM 7041.1, only incremental costs are considered when determining future system costs; therefore, a cost that would occur equally with or without ESEX was not included in this analysis. This is to permit a comparison of only the relevant costs and benefits.

Workload extrapolation methodology. ESEX has been in operation at DISC the longest (more than one year) of all the DSCs; therefore, our investigation of workload associated with ESEX focused on DISC. Based on our analysis of DISC workload data, it was determined that the ESOC workload, both calls and transactions, increased dramatically upon the installation of ESEX. In addition, workload data were analyzed for DGSC and DESC for the period ESEX had been in operation at each site. The data also revealed a large increase in the ESOCs' workload upon implementation of ESEX.

An average percent increase in workload experienced at the ESEX sites was calculated and applied to the workload manually processed at the non-ESEX sites. Our study team assumes that workload increases at the three remaining ESOCs will approximate the increases experienced at DISC, DGSC, and DESC.

Beyond fiscal year 1993, it was assumed that DLA would experience a steady state workload. While the consumable item transfer is ongoing and will increase the number of NSNs managed by the centers, other events such as base realignment and closure, troop drawdowns, and inventory reduction initiatives are having a negative impact on workload. Because it was not possible to estimate the impact of each of these initiatives with any degree of accuracy, it was assumed that the net effect would be a steady state workload.

Financial base year is fiscal year 1993. In accordance with the statement of work and discussions with the DLA Operations Research and Economics Analysis Office (DLA-LO), fiscal year 1993 dollars are used to express costs, benefits and cost avoidances. Although other year dollars, such as historical then year, may appear at certain points in the study, all summaries, comparisons, and net present value calculations are in 1993 dollars.

Discount rate is 10 percent. In accordance with DLAM 7041.1, a 10 percent discount factor was used for this study. This rate is based on the Office of Management and Budget (OMB) circular A-94 which has been updated since the commencement of this analysis and now specifies various discount rates for different types of analyses. Because this analysis compares actual costs and benefits to DLA's original expectations of costs and benefits developed using a 10 percent discount rate, the use of a 10 percent discount rate in this analysis will allow for comparison. However, in anticipation of future compliance with the updated A-94, Appendix C contains a summary of all cost and benefit data using a 3.4 percent discount rate. This rate was extracted from Appendix C of the revised circular A-94. Since highly

unusual inflationary pressures are not expected over the course of the analysis, no additional inflationary effects were incorporated in any part of this analysis. In addition, the discount rate was applied using the continuous discount method, as recommended by DLA-LO.

Benefits loaded at 29.55 percent. Benefits were loaded on the fiscal year 1993 annual salaries at a rate of 29.55 percent, in accordance with DLAM 7041.1. The components of the 29.55 percent benefits loading are:

- 21.70 % retirement
- 1.45 % Medicare
- 4.70 % insurance
- 1.70 % other

Personnel assessment

ESOC personnel savings are the largest quantifiable benefit of ESEX. In Exhibit 3-2 we developed an average burdened salary of ESOC personnel by site for use in benefits quantification. Filled positions were identified through the use of DISC, DESC, DGSC, and DPSC-C&T supply operations personnel rosters and interviews. Because data were not available for DPSC-Med, DPSC-C&T personnel figures were used as a proxy. Each ESOC has several different types of sections, as mentioned previously, but the Customer Service Sections are affected most by ESEX. Therefore, all benefits and cost avoidances were developed using the cost associated with the Customer Service Sections, as presented in Exhibit 3-2. These costs were used to develop cost per call estimates. General schedule (GS) pay is based on calendar years. Since our calculations require that a salary be applied to a fiscal year, pay levels were calculated using 1/4 of year 1 and 3/4 of the next year to arrive at a fiscal year salary.

Cost avoidance

The single largest impact of ESEX operation has been the ability to meet a workload almost twice its former size with fewer personnel. This fact has at least two dimensions:

- prior to ESEX, there existed significant unserviced customer demand which was unknown as to type and amount, and
- that demand can now be estimated and quantified.

In our study, we quantify and present this ESEX productivity improvement as a cost avoidance. Our basic assumption is that the anticipated workload is defined as that level of customer activity observed since implementation of ESEX. To meet that workload without ESEX would require the addition of customer service staff. Note, that the Inspector General mandated that the ESOCs either implement an automated system, or add additional staff to process increased workload. The cost of that additional staff is avoided through implementation of ESEX. This concept is additionally described and correlated in the body of our report by comparing cost per call figures before and after ESEX.

Incurred costs

While the dollar value of all actual costs were well documented through the development contract delivery orders, the timing of these expenditures was not. The DISC delivery order included the development cost of ESEX plus hardware and software for implementation. Because the software development occurred during fiscal year 1990 and 1991, the total software development expense was allocated evenly between fiscal years 1990 and 1991. Implementation costs for DISC were assumed to be completely incurred in fiscal year 1991.

Exhibit 3-2
Average Burdened Customer Service Salaries

Customer Service Sections

	DISC		DGSC		DESC	
	Personnel	Annual Expense	Personnel	Annual Expense	Personnel	Annual Expense
GS- 9	3	$93,637				
GS- 7	1	25,515	1	$25,515	1	$25,515
GS- 6						
GS- 5	7	144,197	7	144,197	12.5	257,494
GS- 4						
GS- 3	1	16,403				
Total	12	$279,751	8	$169,712	13.5	$283,009
Average cost/employee		$23,313		$21,214		$20,964
Average cost with benefits		$30,201		$27,483		$27,158

Total average cost (with benefits) $28,326

Customer Service Sections

	DCSC		DPSC-Med		DPSC-C&T	
	Personnel	Annual Expense	Personnel	Annual Expense	Personnel	Annual Expense
GS- 9			1	$31,212	1	$31,212
GS- 7	1	$25,515	3	76,546	3	76,546
GS- 6			3	68,882	3	68,882
GS- 5	10	205,995				
GS- 4						
Total	11	$231,510	7	$176,640	7	$176,640
Average cost/employee		$21,046		$25,234		$25,234
Average cost with benefits		$27,266		$32,691		$32,691

Total average cost (with benefits) $29,882

DPSC (Med) data was unavailable; DPSC (C&T) was used as a proxy.

Future costs

Because delivery orders were not signed for all sites as of the date of this analysis, some projections were made regarding future implementation costs. Because the DESC delivery order did not contain any extraneous costs (security or custom software), the DESC delivery order was used as a basis for future implementation costs. Averages of the DGSC, DESC, and DPSC(Med) delivery orders were used for the following cost categories:

- site surveys
- on-site installation
- operator and technical training

In addition, based on past DLA experience, it was assumed that future sites would require two 9600 baud modems -- in contrast to the four purchased by DESC.

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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PREMODERNIZATION SCENARIO

The premodernization scenario is defined to include all original estimates of system functionality as well as associated cost and benefit estimates. This section provides historical functional descriptions of ESEX, documents changes as they developed over time, and provides estimates of implementation and development costs from available sources. Finally, benefit estimates from the period prior to ESEX's actual implementation are documented. In Sections 5 and 6 of this report, any deviations in functionality, costs, and benefits are addressed.

Pre-ESEX functional description

Prior to implementing ESEX, the ESOC Customer Service Section was responsible for processing the vast majority of customer information requests that came into the ESOC. Because this was largely a manual process, it was extremely difficult to answer all the calls in a timely and efficient manner.

As calls came into the ESOC, they were sent into the Automatic Call Sequencer (ACS). The ACS placed each call in a first in-first out (FIFO) queue to await an available ESOC operator. At the typical ESOC there were 16 phone lines going into the ACS, but only eight outgoing lines to the individual ESOC operators. Because there were more incoming phone lines then phone lines to operators, many calls were placed on hold. To further complicate the issue, the ESOC operators' phones had a two-position switch. The switch could be placed in the "off" position if the operator was taking another call or busy with other work. As a result, the ACS would view the line as "busy," and no calls would be sent to that operator's line until the switch was returned to the "on" position. This feature once again increased the chances of the caller remaining on hold for an extended period of time.

When the caller reached an operator, the caller could begin the process of requesting the various pieces of information from the ESOC clerk. In the Customer Service Section, requests ranged from a status check on a particular item's availability or an existing requisition to a modification or cancellation of a requisition. The necessary data were then retrieved by the operator by logging on to the mainframe via his/her personal computer and querying the Standard Automated Materiel Management System (SAMMS) database. In some instances, the customer would request information available only from an inventory manager (IM). In these cases the ESOC operator would transfer the caller to an IM in the supply section. This could result in putting the caller in another queue. In some instances, the transferred call was disconnected and never reached supply. In this case, the caller's only option was to try calling the ESOC again.

ESEX functionality

The original idea to automate the processing of some telephone calls coming into the ESOC came from a suggestion submitted by a DLA employee in July 1985[3]. The idea was well received and was gradually enhanced to become the system in place at the ESOCs today.

Employee suggestion

This DLA employee noted that a substantial number of customer telephone inquiries involved requests for requisition status. (Information that was readily available in the mainframe in most instances.) The DLA employee went on to recommend that a "series of telephone

[3] DLA Suggestion #8-0-96-85M, July 29, 1985.

numbers ... be established where status calls could be answered by the computer without human intervention." As a second requirement, the employee proposed that the caller should also have the option of entering requisitions via telephone. The final requirement was that the system must be available 24 hours a day, seven days a week, without the need for personnel monitoring the phones waiting for unpredictable phone inquiries.

Systems analysis and requirements document

The requirements for an Automated Voice Response System (AVRS) began to crystallize as time progressed. The original SARD was prepared in November 1986. This document examined the AVRS concept on a deeper level than had previously been discussed. The proposed AVRS was to consist of a minicomputer, voice response unit (VRU) software, and application software. Following is a description of the original system requirements extracted from the general information section of the SARD:

> The customer would call the ESOC customer service telephone number. An automated voice would respond with a welcome message and then ask if the customer requires stock availability. If affirmative, the customer would be directed to key in the National Stock Number using the telephone numeric keys followed by the asterisk (*)button to signal completion. The system would respond to the customer with an automated response, "Yes, there is stock on hand" or "No, there is not stock on hand." Also, the system should be able to satisfy inquiries concerning status of specific document numbers. The customer would depress the number two on the telephone numeric keys to access this mode. Since the document number consists of alpha and numeric codes, a system would be developed to satisfy the requirement. Once the customer keyed in the document numbers, the automated voice response would provide the status. If the customer wanted to input an off-line requisition, the number three should be depressed which would connect the customer to a supply clerk in the customer service section.

Request for proposal

The RFP for development of an AVRS was released for solicitation in 1989. The RFP outlined the specific requirements DLA wanted as components of their AVRS. Section C of the RFP (General Requirements) summarized the specific components/functions of the system. These requirements were a further enhancement of the requirements presented in the SARD.

The specific requirements for the AVRS to be installed at the ESOC were that it:

- support a minimum of 12 (maximum of 256) incoming telephone lines
- accept alpha, numeric, and alphanumeric input or output data
- forward calls for operator assistance for rotary telephone callers
- forward calls when operator or IM assistance is required by any caller
- contain automatic answering with a welcome message, user instructions, and a menu consisting of the following four items:

  -stock availability
  -status of document numbers
  -transfer to operator
  -instructions for using system

- contain optional menu items for requisition submission or modification

- include polling software to determine if the system is functioning--the automatic answering feature should play a "system unavailable" message if the system is not functioning
- have timer and time-out features, which will guarantee that no caller is connected to the system for too long a period
- have the ability to erase all input after the last terminator character allowing customers to erase erroneous entries
- provide voice repeat of all input/output data
- contain 500 words of speech with expansion capability
- provide a standardized system for tabulating call statistics

The original estimates of costs and benefits associated with the development and implementation of ESEX were based on the levels of functionality described in the two previous sections.

Original estimates of costs

The supporting documentation associated with the first set of requirements (the SARD) and an executive summary report that was recently compiled by DLA provided the most complete estimates of implementation and development costs available. Original estimates to implement ESEX varied as functionality changed over time. The variation in estimates is due to the gradual evolution of ESEX from a suggestion box idea to the modern system that exists today.

1987 economic analysis costs

A summary level economic analysis was performed in 1987, prior to the start of system development. The system functionality covered by the 1987 economic analysis mirrors that which was documented in the SARD; however, cost estimates did not provide for the complete functionality as specified in the SARD. A major assumption made in the 1987 economic analysis was that application software was to be developed based on all numeric data input by the caller despite the SARD requirement of both alpha and numeric capability. Special programming would have been required to handle alpha characters and therefore was not included in this estimate. Note also that only very basic vocabulary was to be provided by the VRU and that the costs for application software were for rather straightforward requirements. Additional vocabulary could be added at the cost of approximately $500 per word in addition to the base cost of approximately $20,000.

The original estimate for the total cost of an AVRS in the 1987 study was $58,000 (fiscal year 1987 dollars); the implementation cost for one unit included a minicomputer, a VRU, VRU software, and application software. A communication monitor such as IBM's Customer Information Control System (CICS) was required to link the mainframe and the VRU. The costs associated with a CICS were rather high and were not included in the cost estimate. Rather, an alternate approach was chosen. The 1987 economic analysis estimated costs based on installing a minicomputer as a stand alone unit to interface between the mainframe and the VRU. All of the software, including the application and the control software, would reside on the minicomputer.

ESEX executive summary report

In February 1992, DLA prepared an executive summary report, which documented, on a summary level, future costs and benefits associated with ESEX implementation. This study compared the costs associated with operating the ESOC in a largely manual fashion to the costs associated with operating with ESEX in place. The analysis spanned a period from 1993 through 2002. However, since it did not include any 1992 and prior sunk costs, the estimate was incomplete. Remaining equipment costs were estimated at $1.16 million. To show an accurate original estimate, we attempted to locate the estimates of fiscal year 1992 expenditures; however, the initial cost estimates were not available. Furthermore, the costs in the report were not broken down into general categories such as hardware and software. Further investigation did not reveal any supporting data. Annual maintenance costs were estimated at $85,500 beginning one year after the equipment was purchased, but supporting documentation specifying the type of maintenance these estimates included was not available.

The cost estimates contained within the executive summary report have been documented here to provide a basis for comparison to other estimates. It should be noted that supporting documentation for executive summary cost estimates was not available. Nor was any information available describing the system functionality associated with these costs. Exhibit 4-1 illustrates the two estimates. The following subsections document original estimates of benefits. These estimates were obtained from historical studies, which also lacked supporting documentation and explanations.

Exhibit 4-1
Original Cost Estimates

DLA Document	Equipment Cost	Maintenance
1987 Economic Analysis	[1] $58,000 (FY 87$)	not provided
1992 Executive Summary Report	[2] $1,160,000 (FY 93$)	$85,500 annually

[1] One Site
[2] All DLA Sites

Original estimates of benefits

Limited documentation exists of the original estimates of benefits expected to accrue as a result of ESEX implementation. The only two sources discovered after careful research were the 1987 economic analysis and the 1992 executive summary report. Each document presents varying degrees of expected savings--one study included savings estimates for one center, the other included DLA-wide estimates.

1987 economic analysis savings

Original estimates of expected benefits contained in the 1987 economic analysis were based on a voice response system with limited functionality. The voice response system was expected to replace three GS-5 supply clerks at a total annual savings of $46,050 (fiscal year 1987 dollars) at DISC. The economic analysis noted that this estimate was very conservative. In addition, it was expected that ESOCs would be able to provide better, more productive service to their customers with this system in place. Prior to the completion of this economic analysis, data gathering and polling were carried out to arrive at some preliminary estimates of savings. These preliminary benefit estimations were slightly lower than what the official economic analysis later predicted. Initial expectations were that the system would be able to automatically process approximately 10,000 availability requests per month at DISC, thereby

saving the workload of two GS-5 supply clerks for a total savings of $30,700 (fiscal year 1987 dollars). No attempt was made in this study to extrapolate the benefits to a DLA-wide level.

ESEX executive summary report

The executive summary report estimated benefits on a DLA-wide level. This summary estimated that 41 employees were required to provide the support necessary to manually process customer inquiries. With the implementation of ESEX, the executive summary report estimated that only 24 employees would be needed to provide the required support. The average annual cost of an employee, including fringe benefits, was estimated at $30,000 per year (average cost of a GS 5/7 plus 30 percent fringe benefits), resulting in an annual savings of $510,000 (fiscal year 1993 dollars) DLA-wide. There was no mention of utilizing these clerks to support other ESOC functions with backlogs of pre-existing workloads. Furthermore, the methodology used to determine these savings was not included in the analysis.

Summary

Exhibit 4-2 illustrates the original estimates of investment costs and benefits made through fiscal year 1992. Since the 1987 economic analysis includes costs and benefits for only one DLA site, and the executive summary report contains estimates of costs for all DLA sites, a direct comparison between the two estimates cannot be made. However, to keep all estimates in a constant year dollar, all savings have been discounted to fiscal year 1993 dollars.

Exhibit 4-2
Original Cost and Benefit Summary ($000)

	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	TOTAL
1 1987 Economic Analysis (FY 87$)											
Investment	$58	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58
Savings	46	46	46	46	46	46	46	46	46	46	461
Net Savings/(Cost)	(12)	46	46	46	46	46	46	46	46	46	403
Net Savings/(Cost) (FY 93 $$)	($15)	$55	$53	$51	$49	$48	$46	$44	$43	$41	$415

	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
2 Executive Summary Report (FY 93$)											
Investment	N/A	$1,160	$0	$0	$0	$0	$0	$0	$0	$0	$1,160
Operation	0	0	86	86	86	86	86	86	86	86	684
Savings	0	510	510	510	510	510	510	510	510	510	4,590
Net Savings/(Cost)	$0	($650)	$425	$425	$425	$425	$425	$425	$425	$425	$2,746

Notes
1 Estimate for one site only
2 Estimate for all DLA sites

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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INCURRED COSTS AND ACCRUED BENEFITS

This section documents what has actually occurred from the time ESEX was in the design phase, through its development and actual implementation, until the end of fiscal year 1992. Any significant variations in ESEX's current functionality from original plans are included in this section along with an analysis of accrued system costs and benefits.

ESEX

The major component and principal cost driver of ESEX's hardware is the AVRS engine. The engine is the "heart" of the system. It is here that the touch-tone phone pulses are translated into data that the mainframe computer can understand and manipulate. This is also where the "voice" that responds to the caller is generated. The data from the mainframe computer is translated to English language words to convey the necessary information to the caller.

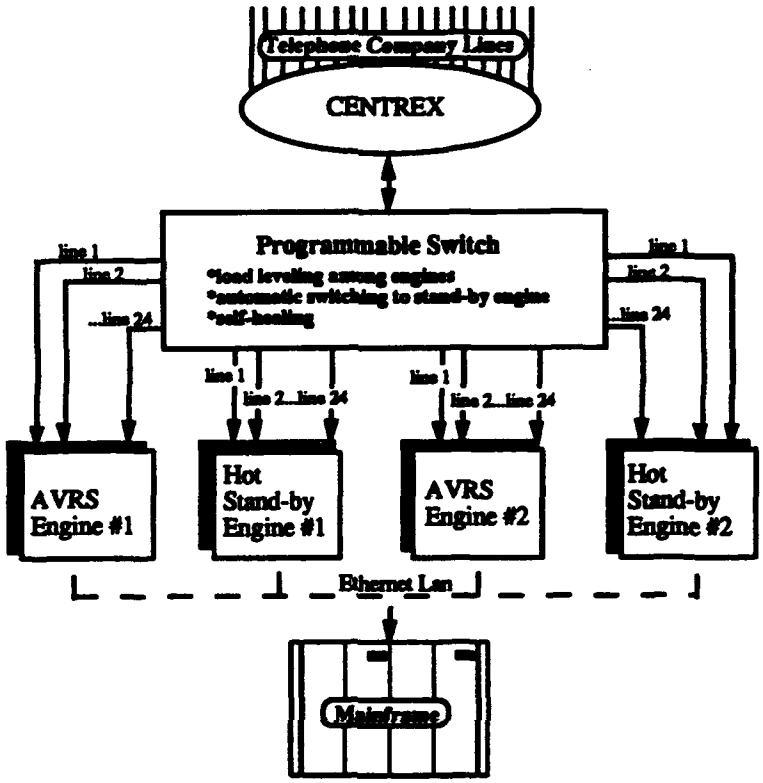
Each ESEX has been designed to simultaneously handle twenty-four incoming calls; each AVRS engine handles 24 phone lines. The possibility of downtime is avoided by the use of a "hot stand-by" engine. Essentially this serves as a backup unit should there be any malfunctions in the main engine. Each ESEX has a combination of one engine and one stand-by for every twenty-four telephone lines. The stand-by engine can also serve as an inexpensive means of expansion to forty-eight lines--of course, this expansion comes at the expense of back-up capability. The actual transfer from the main engine to the stand-by engine is handled by the programmable transfer switch (PTS). The PTS distributes the call workload evenly among the engines in addition to performing the function of automatic switching to the stand-by engine. The engines are connected via Ethernet LAN to the mainframe via a series of switches and modems. Exhibit 5-1 outlines the major components of ESEX.

The ESEX that was implemented exceeded the original foundation level functional requirements in several areas. Among these areas is the ability to provide detailed management reports, real-time statistics, and unattended operation. ESEX provides readily available reports that track total number of calls received, type of transactions, user identification, duration of call, number of calls abandoned or disconnected, and a variety of other data. These reports are accumulated for a day, a week, a month, or an entire year. This type of detail can contribute to successful management of the ESOC by aiding in staffing decisions. Real-time statistics are always readily available at a glance. The manager can look at any one of the ESEX monitors and instantly see what engines are operational, how many lines are occupied, and the peak number of simultaneous calls for the day. Finally, ESEX was designed to run completely unattended. The system design utilizing the PTS eliminates the need to have an attendant monitoring the system. If there is a failure, the PTS automatically switches engines. However, because some ESOC customers have rotary phone, as opposed to touch tone, operators must still field calls at the ESOCs.

Variations from original ESEX plans

As the design and development of ESEX progressed, the system gradually expanded to include features not originally specified in the original request for proposal (RFP). Optional features became the standard, a fail-safe design was introduced, and a variety of design features to improve system user friendliness were incorporated. These additions did not materially change the system's originally planned functionality; rather they enhanced the design.

Exhibit 5-1
ESEX System Diagram



Additional features were incorporated

The ESEX that is in operation today contains expanded capabilities when compared to DLA's initial expectations as documented in the RFP. The RFP discussed two optional main menu features but did not deem their inclusion as necessary to ESEX's design. These functions (requisition submission and modification) were included in the final system design by the contractor. Based on ESEX-generated statistics, these features are currently not heavily utilized; however, the option is available for the customer in the event that there is a true emergency and no other means are available to submit or modify requisitions. It should be noted that these functions were previously performed by ESOC personnel.

Fail-safe system design

The combination of the PTS and the hot stand-by engine, which were both previously discussed, virtually eliminates the chance of a complete system failure. The PTS plays the role of system "traffic cop" by distributing the workload evenly among engines and automatic switching between engines in the event of a malfunction. These features combine to produce a system that is available to the customer 24 hours a day, seven days a week. This is another addition to the RFP system requirements.

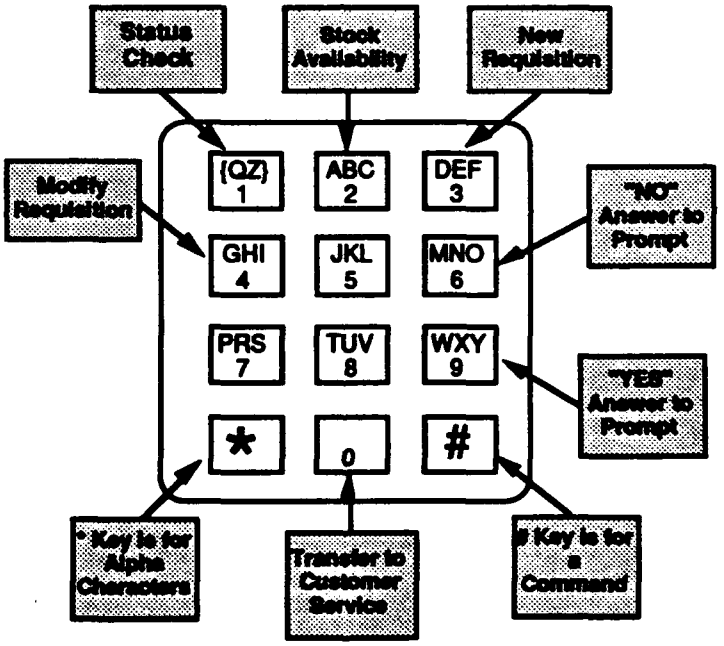
U r friendly operation

A variety of features have been included in ESEX that increase the ease with which a customer may interact with the system. Shortcuts have been incorporated so that experienced users may quickly go through various menus without listening to system prompts in their entirety. Truly expert users do not even have to wait for the prompts at all if they know what data need to be

entered. Another feature saves on extraneous key punch entries. Data already entered during the session in previous transactions or fields is automatically reutilized wherever possible. Default field values have also been incorporated so that the caller will not have to enter any data already available within the system.

Alphabetic character entry has been simplified to improve user interface. ESEX has been designed so that once the caller understands the formula for entering alphabetic characters, they can easily complete any transaction without working off a grid to translate the letters to the numbers on the telephone keypad. To enter a letter, the caller presses the asterisk (*), followed by the key containing the letter, followed by the position of the letter (first, second, or third, 1,2,3,) on the key. For example, to dial an "E," the caller enters asterisk (*), 3, 2. This design feature simplifies navigation through the system and removes the chance of having customers who would not want to interact with the system if it were excessively cumbersome. Exhibit 5-2 illustrates a few of the basic functions that are provided in the main menu of the ESEX system.

Exhibit 5-2
ESEX Function Locator



A "Help" feature was also incorporated into the design. If a caller is in the middle of a transaction and does not understand what to do next, he/she can easily access the system help feature by dialing * (asterisk), * (asterisk), 4 to access help. To exit help at any time during the message, the caller dials * (asterisk), * (asterisk), 9. At this point, ESEX places the caller back at the exact point in the transaction where they originally accessed the help function.

ESEX costs incurred through fiscal year 1992

Because ESEX was contractor developed, actual costs for design and implementation are clearly documented in executed delivery orders from Contract DLA-H00-90-D-0010 with Radix II. Actual expenditures for ESEX began in March 1990 when the first delivery order was executed. The following subsections document all related costs incurred to date as well as any budget detail data that have been made available to the study team.

ESEX development costs

The cost associated with the development of custom ESEX software was a one-time cost that was captured under the delivery order executed at DISC for the original prototype ESEX. Custom software expenses totaled $410,549. As previously noted, these costs have been spread evenly between fiscal year 1990 and 1991.

ESEX implementation costs

Exhibit 5-3 documents the total implementation costs for the three ESOC sites with ESEX installed as of fiscal year 1992, summarized by total costs for hardware, software, and other. The custom software development described above is not included in Exhibit 5-3. "Other" costs include operator and technical training, site preparation, and user's guides. An exact breakdown of costs for each ESEX by site is included in Appendix D. Variations in cost totals are a result of the inclusion of site-specific costs. The ESEX at DISC varies from the other sites' systems in that DISC has been configured to handle a larger number of phone lines: 48 instead of the standard 24. As a result, DISC has two engines and two hot stand-by engines compared to one at each of the other sites. Procurement of other system components also increased in volume to accommodate the increase in telephone lines. These variations combine to dramatically increase the cost of the DISC ESEX. It should also again be noted that each site requires custom installation tuning and modifications to fit the specific commodity that the site handles. A final variation affecting total site cost is the inclusion of the one-time cost for an ESEX security enhancement system in the DGSC delivery order. This system will be installed at all ESEX sites; however, the cost will only appear once, under the DGSC delivery order.

Exhibit 5-3
Total Actual Implementation Costs (Through FY 92)

	DISC	DGSC	DESC	TOTAL
Hardware	$419,393	$162,833	$166,202	$748,428
Software	46,484	198,202	27,751	272,436
Other	35,713	37,451	41,517	114,680
TOTAL	$501,590	$398,486	$235,469	$1,135,544

DISC hardware includes four engines (@ $52,113 ea); DGSC includes security enhancement ($170,451).
Due to rounding totals may not add.

Security software. Modification number 01 to delivery order number 0002 was signed on September 30, 1992, obligating $170,451 to be spent on a security enhancement system for all ESOC sites. Since funds were obligated in fiscal year 1992, the costs associated with the security software will be considered an incurred cost despite the fact that as of January 1993, the software had not been installed. The security software will have class C2 functionality. With this system in place, users will be required to utilize an ID number and password if they desire to submit a requisition or modify an existing requisition. Class C2 security requires that each person having access to the system be accountable for his or her actions. Each person using the system must have a security clearance equal to or higher than the highest classification of data processed in the system. Currently, no classified data is processed by ESEX.

Maintenance costs. As of the end of fiscal year 1992, only immaterial maintenance costs have been incurred. Section H, Special Contract Requirements, of the development/ implementation contract states that the "Government shall not be charged, parts or labor, for the maintenance of any system software or system component provided under this contract for the one year following the successful Standard of Performance for Acceptance..." As a result of this provision, maintenance expenses will begin in fiscal year 1993 for the ESEX at DISC.

In-house costs. Although some internal DLA costs may be attributed to ESEX implementation, it has been assumed that these costs are not material to the analysis. These costs would include time spent monitoring contractor performance by headquarters and field activity personnel, site preparation time spent by DLA personnel, and other incidental costs. While some of these costs exist, their effect on this analysis is not significant.

Delivery orders

Individual delivery orders are executed for each site where ESEX is implemented and for any additional provisions that may arise during the course of implementation. ESEX requires some degree of fine tuning to meet the individual requirements of each individual site. As of the end of fiscal year 1992, ESEX was installed at DISC, DGSC, and DESC; a delivery order has been signed for DPSC-Med, and the two remaining sites, DCSC and DPSC-C&T, are still awaiting delivery orders.

The firm-fixed price contract contains a price schedule documenting all the required items and associated unit prices for completing the prototype ESEX and all subsequent follow-on units. The prices quoted are not subject to escalation for the duration of the five-year life of the contract; however, a provision is included noting that maintenance prices quoted are subject to a 5 percent per year escalation. At the time of this writing, one maintenance-related delivery order has been executed, without the inflated maintenance cost. It has been assumed that maintenance costs will not be inflated since the first delivery order was written without the inflated prices.

The price schedule contained in Section B (Supplies or Services and Prices/Costs) of the contract includes all items that may be needed to complete the ESEX system. Exhibit 5-4 illustrates items and associated prices required to install an ESEX at a typical ESOC. Because DESC does not have any unusual items included in its total price, this site was chosen to illustrate the typical ESEX costs. Other sites, DISC and DGSC in particular, have costs included in their delivery orders, such as the custom software design and security enhancement system-related costs, that may be misleading when determining a typical total standard installation price. The one-time software costs that were included in the DISC and DGSC delivery orders include installation at all sites. The DISC cost was for development of the original ESEX software. The cost at DGSC was for security software that is currently under development for installation at all sites.

Exhibit 5-4
DESC ESEX Price Breakdown

cabinet	$9,387.84	Unix-386 OS	$1,403.89	site survey	$4,770.71
AVRS engine	104,225.02	Unix 386 run time	1,804.20	on site installation	29,923.80
PTS	19,142.81	3270 gateway drivers	6,086.34	operator & tech training	6,378.09
modem switch	613.14	data base manager	1,649.14	users guide	444.00
9600-Baud modem	6,737.56	Unix network	880.40	Total Other	$41,516.60
tape backup system	1,675.93	Ethernet drivers	986.68		
spare parts kit	21,518.64	site modification	14,939.92		
UPS	2,900.58	Total Software	$27,750.57		
Total Hardware	$166,201.52			SITE TOTAL	$235,468.69

Budget submission history

Various budget submissions documenting planned expenditures for ESEX were analyzed in an attempt to validate other cost data received. While some inconsistencies exist between the executed delivery orders and budget figures, most deviations are not material and are simply due to the time periods covered by the different estimates. Budget data are described in the following paragraphs.

In June 1991, DLA estimated hardware costs for ESEX at approximately $1.5 million, and software maintenance at approximately $160,000 annually. In February 1992, the budget submission was modified and ESEX-related expenses were reallocated spanning a three-year period. Hardware expenses were once again estimated at $1.5 million; however, in this submission the only software-related expenditure budgeted was $22,000 for software support. An uninterruptible power supply (UPS) was another component added to the budget at a cost of $2,900. The final budget analyzed was dated October 1992. This estimate of ESEX expenditures allocated hardware costs over a five-year period and increased the anticipated total hardware-related spending to $1.8 million. The UPS cost was still included as a separate component as in the previous budget. However, the October estimate included an additional cost of $222,000 for security software development.

Actual spending through fiscal year 1992 can be compared to the budgeted estimations. A UPS was purchased at DISC at a cost of $2,900. The purchase was added to the original DISC delivery order in a modification. All subsequent ESEXs that have been installed contain a UPS as a core component, which is priced within the main delivery order. Security software was also procured at a cost of $170,451, versus to the budgeted amount of $222,000.

ESEX benefits realized through fiscal year 1992

ESEX operation commenced at DISC in July 1991, at DESC in September 1992, and at DGSC in October 1992. Quantification of benefits as of September 30, 1992, is necessarily limited to activity at DISC. However, the following section of this document, Future Costs and Benefits, provides the study team's analysis and estimations for the system's future.

Reduction in staffing

At the time of this study, all ESEX capable ESOCs had experienced a significant increase in calls and transactions and were in the process of addressing potential staff reduction reapplication as a result of ESEX. However, as of September 30, 1992, no actual staff reductions had taken place at any of the sites. These benefits begin to be realized in fiscal year 1993 and are discussed in the next (Future Costs and Benefits) section.

Increased productivity

Following the implementation of ESEX at DISC, DGSC, and DESC, a significant increase in calls and transactions at the ESOC occurred. In fiscal year 1992, DISC workload grew 165 percent, with the monthly number of calls at the center rising from approximately 12,715 calls pre-ESEX to 33,820 calls post-implementation. DGSC and DESC realized substantial productivity improvements as well, and their impact is discussed in the next section. All workload counts were extracted from ESEX management reports or automated work counts provided by the supply centers. Appendix E summarizes the total number of calls processed at DISC before and after ESEX implementation. This data clearly demonstrates that there was an existing customer need not being met by the ESOCs prior to ESEX implementation.

Increased productivity quantification (DISC only). Cost avoidance associated with increased productivity can be quantified by examining the personnel costs that would be

incurred if staffing were to be provided to manually process the number of calls that are now being processed by ESEX. At DISC, the average number of monthly calls manually processed per full-time equivalent (FTE) prior to ESEX implementation was 1,060. If the post-ESEX workload was to be processed without ESEX a staff increase would be necessary. The number of FTEs required was estimated by taking the average number of phone calls per month after the system was implemented (33,820) and dividing by the average calls per FTE before ESEX was implemented (1,060). This equates to a total FTE requirement of 31.9, or 19.9 more than the 12 FTEs currently on board. Assuming DISC hired additional staff to process the previously unserviced calls, 19.9 FTE would be added to maintain the same ratio of calls per FTE. Using the average ESOC burdened salary of $30,201 for DISC, the total cost avoidance was estimated at $601,500. Data used in these calculations are provided in Appendix E. Cost avoidances of $150,375 were estimated for fiscal year 1991 because DISC operated ESEX for three months (3/12 of $601,500).

Another perspective on this increased productivity is to analyze the average cost per telephone call. By processing an increased volume of calls with the same or smaller staffing, the unit cost per call drops dramatically. The cost reduction per call was calculated by dividing the total personnel costs of the DISC Customer Service Section employees by the total calls processed without ESEX and comparing that to the cost of the ESOC Customer Service Section employees divided by the total number of calls processed with ESEX. The average per call cost at DISC dropped from $1.83 without ESEX to $0.54 with ESEX.

Summary

Although no personnel reductions were taken prior to the end of fiscal year 1992, DLA avoided costs of $751,800 by installing ESEX. This assumes that DISC hired additional staff to meet the needs of its customers instead of implementing ESEX. Exhibit 5-5 illustrates the investment and savings through fiscal year 1992 associated with ESEX implementation at DISC, DGSC, and DESC.

Exhibit 5-5
Actual Costs and Benefits Through FY 92
($000)

	FY 90	FY 91	FY 92	TOTAL
Investment				
Hardware	$0	$419	$329	$748
Software	205	252	226	683
Other	0	36	79	115
Total Investment	$205	$707	$634	$1,546
Hardware Maintenance	0	0	0	0
Total Cost	$205	$707	$634	$1,546
Total Cost (FY 93$)	229	750	657	1,637
Cash savings	0	0	0	0
Net cash savings/(cost)	($229)	($750)	($657)	($1,637)
Cost Avoidance	0	150	602	752
Net total savings/(cost)	($229)	($600)	($56)	($885)

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FUTURE COSTS AND BENEFITS

This section documents estimated future ESEX functionality, costs, and benefits from fiscal year 1993 through fiscal year 2001. Sources of future cost estimates are documented and the methodology for determining costs is explained. Benefit estimations were based on the extrapolation of actual benefits that have occurred to date at the sites with ESEX in place.

Future functionality

Based on our analysis of existing documentation, the only significant change in functionality to ESEX as it exists today is the addition of security features. Since funds for the security feature have been obligated (delivery order number 0002) in fiscal year 1992, it is not addressed as a future cost. However, since the security enhancement system has not yet been installed, it will be a variation from current system functionality. It should be noted that additional minor modifications will probably be made on the system based on site-specific issues resulting from a site's particular activity.

As new technology becomes available, features may be added to the system. Currently, technology is available that would enable the ESOC operator to identify the caller who is being transferred prior to picking up the call. This feature would allow the operator to access the caller's file on the mainframe before connecting with the caller. The operator would also be able to greet the caller by name. While this and other new technology is available, it has not been incorporated into any future DLA budgets or planned system enhancement. It is mentioned solely as an example of technology that is being developed in the field.

Estimates of future costs

There are two major areas of ESEX-related expenditures remaining: (1) the installation of ESEX at the remaining three DLA sites (DPSC-Med, DPSC-C&T, and DCSC) and (2) the ongoing maintenance costs scheduled to begin one year after system implementation.

Follow-on sites

The most current implementation schedule available estimates installation at DPSC-Med for January 1993, DPSC-C&T for May 1993, and DCSC for June 1993. The contract delivery order for DPSC-Med has been executed and is the source of our ESEX implementation cost for that site. The total cost to implement the DPSC-Med ESEX is $232,100, as stated in delivery order 004. The costs for ESEX installation at the two sites without signed delivery orders were estimated using a combination of the contract prices from Section B-1 (Price Schedule) of the development contract for components that are not site specific, and average costs incurred at previous sites for site-specific type components (site preparation, installation, etc.). When there were variations from DSC to DSC in the quantities of a component needed, the lower of the two quantities was used in the estimation. Any differences in quantity are not material to this analysis. Exhibit 6-1 illustrates the estimated cost per ESOC to implement ESEX at DPSC-C&T and DCSC. Notes are provided where average costs were used to calculate the total price for the site. An exact breakdown of system components for all three sites is included in Appendix D.

ESEX maintenance

ESEX maintenance costs are specified in the contract as unit monthly maintenance costs. For the purpose of this analysis, maintenance costs were estimated beginning one full year after system acceptance as outlined in the contract. Maintenance costs at DISC will begin in fiscal year 1993. Delivery order 9301 for DISC maintenance was executed in December 1992.

Exhibit 6-1
ESEX Cost Estimate for a Future DLA Site

cabinet	$9,387.84	Unix-386 OS	$1,403.89	site survey	*	$4,302.85
AVRS engine	104,225.02	Unix 386 run time	1,804.20	on-site installation	*	29,703.62
PTS	19,142.81	3270 gateway drivers	6,086.34	operator & tech training	*	5,710.99
modem switch	613.14	data base manager	1,649.14	users guide		444.00
9600-Baud modem	3,368.78	Unix network	880.40	Total Other		$40,161.46
tape backup system	1,675.93	Ethernet drivers	986.68			
spare parts kit	21,518.64	site modification	14,939.92	SITE TOTAL		$230,744.77
UPS	2,900.58	Total Software	$27,750.57			
Total Hardware	$162,832.74			*average cost calculated		

Maintenance costs are identified for the three system components: the AVRS engine, the PTS, and the tape backup system. Maintenance on other system components is not separately priced and would fall under the hourly rate prices quoted in the contract. Because hourly maintenance can vary significantly from site to site, the costs for miscellaneous maintenance costs are not estimated in this analysis. Base prices for maintenance are as follows:

	Monthly Unit Cost	Annual Unit Cost
AVRS engine	$600.00	$7,200.00
PTS	200.00	2,400.00
Tape backup system	25.00	300.00

Fiscal year 1994 will be the first year in which maintenance costs will be incurred at all six sites. Estimated maintenance costs for all six DLA sites for fiscal year 1994 are $117,000. The cost for an individual site with a standard ESEX (two engines, one PTS, and one tape backup system) in fiscal year 1994 will be approximately $17,100. Appendix F contains schedules documenting cumulative equipment counts, annual maintenance costs, and total maintenance costs segregated by site and aggregated to a DLA-wide level.

Exhibit 6-2 illustrates the estimated investment for DPSC-Med, DPSC-C&T, and DCSC. The breakout of each category is provided in Appendix D. This investment includes the hardware and software required to implement ESEX, physical installation, and user manuals. All costs are expected to be incurred in fiscal year 1993.

Exhibit 6-2
Future Investment

	DCSC	DPSC(Med)	DPSC(C&T)	TOTAL
Hardware	$162,833	$162,833	$162,833	$488,498
Software	27,751	27,751	27,751	83,252
Other	40,161	41,517	40,161	121,839
TOTAL	$230,745	$232,101	$230,745	$693,589

Estimates of future benefits

As the three remaining sites (DPSC-C&T, DPSC-Med, and DCSC) install ESEX during fiscal year 1993, it is anticipated that the centers will experience benefits similar to the original three

implementation sites (DISC, DGSC, and DESC). Estimated benefits were calculated using the same methodology that was used in section 5 of this report.

Consumable item transfer

In an effort to consolidate the management of DoD items, the various military services are transferring items that they manage to DLA. The Consumable Item Transfer (CIT) has increased the workload at the individual supply centers over the past year. In fact, over 800,000 hardware items will be transferred by the end of fiscal year 1993. A large portion of these items are weapon systems items with priority codes. As a result, it is reasonable to expect that weapon systems items will be requisitioned using a fairly high priority, thus increasing the workload of the ESOC. As a result of the CIT, it is anticipated that the ratio of priority calls to total calls will increase. However, other events such as base realignment and closure, troop drawdowns, and inventory reduction initiatives are having a negative impact on workload. Because it was not possible to estimate the impact of each of these initiatives with any degree of accuracy, it was assumed that the net effect would be a steady state workload.

Reduction in staffing

During January 1993, DISC moved three clerks from the Customer Service Section of its ESOC to other functional areas. While the movement of these three positions is not strictly due to ESEX (the reorganization to CBUs was another driving force), the ESOC was in fact operating with three fewer people. Using the average burdened salary at DISC, a recurring annual savings estimate of $90,604 (fiscal year 1993 dollars including benefits at 29.55 percent) was developed. Because the movement of personnel occurred in January 1993, only three quarters of the annual savings were credited in fiscal year 1993.

DESC has also been able to shift its personnel as a direct result of ESEX. Prior to ESEX, the Customer Service Section was composed of one supervisor and 12.5 full time equivalents (FTE). Upon implementation of ESEX, the staffing was reduced to 10.5 FTEs plus a supervisor. However, of the 10.5 FTEs, one person is dedicated to expediting NSNs in a critical state (more than five backorders). Two additional FTEs are detailed to the Intensive Management Section to support expeditors. Lastly, one FTE spends his/her time with CIT workload for the Intensive Management Section. Therefore, 6.5 FTEs plus a supervisor remain in the Customer Service Section to assist customers with telephone inquiries. This results in a savings of six FTEs at DESC. Based on the average burdened salary at DESC, the annual recurring savings was estimated at $162,950.

At the time of this writing, DGSC has not identified any personnel moves as a result of ESEX implementation.

Based on the actual personnel savings realized at DISC and DESC, an average percent reduction in personnel of 26.9 percent was developed. This rate was applied to the three sites that will receive ESEX during fiscal year 1993 to determine the expected personnel reductions. This is illustrated in Exhibit 6-3.

Increased productivity

Following the implementation of ESEX at DISC, DGSC, and DESC, a significant increase in calls and transactions at the ESOC occurred. At DISC, workload grew 165 percent, with the monthly number of calls at the center rising from approximately 12,715 calls prior to ESEX to 33,820 calls post-implementation. The increase at DGSC was similar: a 66 percent increase, with monthly calls rising from approximately 13,214 pre-ESEX to 21,739 after system implementation. DESC also increased the number of calls processed at the center, growing

Exhibit 6-3
Estimated Personnel Reductions

	FTE Before ESEX	FTE After ESEX	FTE Saved	Average Burdened Salary	Cash Savings
DISC	12.0	9.0	3.0	$30,201	$90,604
DGSC	8.0	8.0	0.0	27,483	0
DESC	13.5	7.5	6.0	27,158	162,950
Total	33.5	24.5	9.0		$253,555
Percent Decrease in FTE	26.9%				

	Actual Before ESEX	Estimated FTE Required	Estimated FTE Saved	Average Burdened Salary	Cash Savings
DPSC (C&T)	7.0	5.1	1.9	$32,691	$61,478
DPSC (Med)	7.0	5.1	1.9	32,691	61,478
DCSC	11.0	8.0	3.0	27,266	80,576
Total	25.0	18.3	6.7		$203,533
Grand Total	58.5	42.8	15.7		$457,088

approximately 50 percent from 15,539 to 23,358 calls after ESEX's implementation. All workload counts were extracted from ESEX management reports or automated work counts provided by the supply centers. Appendix E summarizes the total number of calls processed at the individual ESOCs pre- and post-ESEX implementation. These figures clearly demonstrate that there was an existing customer need not being met by the ESOCs prior to ESEX implementation.

Cost avoidances associated with increased productivity can be quantified by examining the personnel costs that would be incurred if staffing were to be provided to process the current ESEX customer call workload without ESEX. Exhibit 6-4 below extrapolates workload increases to the remaining three sites and shows a requirement for a total of 111 FTEs to meet that increase. The number of FTEs required was estimated by taking the average number of phone calls per month after the system was implemented and dividing by the average calls per FTE before ESEX was implemented. The result is an increase of 53 FTEs. Using the average ESOC burdened salary for each of the sites, the total cost avoidance to these centers would be $1,563,919. Data used in these calculations are provided in Appendix E. A summary is provided in Exhibit 6-4.

Exhibit 6-4
Cost Avoidance Calculations

	Monthly Calls After ESEX	Calls per FTE Before ESEX	Required FTE	Actual FTE	Additional FTE	Annual Cost Avoidance
DISC	33,819.9	1,059.6	31.9	12.0	19.9	$601,581
DGSC	21,738.5	1,651.8	13.2	8.0	5.2	141,829
DESC	23,357.5	1,151.1	20.3	13.5	6.8	184,463
DCSC	29,544.4	1,460.0	20.2	11.0	9.2	251,816
DPSC (C&T)	7,838.8	608.7	12.9	7.0	5.9	192,132
DPSC (Med)	11,851.1	920.3	12.9	7.0	5.9	192,132
Total	128,150.2	6,851.5	111.4	58.5	52.9	$1,563,953

Another perspective on this increased productivity is to analyze the average cost per telephone call. By processing an increased volume of calls with the same or smaller staffing, the unit cost per call drops dramatically. The cost reduction per call was calculated by dividing the total salaries of the ESOC Customer Service Section employees by the total calls processed without ESEX and comparing that to the salaries of the ESOC Customer Service Section employees divided by the total number of calls processed with ESEX. The average per call cost at DISC, DGSC, and DESC combined dropped from $1.48 to $0.60. This decrease in average cost per call is illustrated in Exhibit 6-5.

Exhibit 6-5
Average Cost per Call

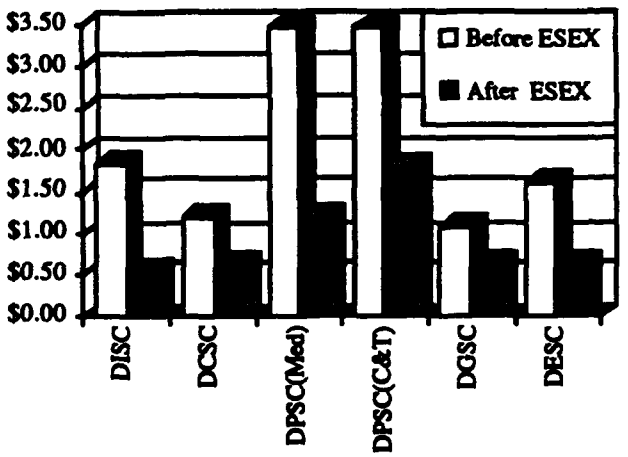

Exhibit 6-6 summarizes the benefits associated with ESEX from fiscal year 1993 through 2001. While some sites are receiving benefits throughout fiscal year 1993, full implementation and operation is not expected until the end of fiscal year 1993.

Exhibit 6-6
Estimated Benefits Fiscal Years 1993 through 2001 (FY 93 000$)

	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	Total
Personnel Savings										
DISC	$68	$91	$91	$91	$91	$91	$91	$91	$91	$793
DGSC	0	0	0	0	0	0	0	0	0	0
DESC	122	163	163	163	163	163	163	163	163	1,426
DCSC	20	81	81	81	81	81	81	81	81	665
DPSC(Med)	46	61	61	61	61	61	61	61	61	538
DPSC(C&T)	15	61	61	61	61	61	61	61	61	507
Total Personnel Savings	$272	$457	$457	$457	$457	$457	$457	$457	$457	$3,928
Cost Avoidances										
DISC	$602	$602	$602	$602	$602	$602	$602	$602	$602	$5,414
DGSC	142	142	142	142	142	142	142	142	142	1,276
DESC	184	184	184	184	184	184	184	184	184	1,660
DCSC	63	252	252	252	252	252	252	252	252	2,077
DPSC(Med)	144	192	192	192	192	192	192	192	192	1,681
DPSC(C&T)	48	192	192	192	192	192	192	192	192	1,585
Total Cost Avoidances	$1,183	$1,564	$1,564	$1,564	$1,564	$1,564	$1,564	$1,564	$1,564	$13,695
Total Savings	$1,455	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$17,623

Summary

Based on actual personnel reductions at sites with ESEX, it was estimated that 6.5 FTEs would be eliminated at the DLA sites receiving ESEX this fiscal year (1993). This results in a total personnel savings of 15.7 FTEs. Cost avoidances associated with processing a significant increase in workload were estimated at 53 FTE. Exhibit 6-6 illustrates the investment and savings from fiscal year 1993 through fiscal year 2001 associated with ESEX implementation at all DLA sites.

Exhibit 6-7
Estimated Costs and Benefits - FY 93 and Beyond
(FY 93 $000)

	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Total Investment	$694	$0	$0	$0	$0	$0	$0	$0	$0	$694
Hardware Maintenance	32	117	117	117	117	117	117	117	117	968
Total Cost	$725	$117	$117	$117	$117	$117	$117	$117	$117	$1,661
Cash savings	272	457	457	457	457	457	457	457	457	3,928
Net cash savings/(cost)	($453)	$340	$340	$340	$340	$340	$340	$340	$340	$2,267
Cost Avoidance	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	13,695
Net total savings/(cost)	$730	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$15,962

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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SUMMARY

Our analysis indicates that implementation of ESEX at the DLA ESOCs produces both personnel savings and cost avoidances. By implementing ESEX, DLA is able to process more calls regarding stock availability and requisition status, while redirecting some ESOC personnel's time to higher priority supply issues.

Because DLA is still in the process of implementing ESEX, benefits are gradually becoming evident as centers come on-line in fiscal year 1992 and 1993. By fiscal year 1994, all centers should be operational (according to current implementation schedules) and the full impact of ESEX operation will be realized. The implementation of ESEX has allowed DLA to provide a new level of customer service in a time when customers are demanding more. Furthermore, by implementing ESEX, DLA has responded to a pending DoD IG finding. Exhibit 7-1 illustrates the actual and estimated costs and benefits associated with implementing ESEX at the six DLA centers: DISC, DGSC, DESC, DCSC, DPSC(Med), and DPSC(C&T).

Exhibit 7-1
Actual and Future Costs and Benefits
($000)

	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Total Investment	$205	$707	$634	$694	$0	$0	$0	$0	$0	$0	$0	$0	$2,240
Hardware Maintenance	0	0	0	32	117	117	117	117	117	117	117	117	968
Total Cost	$205	$707	$634	$725	$117	$117	$117	$117	$117	$117	$117	$117	$3,207
Total Cost (FY 93$)	229	750	657	725	117	117	117	117	117	117	117	117	3,298
Cash savings	0	0	0	272	457	457	457	457	457	457	457	457	3,928
Net cash savings/(cost)	($229)	($750)	($657)	($453)	$340	$340	$340	$340	$340	$340	$340	$340	$631
Cost Avoidance	0	150	602	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	14,446
Net savings/(cost)	($229)	($600)	($56)	$730	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$15,077
DISCOUNTED CASH STREAMS													
Net Present Value				$696	$1,651	$1,501	$1,364	$1,240	$1,128	$1,025	$932	$847	$10,385
PV Total Cost				$692	$101	$92	$84	$76	$69	$63	$57	$52	$1,287
PV Cash Savings				$259	$396	$360	$328	$298	$271	$246	$224	$203	$2,585
PV Cost Avoidances				$1,128	$1,356	$1,233	$1,121	$1,019	$926	$842	$765	$696	$9,087

The profile in Exhibit 7-1 is the combination of our incurred to date and future estimate sections described earlier in our study. Based on the actual and estimated costs and benefits presented in Exhibit 7-1, financial ratios were developed. Exhibit 7-2 illustrates the cost and benefit data from the DLA Executive Summary Report described in the Premodernization section of our study. A comparison of the ratios for this study and the DLA Executive Summary Report is provided in Exhibit 7-3.

The net present value (NPV) for the actual costs and benefits plus expected costs and benefits (excluding sunk costs) is $1,298,000 when only cash personnel savings are considered. The NPV rises to $10,385,000 when cost avoidances are included in the calculation. In accordance with DLAM 7041.1, this calculation uses a discount rate of 10 percent. The net present value (excluding sunk costs) represents the value of the sum of the cash flow for fiscal years 1993 and on, discounted to some time. For this analysis, fiscal year 1993 is the base year (year 1).

Exhibit 7-2
Executive Summary Report Cost and Benefit Summary

	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01
Executive Summary Report (FY 93$)										
Investment	N/A	$1,160	$0	$0	$0	$0	$0	$0	$0	$0
Operation	0	0	86	86	86	86	86	86	86	86
Savings	0	510	510	510	510	510	510	510	510	510
Net Savings/(Cost)	$0	($650)	$425	$425	$425	$425	$425	$425	$425	$425
Discount Factor		0.9538	0.8671	0.7883	0.7166	0.6515	0.5922	0.5384	0.4895	0.4450
Net Present Value (FY 93$)	$0	($620)	$368	$335	$304	$277	$251	$229	$208	$189

Per DLA-LO instructions, the discounted payback period illustrates the time it will take DLA to recover investment costs occurring in fiscal years 1993 and on. The payback for the combined actual and estimated costs and benefits scenario is .50 years when all benefits are included (2.51 when only cash personnel savings are included). In order to determine when payback would occur, the discounted cumulative benefits were compared to the discounted cumulative costs (both starting in fiscal year 1993). Once cumulative savings were greater than cumulative costs, interpolation was used to determine the exact point of payback. The payback period for all savings is graphed in the payback comparison provided in Exhibit 7-4.

Exhibit 7-3
Financial Ratios

	Personnel Only	Total Savings	DLA EA
Net Present Value ($000)	$1,298	$10,385	$1,540
Discounted Payback	2.51	0.50	2.80
Savings Investment	2.96	16.70	2.55
Notes:	- Excludes investment incurred prior to FY93 - Total savings includes 53 FTE cost avoidance - Equates to 15.5 FTE cash savings annually - Sunk costs not included in financial ratios		- DLA 1992 Executive Summary Report - Excludes investment cost incurred prior to FY93 - Does not address cost avoidance to meet workload - Equates to 17 FTE cash savings annually - Sunk costs not included in financial ratios

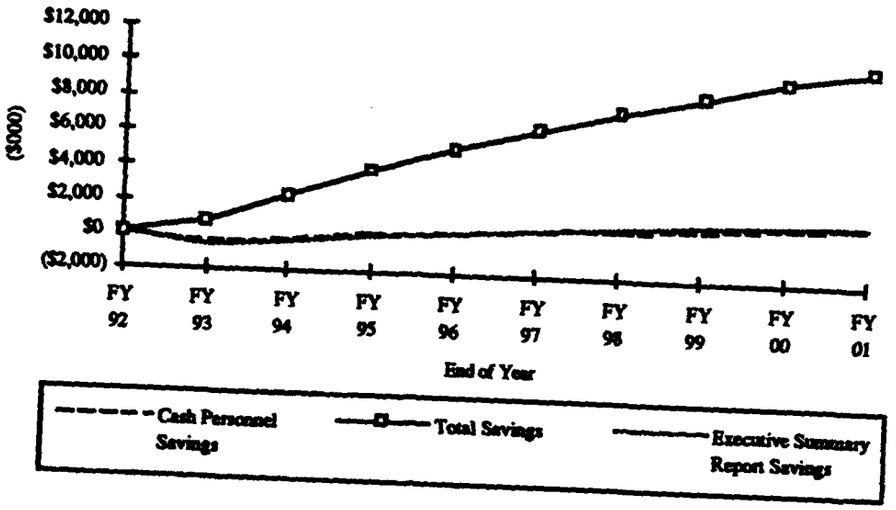
The savings/investment ratio or profitability index was calculated by dividing the present value of the cash savings (less increases in maintenance costs) and cost avoidances by the present value of the investment excluding operation costs starting in fiscal year 1993 and is 16.70 when all benefits are included; 2.96 when cash personnel savings are only considered. This ratio shows the relative profitability of the project, or the present value of the benefits per dollar of investment. This calculation can be confirmed by dividing the present value of all savings ($11,672,000, less discounted maintenance costs of 625,400) by the present value of the investment excluding maintenance ($661,600).

ESEX economic profile including planned military installations

ESEX has been chosen by the JLSC to become the DoD standard emergency supply system. ESEX, to be called DESEX, is expected to be installed at 14 military sites outside of DLA plus DLA's Subsistence ESOC at DPSC. Currently, one delivery order has been written to install

DESEX at an Army site. Based on the first delivery order for the Army site and conversations with DLA personnel, a custom software development cost ($73,200) will be incurred as each

Exhibit 7-4
Payback Comparison



military branch, and possibly DPSC-Subsistence, installs DESEX to modify the system to meet the specific requirements of the services. Increasing the number of sites where ESEX is installed, lowers the total average cost per site by spreading development costs over a larger base. The total cost to install ESEX at the six DLA sites was estimated at $2,330,000 (fiscal year 1993 dollars). This results in an average cost of $388,333 per individual site. The total cost to implement DESEX at the 15 additional sites is estimated to be $3,827,172 (or $255,145 per site). When the two totals are combined, the average site cost of ESEX drops to $293,199. The costs for future DESEX sites were estimated using the costs documented in delivery order number 0005 (see Appendix D) assuming that custom application software costs would be incurred five times; one time for each service: Army, Navy, Air Force, and Marines; and once for DPSC-Subsistence. Exhibit 7-5 summarizes the ESEX/DESEX related cost information.

Exhibit 7-5
Average Future Cost Per Site

229,000 + 750,000 + 657,000 + 694,000 = 2,330,000 Total DLA Investment Cost (FY 93 $)	$2,330,000
2,330,000 / 6 = 388,333 Average Cost per site	$388,333
Estimated price for a future DLA site	230,745
Custom software for each service	73,200
Total cost for custom s/w = 5 * 73,200	366,000
230,745 + (5 * 73,200) / 15 = 255,145 Estimated price for future sites	$255,145
15 * 255,145 = 3,827,172 Cost to implement at 15 military sites	$3,827,172
Total investment cost	$6,157,172
Average for 21 sites	$293,199

By assuming the average service ESOC approximates the average DLA ESOC in terms of personnel, workload, and productivity, we developed a scenario that illustrates a total costs and benefits profile for all 21 sites. This scenario assumes five military sites are implemented in fiscal years 1993, 1994 and 1995 and that benefits accrue in the same proportion as those realized by DLA. This scenario is presented in Exhibit 7-6.

Exhibit 7-6
Cost and Benefits for DLA Plus 15 Additional Sites
(FY 93 $000)

	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	Total
Total Investment	$229	$750	$657	$694									$2,330
15 Site Investment				1,227	1,300	1,300							3,827
Hardware Maintenance	0	0	0	32	117	203	288	374	374	374	374	374	2,507
Total Cost	$229	$750	$657	$725	$1,417	$1,503	$288	$374	$374	$374	$374	$374	$8,664
Cash Savings-Personnel				$272	$457	$457	$457	$457	$457	$457	$457	$457	$3,928
Cost Avoidance		150	602	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	14,446
Total DLA Savings		$150	$602	$1,455	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$18,375
15 Site Savings (w/ cost avoidance)					$1,684	$3,368	$5,053	$5,053	$5,053	$5,053	$5,053	$5,053	$35,368
Net Savings/(Cost)	($229)	($600)	($56)	$730	$2,288	$3,887	$6,786	$6,700	$6,700	$6,700	$6,700	$6,700	$46,306
Net Present Value				$696	$1,984	$3,064	$4,863	$4,365	$3,968	$3,607	$3,279	$2,981	$28,808

Investment parameters for this profile are as follows:

	21 Site Scenario
8-year NPV savings ($000)	$28,808
Payback analysis (years)	.50
Savings/Investment ratio	7.66

Sensitivity analysis

A sensitivity analysis was performed to determine the impacts of a change in the discount rate. All spreadsheets used in this analysis were re-run using a discount rate of 3.4 percent. This rate was based on the rates provided in Appendix C of OMB Circular A-94. As a result of this analysis it was determined that lowering the discount rate increases the NPV of the actual and estimated costs and benefits. Investment in ESEX still shows positive financial results. The results of this analysis are provided in Appendix C.

When a 3.4 percent discount rate is used to compute actual plus future costs and benefits, the present value (excluding sunk costs) increases to the following amounts:

- PV Total Cost $1,507,000
- PV Cash Savings $3,370,000
- PV Cost Avoidances $11,780,000
- Total Net Present Value $13,643,000

Non-quantifiable benefits

Some benefits of ESEX described previously defy monetary quantification. The following summarizes the non-quantifiable benefits of ESEX:

Improved Customer Service. The significant increase in customer usage of the ESOC resource since the introduction of ESEX is a clear indication of improved customer service. Customer productivity has been enhanced through decreases in time wasted waiting on hold for a customer service person, or being inadvertently disconnected and repeating the inquiry cycle.

Improved Material Readiness. ESEX provides a tool for anticipating and avoiding priority system supply problems.

Better Application of Resources. ESEX has enabled DLA management to focus dwindling personnel resources on value added knowledge work as opposed to routine tasks. Priority item ESOC backlogs are decreasing as a result of ESEX.

Improved Data for Management Decisions. ESEX generates automated reports on the nature of customer requests, type, source frequency, time, and many other parameters which provide insight to DLA managers.

Recommendations

Establish guidelines for cost estimating

A solid cost estimate, tied to the expected functionality of a proposed project, is a key beginning point for the development of an information system. Therefore, the methodology and documentation used to arrive at the cost estimate becomes important. Although some general parameters for information system cost estimating exist, both within and outside DLA, the Federal Government and the Secretary of Defense are placing more and more emphasis on initial cost estimates. By establishing guidelines for cost estimating, DLA would again be well prepared to deal with cost justification and would have greater confidence in the expected life cycle cost of a system. Some areas for consideration are:

- document the hardware environment of new system development
- identify and document the skills of in-house development and maintenance personnel
- document and monitor the functionality of the system under estimate

Broaden customer base through technology

The use of ESEX has increased the workload tremendously. However, a significant number of customers cannot use ESEX because they do not have touch tone phones. These customers must still speak with customer service representatives directly. DLA should consider offering its customers simple "tone generators" as a short term solution. A tone generator is an inexpensive electronic device ($10 to $15) that would allow users to transmit tones to ESEX. While the up front cost would be minimal, the benefits would be a further reduction in phone operators.

Utilize ESEX performance reports as a management tool

ESEX automatically provides a wide range of workload and customer statistics. Analysis of this data could provide insight into problem anticipation and resolution, staffing, and improved customer service.

Perform analysis of utilizing interactive fax capabilities

Our research indicates that for relatively little additional hardware cost, DLA can upgrade the current ESEX system to included interactive fax capability. This can further improve customer service by allowing customers to have printed copies of requests sent to them for retention. A brief analysis should be performed to weigh the cost of this additional functionality against possible savings from further personnel reductions, paper and mailing costs and decreased workload from repeat callers, as well as the additional customer service benefits provided.

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Title

Draft Estimates of Recommended Buy Benefits for SAMMS I^3

SAMMS I^3 Benefit Analysis, Milestone II

ESEX Executive Summary Report/Business Case

PA&E Draft Guidelines

DoDI 7041.2 "Economic Analysis and Program Evaluation for Resource Management," October 18, 1972

DLAM 7041.1 "Economic Analysis," May 1985

DLAR 7041.1 "Economic Analysis and Program Evaluation for Resource Management," February 25, 1985

RADIX II, ESEX: A Management Overview

ESEX, DLA Briefing, February 27, 1992

ESEX Operator's Reference Manual

Customer Assistance Handbook, 10th edition, 1991

DLA Memo, re: ESEX Statistics

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Requirements Analysis (Update) for Automated Voice Response System, June 1989

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Customer Demand Analysis Data, DISC, 12/92

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DLAR 5200.17, Security Requirements for Automated Information and Telecommunications Systems, Oct. 9, 1991

JLSC Memo, May 23, 1992, re: ESEX at non-DLA sites

ESEX Desk Top Guide

IG Inspection reports, various dates

Science and Technology, volume 129, number 11, p. 38, "Speaking of Efficiency, Say Hello to Voice Technology"

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ESEX List of Contacts

Name		Office Symbol	Room #	Topic
Maj Scott	Aitkens	ESOC	4C473	ESOCs
Dan	Bochra	DCSC-OSE		DCSC ESOC Deputy Chief
Shelly	Broussard	DLA-ZS	3A675	System
John	Bryant	DORO	Bldg 32	CIT Workload Data
Col J.	Carpenter	DLA-OM	Bldg 5 Dr10	C.I.T.
Marcia	Chapen	DLA-ZRM	3A558	Cost data
Vickie	Christensen	DLA-OM	Bldg 5 Dr10	CIT Workload Data
Mark	Cunningham	DLA-CM	3D617	Actual Personnel Costs
John	DeSanto	DISC-Z	Bldg 3	HW Configuration-Lans
Linda	Fields	DLA-ZSS	3A675	Hardware Maintenance
Merle	Foster	DGSC-OSE		DGSC ESOC Deputy Chief
Maj Cathy	Garmon	DPSC-FOE		DPSC C&T ESOC Chief
Jeanne	Gerwitz	DLA-ZS	Bldg 3	Project Oversight
Peggy	Glasheen	DLA-CE	Bldg 3	Standards
Maj Ann	Green	DISC-OCE	Bldg 3	DISC ESOC Chief
Carl	Gulley	DPSSO	Bldg 33	Standards
Cheryl	Haines	DISC-RMO	Bldg 36	Lead Time
Burt	Hoffman	DISC-OPD	Bldg3 B-3	Supply Systems
Lou	Julg	DISC-RM	Bldg 36	Resource Data
Stephanie	Kelso	DGSC-OSCC	Bldg 32	ESOC Operations
Sandra	King	DLA-ZSM	3A675	Project Oversight
Kris	Krishnan	DLA-OWM	Bldg 4	Exec Summary Report Detail
Joe	Kutza	DPSC-M		ESEX Workload/Personnel
Dave	Lampe	DISC-AO	Bldg 5	Lead Time
Tom	Lanagan	DORO	Bldg 32	Lead Time
Tom	Lee	DGSC-O	Bldg 32	ESEX Workload Data
Ginalee	Lewis	DESC		ESEX Workload/Personnel Data
Maj Betty(BJ)	Messmore	DESC-OSE		DESC ESOC Chief
Stanley	Naimon	DGSC-OPR	Bldg 32-I	ESEX Configuration/Hardware
Arlester	Newsome	DESC-OSE		DESC ESOC Deputy Chief
Mike	Pouy	DLA-OSP	Bldg 4	Supply Policy/Lead Time
Jan	Rider	DLA-LO	Bldg 3	COTR
Stan	Rimdzins	DISC-RMO	Bldg 36	Lead Time
Dave	Robinson	DPSC-FOE		DPSC C&T ESOC Deputy Chief
Valerie	Shepard	DLA-K		Personnel Data
Barbara	Standard	DLA-C	Bldg 3	Budgets
Steve	Super	DISC-ZW	Bldg 3	Hardware
Avis	Titcher	DISC-Z	Bldg 3	HW Configuration
Kay	Vierra	DLA-OSS	4B260	Functional

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ESEX Historical Economics ($000)
(3.4% discount rate)

	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	TOTAL
1 1987 Economic Analysis (FY 87$)											
Investment	$58	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58
Savings	46	46	46	46	46	46	46	46	46	46	461
Net Savings/(Cost)	(12)	46	46	46	46	46	46	46	46	46	403
Net Savings/(Cost) (FY 93 $$)	($15)	$55	$53	$51	$49	$48	$46	$44	$43	$41	$415

	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
2 Executive Summary Report (FY 93$)											
Investment	N/A	$1,160	$0	$0	$0	$0	$0	$0	$0	$0	$1,160
Operation	0	0	86	86	86	86	86	86	86	86	684
Savings	0	510	510	510	510	510	510	510	510	510	4,590
Net Savings/(Cost)	$0	($650)	$425	$425	$425	$425	$425	$425	$425	$425	$2,746
Net Present Value (FY 93$)	$0	($639)	$404	$390	$378	$365	$353	$342	$330	$320	$2,243

Notes
1 Estimate for one site only
2 Estimate for all DLA sites

KPMG Peat Marwick

ESEX Incurred and Projected Costs and Benefits ($000)
(3.4% discount rate)

	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Total Investment	$205	$707	$634	$694	$0	$0	$0	$0	$0	$0	$0	$0	$2,240
Hardware Maintenance	0	0	0	32	117	117	117	117	117	117	117	117	968
Total Cost	$205	$707	$634	$725	$117	$117	$117	$117	$117	$117	$117	$117	$3,207
Cash savings	0	0	0	272	457	457	457	457	457	457	457	457	3,928
Net cash savings/(cost)	($229)	($750)	($657)	($453)	$340	$340	$340	$340	$340	$340	$340	$340	$631
Cost Avoidance	0	150	602	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	14,446
Net total savings/(cost)	($229)	($600)	($56)	$730	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$1,904	$15,077
DISCOUNTED CASH STREAMS													
Net Present Value				$718	$1,811	$1,751	$1,694	$1,638	$1,584	$1,532	$1,482	$1,433	$13,643
PV Total Cost				$713	$111	$108	$104	$101	$97	$94	$91	$88	$1,507
PV Cash Savings				$267	$435	$420	$407	$393	$380	$368	$356	$344	$3,370
PV Cost Avoidances				$1,163	$1,488	$1,439	$1,391	$1,346	$1,301	$1,259	$1,217	$1,177	$11,780

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Actual and Estimated Costs and Benefits (Including Military Sites)
($000)
(3.4% discount rate)

	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	Total
Total Investment	$229	$750	$657	$694									$2,330
15 Site Investment				1,227	1,300	1,300							3,827
Hardware Maintenance	0	0	0	32	117	203	288	374	374	374	374	374	2,507
Total Cost	$229	$750	$657	$725	$1,417	$1,503	$288	$374	$374	$374	$374	$374	$8,664
Cash Savings-Personnel				$272	$457	$457	$457	$457	$457	$457	$457	$457	$3,928
Cost Avoidance		150	602	1,183	1,564	1,564	1,564	1,564	1,564	1,564	1,564	1,564	14,446
Total DLA Savings		$150	$602	$1,455	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$2,021	$18,375
15 Site Savings (w/ cost avoidance)					$1,684	$3,368	$5,053	$5,053	$5,053	$5,053	$5,053	$5,053	$35,368
Net Savings/(Cost)	($229)	($600)	($56)	$730	$2,288	$3,887	$6,786	$6,700	$6,700	$6,700	$6,700	$6,700	$46,306
Net Present Value				$718	$2,176	$3,575	$6,037	$5,765	$5,575	$5,392	$5,214	$5,043	$39,494

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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DISC

	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	4	52,112.51	208,450.04
	transceivers	4	303.05	1,212.20
	programmable transfer switch	1	19,142.81	19,142.81
	modem switch	1	613.14	613.14
	9600-baud sync modems	2	1,684.39	3,368.78
	tape backup system	1	1,675.93	1,675.93
	spare parts kit	1	21,518.64	21,518.64
	test/life cycle support equipment	1	125,291.00	125,291.00
	upgrade to life cycle support equipment	1	25,832.28	25,832.28
	uninterruptible power supply	1	2,900.58	2,900.58
SOFTWARE				
	UNIX-386 OS (full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	3	902.10	2,706.30
	3270 gateway drivers	4	3,043.17	12,172.68
	data base manager	4	824.57	3,298.28
	UNIX network (supports three engines)	2	1,320.73	2,641.46
	Ethernet drivers	4	493.34	1,973.36
	custom software	1	410,548.99	410,548.99
	modification to fit ESEX to site	1	22,287.72	22,287.72
OTHER				
	on-site installation, fine tuning	1	$31,391.56	$31,391.56
	operator training	2	1,938.53	3,877.06
	operator/user guide	6	74.00	444.00
	Total Cost for ESEX at DISC			$912,138.54
	DISC Implementation Only			$501,589.55

Costs extracted from Delivery Order #0001, RADIX II Contract.

Custom software of $410,548.99 was a one time charge and was paid for through this delivery order.

DGSC	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	2	52,112.51	104,225.02
	programmable transfer switch	1	19,142.81	19,142.81
	modem switch	1	613.14	613.14
	9600-baud sync modems	2	1,684.39	3,368.78
	tape backup system	1	1,675.93	1,675.93
	spare parts kit	1	21,518.64	21,518.64
	uninterruptible power supply	1	2,900.58	2,900.58
	security enhancement system	1	170,451.00	170,451.00
SOFTWARE				
	UNIX-386 OS (full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	2	902.10	1,804.20
	3270 gateway drivers	2	3,043.17	6,086.34
	data base manager	2	824.57	1,649.14
	UNIX network (supports three engines)	0.67	1,320.73	884.89
	Ethernet drivers	2	493.34	986.68
	modification to fit ESEX to site	1	14,939.92	14,939.92
OTHER				
	site survey	1	$3,973.19	$3,973.19
	on-site installation, fine tuning	1	27,795.50	27,795.50
	operator training	2	1,858.30	3,716.60
	technical training	1	1,521.94	1,521.94
	operator/user guide	6	74.00	444.00
	Total Cost for ESEX at DGSC			$398,490.03

Notes:

1. System is included at all sites; charge is included in this delivery order as a one time charge.
   Costs extracted from Delivery Order #0002, RADIX II Contract.

DESC	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	2	52,112.51	104,225.02
	programmable transfer switch	1	19,142.81	19,142.81
	modem switch	1	613.14	613.14
	9600-baud sync modems	4	1,684.39	6,737.56
	tape backup system	1	1,675.93	1,675.93
	spare parts kit	1	21,518.64	21,518.64
	uninterruptible power supply	1	2,900.58	2,900.58
SOFTWARE				
	UNIX-386 OS (full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	2	902.10	1,804.20
	3270 gateway drivers	2	3,043.17	6,086.34
	data base manager	2	824.57	1,649.14
	UNIX Network (supports three engines)	0.67	1,320.73	884.89
	Ethernet drivers	2	493.34	986.68
	modification to fit ESEX to site	1	14,939.92	14,939.92
OTHER				
	site survey	1	$4,770.71	$4,770.71
	on-site installation, fine tuning	1	29,923.80	29,923.80
	operator training	2	2,221.10	4,442.20
	technical training	1	1,935.89	1,935.89
	operator/user guide	6	74.00	444.00
	Total Cost for ESEX at DESC			$235,473.18

Costs extracted from Delivery Order #0003, RADIX II Contract.

DPSC (MED)	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	2	52,112.51	104,225.02
	Programmable transfer switch	1	19,142.81	19,142.81
	modem switch	1	613.14	613.14
	9600-baud sync modems	2	1,684.39	3,368.78
	tape backup system	1	1,675.93	1,675.93
	spare parts kit	1	21,518.64	21,518.64
	uninterruptible power supply	1	2,900.58	2,900.58
SOFTWARE				
	UNIX-386 OS (full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	2	902.10	1,804.20
	3270 gateway drivers	2	3,043.17	6,086.34
	data base manager	2	824.57	1,649.14
	UNIX Network (supports three engines)	0.67	1,320.73	880.49
	Ethernet drivers	2	493.34	986.68
	modification to fit ESEX to site	1	14,939.92	14,939.92
OTHER				
	site survey	1	$4,164.66	$4,164.66
	on-site installation, fine tuning	1	31,391.56	31,391.56
	operator training	2	1,938.53	3,877.06
	technical training	1	1,639.25	1,639.25
	operator/user guide	6	74.00	444.00
	Total Cost for ESEX at DPSC (Med)			$232,099.93

Costs extracted from Delivery Order #0004, RADIX II Contract.

DCSC and C&T Estimate

	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	2	$52,112.51	$104,225.02
	PTS	1	$19,142.81	$19,142.81
	modem switch	1	$613.14	$613.14
	9600-baud sync modem	2	$1,684.39	$3,368.78
	tape backup system	1	$1,675.93	$1,675.93
	spare parts kit	1	$21,518.64	$21,518.64
	uninterruptible power supply	1	$2,900.58	$2,900.58
SOFTWARE				
	UNIX-386 OS (full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	2	$902.10	$1,804.20
	3270 gateway drivers	2	$3,043.17	$6,086.34
	database manager	2	$824.57	$1,649.14
	UNIX network (supports 3 engines)	0.67	$1,320.73	$884.89
	Ethernet drivers	2	$493.34	$986.68
	modification to fit ESEX to site	1	$14,939.92	$14,939.92
OTHER				
	site survey	1	$4,302.85	$4,302.85
	on-site installation, fine tuning	1	$29,703.62	$29,703.62
	operator training	2	$2,005.98	$4,011.96
	technical training	1	$1,699.03	$1,699.03
	operator/user guide	6	$74.00	$444.00
	Total cost for ESEX			$230,749.26

Costs are estimated using averages of DESC, DOSC, and DPSC (Med).

ARMY DESEX

	ITEM	Quantity per system	Unit Price	Total Price
HARDWARE				
	cabinet	2	$4,693.92	$9,387.84
	AVRS engines	2	52,112.51	104,225.02
	programmable transfer switch	1	19,142.81	19,142.81
	modem switch	1	613.14	613.14
	9600-baud sync modems	4	1,684.39	6,737.56
	tape backup system	1	1,675.93	1,675.93
	spare parts kit	1	21,518.64	21,518.64
	uninterruptible power supply	1	2,900.58	2,900.58
SOFTWARE				
	UNIX-386 OS			
	(full development version)	1	$1,403.89	$1,403.89
	UNIX-386 (run time version)	2	902.10	1,804.20
	3270 gateway drivers	2	3,043.17	6,086.34
	data base manager	2	824.57	1,649.14
	UNIX Network (supports three engines)	0.67	1,320.73	884.89
	Ethernet drivers	2	493.34	986.68
	modification to fit ESEX to site	1	14,939.92	14,939.92
	custom application software	1	73,200.00	73,200.00
OTHER				
	site survey	1	$4,164.66	$4,164.66
	on-site installation, fine tuning	1	31,391.56	31,391.56
	operator training	2	1,938.53	3,877.06
	technical training	1	1,639.25	1,639.25
	operator/user guide	6	74.00	444.00
	Total Cost for DESEX at first Army site			$308,673.11

Costs extracted from Delivery Order #0005, RADIX II Contract.

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

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DISC ESOC Summary

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls	Salary per call	Calls per FTE
March 1991	12	$23,313	13,235	$1.76	1,103
April 1991	12	23,313	11,977	1.95	998
May 1991	12	23,313	12,932	1.80	1,078
		Average Before ESEX	12,715	$1.83	1,060
June 1991	Transition Period		←		
July 1991	12	23,313	37,882	0.62	3,157
August 1991	12	23,313	32,777	0.71	2,731
September 1991	12	23,313	30,061	0.78	2,505
October 1991	12	23,313	35,413	0.66	2,951
November 1991	12	23,313	28,719	0.81	2,393
December 1991	12	23,313	22,768	1.02	1,897
January 1992	12	23,313	31,794	0.73	2,650
February 1992	12	23,313	35,348	0.66	2,946
March 1992	12	23,313	40,067	0.58	3,339
April 1992	12	23,313	36,638	0.64	3,053
May 1992	12	23,313	32,193	0.72	2,683
June 1992	12	23,313	31,999	0.73	2,667
July 1992	12	23,313	32,291	0.72	2,691
August 1992	12	23,313	34,613	0.67	2,884
September 1992	12	23,313	35,164	0.66	2,930
October 1992	12	23,313	43,598	0.53	3,633
November 1992	12	23,313	32,889	0.71	2,741
December 1992	12	23,313	34,544	0.67	2,879
		Average After ESEX	33,820	$0.69	2,818
January 1993	9	$18,163	33,820	$0.54	3,758
February 1993	9	18,163	33,820	0.54	3,758
March 1993	9	18,163	33,820	0.54	3,758
April 1993	9	18,163	33,820	0.54	3,758
May 1993	9	18,163	33,820	0.54	3,758
June 1993	9	18,163	33,820	0.54	3,758
July 1993	9	18,163	33,820	0.54	3,758
August 1993	9	18,163	33,820	0.54	3,758
September 1993	9	18,163	33,820	0.54	3,758
	Average After ESEX with Personnel Reduction		33,820	$0.54	3,758

Average Monthly Calls With ESEX	33,819.9
Calls Processed Per Person Without ESEX	1,059.6
Imputed FTE required without ESEX	31.9
FTE Avoided	19.9
Burdended Personnel Costs Avoided	$601,581

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.
All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews .

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DGSC ESOC Summary

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls	Salary per call	Calls per FTE
March 1991					
April 1991					
May 1991					
June 1991					
July 1991					
August 1991					
September 1991					
October 1991	8	$14,143	11,620	$1.22	1,453
November 1991	8	14,143	10,017	1.41	1,252
December 1991	8	14,143	6,768	2.09	846
January 1992	8	14,143	12,506	1.13	1,563
February 1992	8	14,143	13,841	1.02	1,730
March 1992	8	14,143	16,243	0.87	2,030
April 1992	8	14,143	15,078	0.94	1,885
May 1992	8	14,143	14,230	0.99	1,779
June 1992	8	14,143	11,142	1.27	1,393
July 1992	8	14,143	16,670	0.85	2,084
August 1992	8	14,143	15,967	0.89	1,996
September 1992	8	14,143	17,011	0.83	2,126
October 1992	8	14,143	10,692	1.32	1,337
		Average Before ESEX	13,214	$1.07	1,652
November 1992	8	14,143	21,368	$0.66	2,671
December 1992	8	14,143	22,109	0.64	2,764
		Average After ESEX	21,739	$0.65	2,717

Average Monthly Calls With ESEX	21,738.5
Calls Processed Per Person Without ESEX	1,651.8
Imputed FTE required without ESEX	13.2
FTE Avoided	5.2
Burdended Personnel Costs Avoided	$141,829

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.
All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews

DESC ESOC Summary

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls	Salary per call	Calls per FTE
March 1991					
April 1991					
May 1991					
June 1991					
July 1991					
August 1991					
September 1991					
October 1991	13.5	$23,584	16,867	1.40	1,249
November 1991	13.5	23,584	11,830	1.99	876
December 1991	13.5	23,584	11,437	2.06	847
January 1992	13.5	23,584	12,437	1.90	921
February 1992	13.5	23,584	19,564	1.21	1,449
March 1992	13.5	23,584	18,151	1.30	1,345
April 1992	13.5	23,584	18,240	1.29	1,351
May 1992	13.5	23,584	14,651	1.61	1,085
June 1992	13.5	23,584	14,306	1.65	1,060
July 1992	13.5	23,584	17,151	1.38	1,270
August 1992	13.5	23,584	15,439	1.53	1,144
September 1992	13.5	23,584	16,399	1.44	1,215
		Average Before ESEX	15,539	$1.52	1,151
October 1992	Transition Period		←		
November 1992	7.5	13,284	22,774	0.58	3,037
December 1992	7.5	13,284	23,941	0.55	3,192
		Average After ESEX	23,358	$0.57	3,114

Average Monthly Calls With ESEX	23,357.5
Calls Processed Per Person Without ESEX	1,151.1
Imputed FTE required without ESEX	20.3
FTE Avoided	6.8
Burdended Personnel Costs Avoided	$184,463

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.
All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews

DCSC ESOC

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls	Salary per call	Calls per FTE
January 1992	11	$19,293	16,039	$1.20	1,458
February 1992	11	19,293	15,600	1.24	1,418
March 1992	11	19,293	16,368	1.18	1,488
April 1992	11	19,293	15,848	1.22	1,441
May 1992	11	19,293	14,571	1.32	1,325
June 1992	11	19,293	15,591	1.24	1,417
July 1992	11	19,293	16,365	1.18	1,488
August 1992	11	19,293	16,628	1.16	1,512
September 1992	11	19,293	15,820	1.22	1,438
October 1992	11	19,293	17,366	1.11	1,579
November 1992	11	19,293	15,955	1.21	1,450
December 1992	11	19,293	16,571	1.16	1,506
January 1993	11	19,293	16,060	1.20	1,460
February 1993	11	19,293	16,060	1.20	1,460
March 1993	11	19,293	16,060	1.20	1,460
April 1993	11	19,293	16,060	1.20	1,460
May 1993	11	19,293	16,060	1.20	1,460
June 1993	11	19,293	16,060	1.20	1,460
Pre ESEX Average			16,060	1.20	1,460
July 1993	8	19,293	29,544	0.65	3,672
August 1993	8	19,293	29,544	0.65	3,672
September 1993	8	19,293	29,544	0.65	3,672
October 1993	8	19,293	29,544	0.65	3,672
November 1993	8	19,293	29,544	0.65	3,672
December 1993	8	19,293	29,544	0.65	3,672

Estimated Average Monthly Calls With ESEX	29,544.4
Calls Processed Per Person Without ESEX	1,460.0
Imputed FTE required without ESEX	20.2
FTE Avoided	9.2
Burdended Personnel Costs Avoided	$251,816

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.
All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews

DPSC-Med ESOC

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls	Salary per call	Calls per FTE
January 1992	Not provided				
February 1992	Not provided				
March 1992	Not provided				
April 1992	Not provided				
May 1992	Not provided				
June 1992	7	$14,720	6,100	2.41	871
July 1992	7	14,720	6,080	2.42	869
August 1992	7	14,720	4,257	3.46	608
September 1992	7	14,720	7,231	2.04	1,033
October 1992	7	14,720	8,077	1.82	1,154
November 1992	7	14,720	6,909	2.13	987
December 1992	7	14,720	6,442	2.28	920
January 1993	7	14,720	6,442	2.28	920
Pre ESEX Average			6,442	2.37	920
February 1993	5	14,720	11,851	1.24	2,315
March 1993	5	14,720	11,851	1.24	2,315
April 1993	5	14,720	11,851	1.24	2,315
May 1993	5	14,720	11,851	1.24	2,315
June 1993	5	14,720	11,851	1.24	2,315
July 1993	5	14,720	11,851	1.24	2,315
August 1993	5	14,720	11,851	1.24	2,315
September 1993	5	14,720	11,851	1.24	2,315
October 1993	5	14,720	11,851	1.24	2,315
November 1993	5	14,720	11,851	1.24	2,315
December 1993	5	14,720	11,851	1.24	2,315

Estimated Average Monthly Calls With ESEX	11,851.1
Calls Processed Per Person Without ESEX	920.3
Imputed FTE required without ESEX	12.9
FTE Avoided	5.9
Burdended Personnel Costs Avoided	$192,132

Bound call data was estimated using the ratio of transactions per call data provided.

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.

All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews

DPSC-C&T ESOC

	Personnel (FTE)	Personnel Unburdended Monthly Payroll cost	Calls *	Salary per call	Calls per FTE
January 1992	7	$14,720	2,750	5.35	393
February 1992	7	14,720	2,800	5.26	400
March 1992	7	14,720	2,300	6.40	329
April 1992	7	14,720	3,700	3.98	529
May 1992	7	14,720	4,100	3.59	586
June 1992	7	14,720	4,500	3.27	643
July 1992	7	14,720	4,800	3.07	686
August 1992	7	14,720	6,500	2.26	929
September 1992	7	14,720	6,900	2.13	986
October 1992	7	14,720	4,261	3.45	609
November 1992	7	14,720	4,261	3.45	609
December 1992	7	14,720	4,261	3.45	609
January 1993	7	14,720	4,261	3.45	609
February 1993	7	14,720	4,261	3.45	609
March 1993	7	14,720	4,261	3.45	609
April 1993	7	14,720	4,261	3.45	609
May 1993	7	14,720	4,261	3.45	609
Pre ESEX Average			4,261	3.45	609
June 1993	5	14,720	7,839	1.88	1,531
July 1993	5	14,720	7,839	1.88	1,531
August 1993	5	14,720	7,839	1.88	1,531
September 1993	5	14,720	7,839	1.88	1,531
October 1993	5	14,720	7,839	1.88	1,531
November 1993	5	14,720	7,839	1.88	1,531
December 1993	5	14,720	7,839	1.88	1,531

Estimated Average Monthly Calls With ESEX	7,838.8
Calls Processed Per Person Without ESEX	608.7
Imputed FTE required without ESEX	12.9
FTE Avoided	5.9
Burdended Personnel Costs Avoided	$192,132

All call data was extracted from ESEX reports, automated work counts, phone interviews, or was estimated for future periods.
All salary and FTE data are based on the site specific personnel composition as determined by personnel rosters and interviews
Due to unusually high volume of buying resulting from conditions in Somolia, the average number of calls from January to Septembe was substituted for October, November, and December 1992 based on conversations with DPSC personnel.

ECONOMIC ANALYSIS OF THE EMERGENCY SUPPLY EXPERT SYSTEM

CONTENTS

KPMG Peat Marwick

Unit Monthly Maintenance Costs	
AVRS Engine	$600
PTS	200
Tape Backup System	25

Annual ESOC Maintenance Costs (FY 93 $$)

	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01
SC									
Engine	$28,800	$28,800	$28,800	$28,800	$28,800	$28,800	$28,800	$28,800	$28,800
PTS	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	300	300	300	300	300	300	300	300	300
SC									
Engine	0	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
PTS	0	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	0	300	300	300	300	300	300	300	300
SC									
Engine	0	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
PTS	0	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	0	300	300	300	300	300	300	300	300
SC (Med)									
Engine	0	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
PTS	0	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	0	300	300	300	300	300	300	300	300
SC (C&T)									
Engine	0	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
PTS	0	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	0	300	300	300	300	300	300	300	300
SC									
Engine	0	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
PTS	0	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Tape B/U	0	300	300	300	300	300	300	300	300
TAL	$31,500.00	$117,000.00	$117,000.00	$117,000.00	$117,000.00	$117,000.00	$117,000.00	$117,000.00	$117,000.00

ITEM	FY 91	FY 92	FY 93	FY 94	FY 95
Engine	4	6	4	0	continued through FY 01
PTS	1	3	2	0	continued through FY 01
Tape B/U	1	3	2	0	continued through FY 01

Cumulative equipment

ITEM	FY 91	FY 92	FY 93	FY 94	FY 95
Engine	4	10	14	14	continued through FY 01
PTS	1	4	6	6	continued through FY 01
Tape B/U	1	4	6	6	continued through FY 01

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13. ABSTRACT *(Maximum 200 words)*

The Standard Automated Materiel Management System (SAMMS) is the AIS that DLA's Defense Supply Centers use to manage wholesale inventories of all assigned commodities other than fuels and subsistence. SAMMS has several satellite systems, three of which are partially implemented, and these particular projects required economic analysis updates. The three systems are the Emergency Supply Expert (ESEX) System, the Automated Inventory Manager Support (AIMS) System, and the DLA Pre-Award Contracting System (DPACS).

The heart of the ESEX system is an automated voice response system to handle customer inquiries. The AIMS system processes recommended buys and DPACS primary workload includes purchase requests.

14. SUBJECT TERMS

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