Integrated Logistics Support Life Cycle Cost

Technical Report
Topic N92-938 Final Report

April 1993

Prepared For

Naval Sea Systems Command
SBIR Topic N92-938

Administered By

DCMAO – Baltimore
200 Towsontown Blvd.
West Towson, MD 21204-5299
Contract N00024-92-C-4303

Submitted By

ANADAC, Inc.
2011 Crystal Drive, Suite 401
Arlington, VA 22202

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13. ABSTRACT *(Maximum 200 words)*

The Integrated Logistics Support Life Cycle Cost project consisted of a study to determine the feasibility of developing an innovative method for estimating logistics life cycle costs for Navy systems and equipment. By designing logistics considerations into systems and equipment, life cycle costs may be reduced--although initial acquisition cost may increase The ability to logistically influence system design, and reduce costs, greatly diminishes with each stage in the acquisition process. The research and analysis included: requirements determination, data collection, data analysis, and cost relationship factor development; and focused on the logistics costs in several NAVSEA acquisition programs to determine a range of representative logistics costs. Several methods for estimating system life cycle costs currently exist. The Logistic Support Analysis process permits integration of logistics considerations and system design and comparison of design alternatives. This research demonstrates that because comparable systems and equipment have similar logistics support requirements, logistics support cost estimating factors can be developed based on existing logistics support data, and used to predict the cost of logistics support plans and products in similar acquisition programs.

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This technical report documents the results of the Phase I feasibility study conducted in accordance with Contract #N00024-92-C-4303 awarded under SBIR Topic No. N92-938.

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1.0 INTRODUCTION

1.1 Overview

This Phase I of the Integrated Logistics Support Life Cycle Cost Small Business Innovative Research (SBIR) project was a research study to determine the feasibility of developing an innovative method for estimating logistics life cycle costs for Navy systems and equipment and thus provide for trade-off analysis during system design to minimize logistics life cycle cost. The objectives of this project were to develop and document a method of estimating life cycle costs of proposed system designs and to display the resulting data for comparative and trade-off analysis. The governing premise of this effort was the belief that by designing logistics considerations into new systems and equipment, although initial acquisition cost may be increased, the total life cycle cost may be reduced. The parallel to this premise is that the ability to logistically influence new system design, and thereby potentially reduce costs, greatly diminishes with each succeeding stage in the acquisition process.

1.2 Approach

The general approach applied in this study was a process of research and analysis. This process was characterized by several logical and distinct phases, including:

- requirements determination
- data collection
- data analysis
- cost relationship factor development

This effort specifically focused on the logistics costs in several Naval Sea Systems Command (NAVSEA) acquisition programs to determine a range of representative logistics costs. That was the starting point from which logistics cost relationship factors could be developed.

2.0 CURRENT SCENARIO

It is widely recognized that Integrated Logistics Support (ILS) costs can represent a large portion of a system's total life cycle cost. That cost is further influenced by the type of system and length of development time. As a result, increased emphasis has been placed on ILS costs in program acquisition. The acquisition policies and procedures promulgated by recent Department of Defense (DOD) and Secretary of the Navy

(SECNAV) directives require that life cycle cost and alternative design trade-off analyses be considered for all acquisition programs. In the current environment of declining resources, this will become even more important. Acquisition program managers must be able to accurately determine the ILS requirements and costs of the programs for which they are responsible.

It was within this framework that this research study began to approach the objective of developing a logistics support life cycle cost model. A detailed review of related efforts, however, revealed that a number of excellent tools and methods for accurately estimating the life cycle costs of a system or equipment are currently available. Figure 1 is a list of models or methods determined to be the best of those reviewed.

ACQUISITION PROGRAM LIFE CYCLE COST ESTIMATING GUIDANCE

- Operating and Support Cost-Estimating Guide; Office of the Secretary of Defense Cost Analysis Improvement Group; May 1992
- Integrated Logistics Support (ILS) Cost Tables; Naval Sea Logistics Center, August 1992
- Integrated Logistics Support (ILS) Life Cycle Cost Model (LCCM); NAVSEA 04PA; March 1991
- Life Cycle Cost Model for Defense Material Systems; MIL-HDBK-276-1(MC)
- Life Cycle Cost Estimating Guidance for the Logistics Requirements and Funding Plan; NAVSEA SL-000-AA-LOG-010

Figure 1

It should not be assumed that this review included all such cost estimating guidance. Clearly, other guidance, some acquisition program specific, also exists. This was evident from program life cycle cost estimates reviewed. The Operating and Support Cost Estimate for Sponsors Program Proposal developed for the AN/BSY-2 Submarine Combat System Program is an excellent example of program specific life cycle cost estimating.

It was also equally evident during this initial review that a definitive process currently exists by and through which logistics considerations and system design can be integrated, and design alternatives can be compared. That process is Logistic Support Analysis (LSA). LSA, a systems engineering process, is required of all Navy acquisition programs. The objectives of LSA are to influence system design, identify and specify logistics support resource requirements, avoid duplication of the analytical effort and assess supportability. Detailed guidance for performing LSA, and for LSA tailoring, is provided in MIL-STD-1388-1A. Additionally, MIL-STD-1388-2A provides guidance for creating an LSA record (LSAR), which documents LSA generated data.

In the current Navy environment, the total objectives of the ILS and LSA processes are seldom met. The most common reason is that LSA is not carried out with design or in direct conjunction with the ILS elements. Rather, LSA, which was intended to be an integral process of ILS, has evolved as a separate discipline, and the LSAR has become a stand-alone product instead of the source of data for the generation of subsequent logistics products. The problem with LSA lies in its application, not with the concept. The LSA process is often viewed as too difficult to be implemented in NAVSEASYSCOM acquisition programs. Principally, LSA must be planned and scheduled in an integrated fashion, and then it must be reviewed in an integrated fashion. This involves establishment of the LSA strategy; determining the applicable tasks, products and data requirements; and planning how the LSA process will be conducted. Management of the LSA process must establish the relationships between the data development and use, and coordinate the timing and scheduling of the data flow within and among the process. This is all extremely difficult and time-consuming for the program manager. To be fully utilized, and produce the benefit intended, the LSA process must be streamlined.

In those acquisition programs in which LSA has been properly performed and the data properly used, design alternatives and support concepts which maximize life cycle support while minimizing life cycle costs are the result. For example, the AN/BQQ-5E Sonar System acquisition program has used LSA extensively, and qualitative and quantitative support objectives have been refined into design parameters for use in design, cost, operational readiness, capability trade-offs, risk assessment and the development of logistics support capabilities. Initially, LSA was used to evaluate the effects of alternative designs on support costs and operational readiness. During design, the analysis was oriented toward incorporating logistics requirements into hardware design, with the goal of creating an optimum sonar system that meets performance specifications and is most cost-effective over the planned life cycle. As the program progresses through development and production, LSA will concentrate on providing timely, valid data for all ILS elements to ensure system supportability.

The initial efforts of this study served to emphasize that excellent tools are currently available to acquisition program managers to estimate the logistics support life cycle costs of systems and equipments, and that LSA remains the best, as well as the required, method of conducting cost and support trade-off analyses during system design. Reenforcement of the use of these by NAVSEASYSCOM program managers, rather than development of additional methods and processes appears to be a more appropriate course of action. The same initial efforts, however, revealed that there is a logistics support cost area that could be better defined; a cost area not well covered in existing models and analyses: the costs for logistics planning documents and logistics support products.

After discussion with the Contracting Officer Technical Representative (COTR) relative to the initial review, it was agreed that this study effort would be refocused on acquisition program ILS costs, specifically those ILS requirements such as logistics planning documents and logistics support products which are acquired directly by the acquisition program manager, with acquisition program funds, during the acquisition process. This is funding over which the program manager has direct control, and for which he is directly responsible. Additionally, the decisions made by the program manager relative to the acquisition of ILS plans and products directly impact support of the system being acquired. It is believed that this effort will provide program managers with an easier and more straightforward method of selecting and estimating the cost of acquisition logistics support requirements.

3.0 ACQUISITION PROGRAM EVALUATION

In-depth reviews were conducted on a number of NAVSEASYSCOM acquisition programs in order to identify and select representative programs from which to develop logistics support costs relationship factors. The programs reviewed are listed in Figure 2 and represent a cross-section of NAVSEA acquisition programs. In addition to the programs listed in Figure 2, several shipbuilding programs were reviewed, but not used in the logistics support cost factor development because they were considered too complex for this initial study effort.

3.1 Evaluation Criteria

To develop useful and sound cost relationships, it is necessary to group available data into relatively homogeneous categories. Specifically, for this effort, it was appropriate to group similar acquisition programs together to develop logistics support cost relationship factors. The underlying assumption is that similar systems should have

PROGRAMS REVIEWED

AN/STC-3 Fiber Optic Integrated Voice Communication System (FOIVCS)

AN/SRC-53(V) Damage Control Wirefree Communications System (DC WIFCOM)

AN/SRC-47(V) Flight Deck Communications System (FDCS)

Lightweight Dive System (LWDS)

Diver Active Thermal Protection System (DATPS)

AN/BPS-16(V) Series Radar

AN/BQQ-5E Sonar Set

AN/SYS-2(V)1 Integrated Autom atic Detection and Tracking (IADT) System

AN/SPS-48E Radar Set

Combat Control System (CSS) MK 1

Standard Missile – 2 (SM-2)

Vertical Launch ASROC (VLA) Missile

AN/SQQ-89 Improved Surface Anti-Submarine Warfare Combat System

AEGIS Weapon System MK 7

AN/BSY-2 Submarine Combat System

Figure 2

similar logistics support requirements with similar costs, whereas the logistics support requirements of a complex electronics system should be different from those of a missile.

The criteria with which the programs were reviewed reflected this assumption. All the programs selected were at the same relative place in the acquisition process. Because logistics support requirements may change as the system development progresses, any comparison should be sensitive to the program's position in the acquisition process. For this effort, the program data were applicable to Milestone III. The programs reviewed were either at the end of the Engineering and Manufacturing Development Phase or the beginning of the Production and Deployment Phase. It was considered equally important that the program documentation from which data was extracted should have been generated within approximately the same timeframe. This ensures that logistics support decisions reflected in the data were made in the same overall funding environment and in accordance with the same NAVSEASYSCOM program support philosophy.

3.2 Cost Data Source

For this effort, logistics support cost data were collected from acquisition program Logistics Requirements and Funding Plans (LRFP). It should be noted that the LRFP is a Chief of Naval Operations requirement and is produced by the individual weapon system program office. The LRFP is organized by the ILS elements, plus a separate category for ILS Planning, and a summary of total ILS costs. Figure 3 is a functional overview of the LRFP. The Work Breakdown Structure and a short description of the reporting requirements grouped into each ILS category are provided in Figure 4. Since the primary objective of this effort was to develop a methodology for estimating the cost of logistics support requirements, all data organization and subsequent development of logistics support cost relationship factors were based on this LRFP Work Breakdown Structure. In addition, although the LRFP reports "Required" and "Funded" amounts for each ILS line item entry, the "Required" amount was used for cost relationship development. While it is recognized that the "Funded" amount may ultimately become the actual amount, the ILS requirements, as determined by the program manager, were the focus of the review.

3.3 ILS Planning Data Source

Individual program characteristics, support concepts, and logistics support requirements were collected from program documentation, principally the Integrated Logistic Support Plan (ILSP), Maintenance Plan, Logistics Support Analysis Strategy and the Test and Evaluation Master Plan (TEMP). With one exception, the ILSP proved to be the preferred source because it provides the most comprehensive explanation of system support

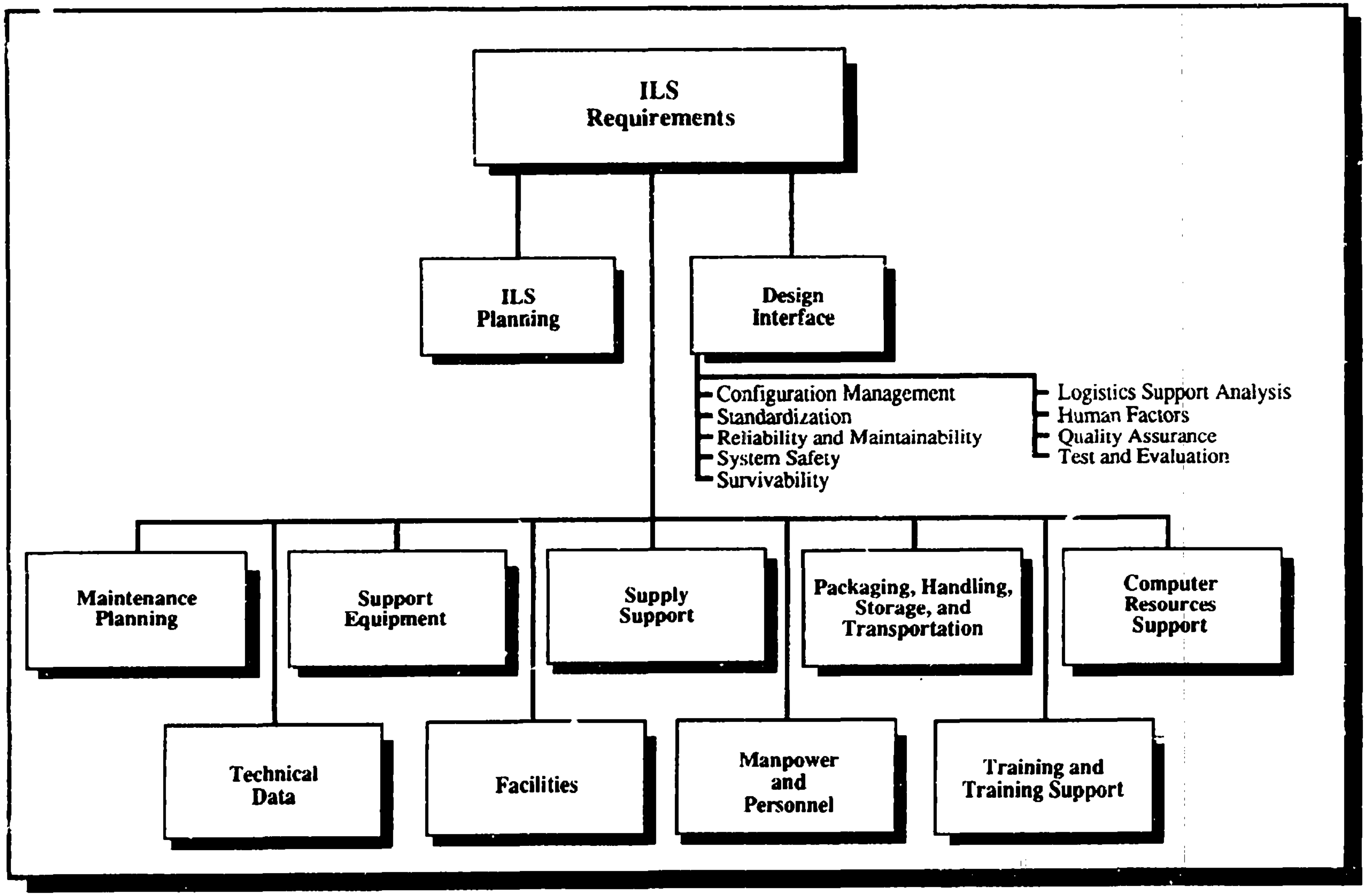

Figure 3
LRFP Functional Overview

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LRFP WORK BREAKDOWN STRUCTURE AND DEFINITIONS	
ILS PLANNING:	Consists of the requirements necessary to ensure the development and conduct of an ILS program. Includes ILS Management; the requirements for a Logistic Requirements and Funding Plan; CALS; the ILS Plan; Acquisition Plan; TEMP; Operational Logistic Support Summary and the costs associated with these plans.
DESIGN INTERFACE:	Consists of all other support related programs which are not planned by another requirement or funding process. This includes Configuration Management; Standardization; Reliability and Maintainability; Safety; Survivability; Logistic Support Analysis; Quality Assurance; Manned Systems Engineering and the plans, analysis and data required to support these factors.
MAINTENANCE PLANNING:	Consists of contractor and/or government maintenance requirements. Includes Level of Repair Analysis; Organizational Level Requirements; Intermediate Level Requirements; Depot Level Requirements; Miniature/Microminiature; MAMs; Depot Plan; Maintenance Plan and Direct Fleet Support (NETS, CETS and MOTU).
SUPPORT EQUIPMENT:	Consists of Support and Test Equipment Requirements for all Levels of Maintenance; Training Sites; Test Sites; and Software Support Activities. Includes Common Test Equipment; Special Test Equipment; Test Program Sets; Tools, Jigs, and Fixtures; Calibration/Calibration Standards; and analysis, studies, plans, and data associated with Support Equipment.
SUPPLY SUPPORT:	Consists of requirements to ensure the appropriate spare and repair parts support. Includes Program Support Data Sheets; Provisioning Technical Documentation; spares and repair parts for initial outfitting, intermediate level support, depot level support, installation and checkout, test site and stock; Interim Contractor Supply Support; transition to Navy support; allowance lists and the analysis, plans and data associated with Supply Support.
PACKAGING, HANDLING, STORAGE & TRANSPORTATION:	Consists of requirements to ensure the proper packaging, handling, storage and transportation of the system/equipment. Includes special containers or handling equipment; special preservation requirements; security pertaining to PHS&T and the associated analysis, plans and data.

Figure 4

LRFP WORK BREAKDOWN STRUCTURE AND DEFINITIONS	
COMPUTER RESOURCES SUPPORT:	Consists of the requirements for the maintenance of all Computer Software (operational, test, support, and training) by Contractors, Navy Software Support Activities and Training activities. Includes the requirements for operational hardware, peripherals, and software support system hardware needed to establish and support Software Support Activities, and the data, analysis and plans required to develop and manage a computer hardware and software life cycle.
TECHNICAL DATA:	Consists of the resources required for the preparation, publication, and printing of the initial technical manuals required for operation and maintenance of the systems/equipment. Also includes costs associated with Technical Manual Changes; Technical Manual Management; Drawing/Reproduction Data; Planned Maintenance Systems; Technical Repair Standards; and analysis, studies, and plans associated with Technical Data.
FACILITIES:	Consists of the cost of Military Construction Planning and Design; Military Construction; O&M,N Unspecified Minor Constr[illegible]on; MCON Unspecified Minor Construction, Publi[illegible]rks Support; and Utilities.
MANPOWER & PERSONNEL:	Consists [illegible]ource requirements for perfor[illegible]g analyses to deter[illegible] [illegible]anpower and personnel requirements, inc[illegible]ding the [illegible]heduling of the arrival of trained pers[illegible]el.
TRAINING & TRAINING SUPPORT:	[illegible] the requirements for training course development, [illegible]al or Contractor Training Services; Technical Training Equipment; Installation of Training Equipment; Training Devices/Aides; and analysis, studies, plans, and data required for Training and Training Support.
TOTAL ILS COST:	Consists of the sum of the above elements. Includes a composite of the estimated ILS requirements, approved funding levels for ILS requirements and total program ILS requirements.

Figure 4 (contin[illegible]

concepts and overall logistics support requirements. Also, it is updated at each milestone and is relatively more accessible than other program documentation. The exception mentioned above related to system quantity being acquired. The acquisition quantity used to develop cost relationship factors represents the quantity found in the TEMP because quantities listed in the LRFPs were often inconsistent. Some LRFPs provided only the quantity associated with the LRFP specified years, while others provided total or no quantity. The quantity used to develop cost relationship factors includes the total of both developmental and production systems.

4.0 REPRESENTATIVE PROGRAM REVIEW

For this initial effort, the programs reviewed were grouped into three broad categories based on the size and complexity of the system being acquired and the logistics support structure required by the system. The underlying assumption being that the more complex a system is to support, the greater the acquisition logistics costs. The three categories established were Low Complexity, High Complexity and Ordnance Programs. It became quickly evident that, using this approach, the system maintenance and support philosophy was the principal determinant of system complexity.

4.1 Low Complexity Systems

The programs included in this category are relatively small, inexpensive systems which support shipboard functions. The support concept for these programs is typically based on a very limited, and specifically tailored, application of Logistic Support Analysis. These programs are characterized by a maintenance concept consisting of three levels of maintenance: organizational, intermediate and depot. Organizational maintenance typically involves planned maintenance accomplished in accordance with Planned Maintenance System (PMS) documentation and corrective maintenance consisting of piece part repair of components and remove/replace of system modules. Corrective maintenance is typically performed through the use of Built-In-Test/Built-In-Test-Equipment to fault isolate. Intermediate level maintenance consists of repair beyond the capability of the organizational level, while major repair and overhaul of system modules are accomplished at the depot level. Maintenance assistance at the organizational level is provided through Direct Fleet Support, which includes Navy Engineering Technical Services (NETS) and Contractor Engineering Technical Services (CETS).

Typically, the other support requirements of low complexity programs follow established processes. Supply support consists of the application of standard Navy provisioning and supply procedures to ensure timely and adequate spare and repair parts support. Appropriate spares are provided at all levels of maintenance and are replenished through the supply system. Maintenance Assist Modules (MAMs) and Installation and Checkout (INCO) spares may also be provided. In the area of Packaging, Handling, Storage and Transportation, the only unique requirements are special packaging for Electrostatic Sensitive Devices (ESD), special handling of any classified components and the storage constraints of any portable power supplies and shelf-life material. Support equipment for a low complexity system typically consists of common tools and already available General Purpose Electronic Test Equipment (GPETE), although limited Special Purpose Electronic Test Equipment (SPETE) may be required. The only Computer Resources Support requirement is that for the Built-In-Test Equipment software. Technical documentation consists of technical manuals for the three maintenance levels, the appropriate technical drawings, Provisioning Technical Documentation (PTD) for spares determination, PMS documentation for the organizational level and Technical Repair Standards (TRS) for depot repair. Training and training support is generally limited to factory or Navy training of depot and NETS personnel, Navy training of organizational level maintenance personnel and operational training conducted by installation teams. The related factors such as configuration management, quality assurance, safety and standardization varied among programs, but typically did not constitute major cost requirements. For the low complexity systems there were no manpower and personnel or facilities requirements.

4.2 High Complexity Systems

The programs included in this category are large, costly systems which form a major part of a ship's mission. As a result, system operational availability (A_o) is high, and the support concept is designed to maintain that high state of operational readiness. For the high complexity systems reviewed, comprehensive Logistics Support Analysis (LSA) and Level of Repair Analysis (LORA) were conducted, frequently under the development contract. Results of these analyses formed the basis of the system maintenance support concept. The maintenance concept of these programs typically consists of three levels of maintenance, but with greater emphasis placed on the organizational and depot level, and limited intermediate level maintenance. At the organizational level, emphasis is placed on planned maintenance (PMS) and the removal and replacement of assemblies, through extensive use of prescribed diagnostic procedures, built-in test features and specified test sets. Depot maintenance includes system overhaul and refurbishment, repair and replacement of components and assemblies and manufacture of critical non-available parts. Maintenance assistance is provided through NETS and CETS Direct Fleet Support.

LSA is typically used to identify supply support requirements which are satisfied through standard provisioning and supply procedures, with spares and repair parts provided to the appropriate maintenance levels. The complexity of the system and the resulting depth of supply support necessary, however, frequently requires Interim Contractor Supply Support (ICSS) until full Navy supply support is in place. ICSS requires establishment of a contractor spares/repair parts stock point, requisitioning and distribution procedures for required spares and planning for future transition to Navy support. Packaging, Handling, Storage and Transportation requirements are generally limited to the special packaging of any Electrostatic Discharge (ESD) sensitive and Electromagnetic Interference (EMI) items, handling of classified components and shelf-life considerations. Support equipment requirements reflect an increased need for unique diagnostic equipment, resulting in a larger range and depth of Special Purpose Electronic Test Equipment (SPETE), as well as increased requirements for General Purpose Electronic Test Equipment (GPETE). High complexity systems also reflect increased Computer Resources Support because of significant computer software development, maintenance and simulation requirements. Technical documentation represents another increased support requirement; increased complexity requires an increase in the technical detail necessary to operate and maintain the system. Technical manuals, drawings, Provisioning Technical Documentation (PTD), PMS documentation and Technical Repair Standards (TRS) become significant support cost requirements. Training and training support also represent increased requirements for complex systems. As complexity increases, both in operation and maintenance, personnel skill levels must also increase thereby increasing the requirements for operator and maintenance training, training equipment and devices and unique training facilities, with their own support requirements. The logistics support related factors increase in volume and importance as system complexity increases. Configuration management, reliability and maintainability, standardization, safety and quality assurance can become major aspects of system support, with significant cost impact. While increased system complexity can increase requirements for manpower and personnel and facilities, the high complexity programs reviewed accommodated those requirements within existing support structures. As a result, no increased support costs in these areas were reflected.

4.3 Ordnance Programs

During the review of the programs, it quickly became clear that ordnance programs, while meeting the high complexity criteria, were unique enough to warrant a separate category. The unique requirements of these programs result in different support concepts with different costs. As with the high complexity systems, Logistics Support Analysis (LSA) and Level of Repair Analysis (LORA) were used to generate the source data for the development of logistics support and documentation. The difference between the ordnance programs and the other high complexity programs is in the maintenance concept. The ordnance programs have only two levels of maintenance — intermediate and depot. Organizational maintenance is limited to inspection, cleaning and preservation. Test and assembly/disassembly of repairable sections are performed at the intermediate level; sections and components are repaired and reassembled at the depot level. The elimination of organizational level maintenance drives the other support elements. Supply support is not provided for the organizational level. No support or test equipment is required at the organizational level. Although computer resources support and technical data are required by the program, application to the organizational level is limited. Training and training support are required, but organizational training is limited to operational training only. As in the other high complexity programs, the logistics support related factors increase in scope and cost. The requirement for reliability and maintainability, quality assurance and safety are major factors. Similar to the other high complexity programs, the ordnance programs had no increased requirements in the manpower and personnel and facilities support elements. The most unique support characteristic of the ordnance programs is the requirement for specialized containers for handling, storage and transportation. These containers were a major cost consideration in the ordnance programs reviewed.

5.0 ILS COST RELATIONSHIPS

5.1 Representative Costs of ILS Requirements

After completion of the program review, the final phase of this research effort was to develop representative logistics support requirement costs. This was accomplished through examination of the actual costs of support requirements within each of the three program categories established. Again, the underlying premise was that similar systems should have similar support requirements, with similar costs. The cost of each logistics support element was examined across the spectrum of programs within each category, and a representative cost for each element was determined. This did not involve cost averaging, but, rather, entailed an objective should-cost approach using logistics support cost data and cost estimating methods available. Figure 5 provides the representative costs of logistics support requirements developed for the three categories of acquisition programs reviewed. The increase in logistics support costs inherent in increased system complexity is also clearly demonstrated in Figure 5.

REPRESENTATIVE COSTS OF ILS REQUIREMENTS
($K)

REQUIREMENT	SYSTEM COMPLEXITY		ORDNANCE PROGRAM
	Lo	Hi	
ILS Planning/Management	299	1,090	9,707
Design Interface (includes LSA)	478	4,619	86,599
Maintenance	2,872	82,028	329,508
Support Equipment	539	1,592	93,340
Supply Support	732	44,738	134,928
Packaging, Handling, Storage & Transportation	0	0	17,627[1]
Computer Resources Support	35	12,092	6,680
Technical Data	1,029	10,596	10,554
Facilities	0	0	0
Manpower & Personnel	0	0	0
Training & Training Support	70	63,758	55,880
Total ILS Cost	6,054	220,513	744,823

Note 1: Specialized container cost

Figure 5

5.2 Representative Costs of Logistics Planning Documents and Products

The next step in determining representative logistics support costs focused on the logistics planning documents and products required by the acquisition program manager to ensure support of the system being acquired. The approach used to develop a representative cost for selected documents and products was the same as that used for determining the representative costs of overall logistics requirements. The actual cost of these planning documents and products across the three program categories was used to determine the representative costs of similar plans and products. The representative costs developed for logistics planning documents for the three program categories are shown in Figure 6. The representative costs of logistics products are shown in Figure 7.

REPRESENTATIVE COSTS OF SELECTED LOGISTICS PLANNING DOCUMENTS ($K)

DOCUMENT	SYSTEM COMPLEXITY		ORDNANCE PROGRAM
	Lo	Hi	
ILS Plans	103	361	1,359
Logistics Support Analysis	134	141	3,051
Maintenance Analysis/Plans	60	173	15,223
Supply Support Analysis/Plans	58	578	4,906
CRLCMP	0	239	1,185
Technical Manual Management	23	1,824	1,226
Technical Drawing Management	0	798	5,857
Training Analysis/Plans	42	1,610	0

Figure 6

REPRESENTATIVE COSTS OF SELECTED LOGISTICS PRODUCTS ($K)

PRODUCT	SYSTEM COMPLEXITY		ORDNANCE PROGRAM
	Lo	Hi	
Configuration Status Accounting System	42	547	8,615
ILS Management/Team	138	729	4,548
Special Purpose Test Equipment	68	423	37,493
Special PHS&T Equipment	0	0	17,627
Computer Software	80	9,006	4,125
Technical Manuals	273	2,931	4,697
Technical Drawings	121	798	5,857
PMS Documentation	15	579	0[1]
Training Course Development	207	7,904	8,106
Training Devices/Aids	0	8,609	47,598

Note 1: Reflects maintenance concept of minimum organizational level maintenance

Figure 7

5.3 Logistics Cost Relationship Factors

The final step of this study was to establish cost relationship factors for the selected logistics support planning documents and logistics support products. These cost relationship factors were determined through the comparison of the number of system or equipment units acquired by the representative programs with the typical costs of the logistics support plans and products. This cost relationship factor represents the cost of a specific plan or product for one unit of that program category. The resulting cost relationship factors for logistics planning documents are provided in Figure 8. The cost relationship factors for logistics products are provided in Figure 9.

LOGISTICS PLANNING DOCUMENT COST FACTORS

DOCUMENT	SYSTEM COMPLEXITY		ORDNANCE PROGRAM
	Lo	Hi	
ILS Plans	2,340.91	10,027.78	92.59
Logistics Support Analysis	3,045.45	3,916.67	207.88
Maintenance Analysis/Plans	1,363.64	4,805.56	1,037.20
Supply Support Analysis/Plans	1,318.18	16,055.56	334.26
CRLCMP	0	6,638.89	80.74
Technical Manual Management	522.73	50,666.67	83.53
Technical Drawing Management	0	22,166.67	399.06
Training Analysis/Plans	954.55	44,722.22	0

Figure 8

By reducing the representative cost of logistics plans and products to a unit level, it becomes possible to develop an algorithm for estimating the cost of these plans and products for similar acquisition programs. That algorithm is:

$$C = N \cdot c(Ef_1 \cdot Ef_2 \cdot ---- Ef_n)$$

where

C = cost of logistics plan/product
N = number of units being acquired
c = appropriate logistics plan/product cost factor (from Figure 8 or 9)

LOGISTICS PRODUCT COST FACTORS

PRODUCT	SYSTEM COMPLEXITY		ORDNANCE PROGRAM
	Lo	Hi	
Configuration Status Accounting System	954.55	15,194.44	586.97
ILS Management/Team	3,136.36	20,250.21	309.87
Special Purpose Test Equipment	1,545.46	11,750.16	2,554.54
Computer Software	1,818.18	250,166.67	281.05
Technical Manuals	6,204.55	81,416.67	320.02
Technical Drawings	2,751.16	22,166.76	399.06
PMS Documentation	340.91	16,083.33	0
Training Course Development	4,704.54	219,55.56	552.29
Training Devices/Aids	0	239,138.89	3,243.03

Figure 9

Ef = annual escalation index (provided in NAVCOMPTNOTE 7111)
n = number of cost escalation years; i.e. number of years the system is being procured

During this study effort, it became clear that it is feasible to develop l[illegible]ics support cost estimating factors from historical data and use those estimating factc[illegible]ith cost escalation indices, in an algorithm to predict current logistics support costs. The application of this methodology will enable NAVSEASYSCOM program managers to anticipate the cost of logistics support plans and products for similar acquisition programs.

6.0 SIGNIFICANCE OF CURRENT NAVY INITIATIVES

6.1 Zero-Based Logistics

The logistics support cost estimating method proposed here is complimentary to the logistics support costs determination requirements of the currently ongoing NAVSEASYSCOM Zero-Based Logistics effort. Before implementation of DoDD 5000.1 and DoDI 5000.2, there were over 400 instructions, from DoD to the SYSCOM level, and more than 60 commonly required plans which could apply to a major acquisition program.

In 1989, NAVSEASYSCOM began the Zero-Based Logistics process with an analysis of the requirements for acquisition planning documents. It was found that 82% of the program information was redundant, appearing in multiple documents.

The revision of DOD Directive 5000.1 resulted in the cancellation of a host of requirements associated with the acquisition process. However, recent research shows that, even under the new DOD 5000 series, more than 130 program plans could still be required by or of program offices responsible for acquisitions. But DOD Instruction 5000.2, in discussing program plan requirements, states that, "Plans may be combined to best satisfy the needs of the Program Manager." With the ZBL effort as a strong foundation, NAVSEASYSCOM is now developing the Master Program Plan (MAPP) in response to this guidance. The MAPP initiative is designed to implement the intent of the DOD 5000 series as it relates to the streamlining of the Navy's acquisition logistics process. By eliminating redundancies and providing only essential data, this effort will reduce costs, increase program office productivity, and improve the quality of acquisition data.

Ultimately, the MAPP will be a flexible, automated data base in which all redundancies are eliminated and all data is controlled by the program office. During the first phase of the MAPP methodology development effort, the MAPP is essentially a data element dictionary made up of two parts. Part I contains system information which applies across the entire acquisition program. Part II comprises a series of annexes, one for each relevant support area (e.g., maintenance planning, technical data, manpower/personnel, training, configuration management, supply support). Once all data elements are refined and approved, they will be structured into a data base and output report options will be defined.

The restructuring of the Logistics Requirements and Funding Plan (LRFP) consistent with the MAPP is also underway. Program funding data will be included as a distinct section of the MAPP. This logistics support cost estimating methodology will provide a rapid means of developing the necessary logistics support cost estimates for the MAPP LRFP.

6.2 Logistics Planning and Requirements Simplification System (LOGPARS)

The objective of this ongoing effort is to merge the current Army LOGPARS shell environment and the Navy logistics knowledge data base to form a larger Navy-wide composite logistics knowledge-based expert system. The completed Navy LOGPARS will standardize logistics products across the Navy and enhance acquisition program office productivity through the use of an automated ILS expert system. This expert system will be designed to integrate program budgeting with program planning through the use of a Logistics Requirements and Funding Summary (LRFS). Previously called the Logistics Requirements and Funding Plan (LRFP), the content and format of the LRFS and LRFP are the same. The LRFS will be standardized for all Navy acquisition programs and will provide the capability to display the funding requirements represented in the Integrated Logistics Support Plan, as well as display the impacts of program budget changes. The methodology presented in this study for estimating the costs of logistics planning documents and logistics products will dovetail with the requirement for developing logistics support cost data for LOGPARS.

7.0 FUTURE RESEARCH

As a follow-on to the development of these preliminary logistics support cost estimating factors, the focus of future effort will be two-fold. The first will be the significant expansion of acquisition program categories from which to develop cost estimating factors. This initial research clearly indicates that the more homogeneous the program categories are, the better the cost estimating factors that are produced. The expanded groupings, coupled with an increased program sample size, could be based on functional commonality, such as electronics, and include categories for shipboard electronics, ordnance electronics and other electronics, as an example. Further refinement could be based on program size, as defined by Acquisition Category (ACAT). A note of caution, however, is appropriate relative to shipbuilding programs. Since there are only several shipbuilding programs currently underway, and the difference in mission, systems and equipment among them is so great, it is doubtful that reasonable logistics cost estimating factors for shipbuilding programs could be developed.

After refining the program categories and establishing representative logistics support cost factors for those expanded categories, the development of an automated cost estimating model will be the next step. This model will be based on the cost estimating methodology and algorithm previously discussed. Designed for a microcomputer environment, this automated model will provide program managers with a user-oriented method of predicting the cost of logistics support plans and products. The software development services necessary to automate the cost estimating model are readily available, as are the PC systems within NAVSEASYSCOM Program Offices on which to operate it.

8.0 SUMMARY

Based on the premise that similar systems and equipments have similar logistics support requirements, at similar costs, this SBIR research effort demonstrates that logistics support cost estimating factors can be developed based on existing logistics support data, and then used to predict the cost of logistics support plans and products in similar acquisition programs. The effort grouped a number of NAVSEASYSCOM programs, at the same relative place in the acquisition process, into three homogeneous categories — low complexity, high complexity and ordnance programs. Recognizing that programmatic characteristics are the best predictors of logistics support costs, the support concepts of the programs in each category were reviewed, with the maintenance philosophy being the principal driver of the logistics support structure established for the systems being acquired. The logistics support cost of each system was also reviewed, and that cost data used to develop representative costs, for each category, of logistics support functions, planning documents and products. Representative cost factors for selected logistics support plans and products were then established based on the number of typical systems being acquired. Finally, an algorithm was developed to which the logistics support cost factors could be applied to produce a cost estimate for the logistics support plans and products of a system being acquired. This simplified methodology can provide program managers with a rapid and viable means of estimating acquisition logistics support costs.

Consistent with other ongoing Navy initiatives, future, follow-on efforts will expand the NAVSEASYSCOM program sample size and establish more definitive and homogeneous groupings of programs. This will serve to refine the representative logistics support cost factors previously developed. The final step will be the development of a microcomputer model, based on the support cost algorithm. This automated process will provide NAVSEASYSCOM program managers with the capability of predicting the cost of logistics support plans and products for the systems they are acquiring — a capability essential for those program managers to compete in the current environment of decreasing resources.

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