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THE DEVELOPMENT OF RECOMMENDATIONS
 FOR APPLYING LOGISTIC SUPPORT ANALYSIS
 ON AERONAUTICAL SYSTEMS DIVISION PROGRAMS

Thesis

Fred Conway, Jr., GS-13

AFIT/GLM/LSY/88S-14

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DEPARTMENT OF THE AIR FORCE
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AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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THE DEVELOPMENT OF RECOMMENDATIONS FOR APPLYING LOGISTIC
SUPPORT ANALYSIS ON AERONAUTICAL SYSTEMS DIVISION PROGRAMS

THESIS

PRESENTED TO THE FACULTY OF THE SCHOOL OF SYSTEMS AND
LOGISTICS OF THE AIR FORCE INSTITUTE OF TECHNOLOGY
AIR UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

FRED CONWAY, JR., GS-13

September 1988

Approved for public release; distribution unlimited

Preface

The purpose of this thesis was to develop recommendations for improving the Logistic Support Analysis (LSA) management process. ASD management personnel have indicated that ineffective LSA implementation has resulted in problems with weapon system support on ASD programs. Problems have occurred primarily because of incomplete and late LSA data. Therefore, this research effort focused on developing recommendations to improve the LSA implementation process. Although the research in this study was limited to Aeronautical Systems Division (ASD) programs, the same analysis could be applied to the other AFSC weapon system development divisions, Space Division (SD), Ballistic Missile Office (BMO), Electronic Systems Division (ESD), and Armament Division (AD).

The approach in accomplishing this study was to select several ASD weapon systems, review the LSA contractual requirements and contractor responses, document any problems in LSA implementation, and formulate recommendations to improve the LSA implementation process.

This research could not have been performed without the assistance of logistics personnel in the various staff and weapon system program offices. These personnel included Mr. Gunars Fricsons, ASD/ALT, who proposed the study; Mr Charles McArthur, ASD/ALTB, who provided the initial direc-

tion and contacts for the study; Bobby Davis in the C-17 SPO, Capt Robert Chinn in the F-15 Ring Laser Gyro program office; Ronald Potter in the A-7D Aircraft Upgrade and Peace Pearl program offices; Nevin Fessler in the simulator program office; Mary Waker, the GPG Integrated Logistics Support Manager (ILSM); Keith Edwards in the MARK XV program office; John Yaniec, the LSA manager for the AC-130, ATARS, INEWS, and ALE-47 programs; and Carrie Mae Hull in the F100-PW-229 program office.

A special thanks to Capt Brett Andrews for his guidance, time, and effort in reviewing this thesis and to Lt Col Materna for serving as the reader.

And last but not least thanks to my family for their dedication and perseverance during this research effort.

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Abstract

The purpose of this study was to develop recommendations for improving the application of Logistic Support Analysis (LSA) tasks on Aeronautical Systems Division (ASD) programs in accordance with Department of Defense and U.S. Air Force regulatory requirements. The scope of the study was limited to ASD programs.

A literature review was conducted to provide background information for the thesis and identify other efforts in the LSA area. The literature search focused on efforts which have been conducted to assess the impact of applying logistic support analysis techniques.

LSA implementation problems were reviewed at ASD and recommendations were developed to improve the LSA management process. The results of the review indicated that there is a causal relationship between LSA tasking and support problems encountered on ASD weapon system programs.

The study was concluded with lists of recommendations for improving the LSA implementation process and areas for conducting further studies.

THE DEVELOPMENT OF GUIDELINES FOR APPLYING LOGISTIC
SUPPORT ANALYSIS ON AERONAUTICAL SYSTEMS DIVISION PROGRAMS

I. Introduction

Background

Recent decisions by the President and Congress have caused significant cuts in the Department of Defense Budget. A significant portion of that budget is spent maintaining and operating Air Force weapon systems. Therefore, it is essential that we as Air Force personnel, ensure that limited resources are used in the most efficient manner to maintain force readiness. This requirement places more emphasis on the need of the military services to implement the provisions of DODD 5000.39, "Acquisition and Management of Integrated Logistic Support for Systems and Equipment." Integrated Logistic Support (ILS) is a disciplined, unified, and iterative approach to the management and technical activities necessary to integrate support considerations into system and equipment design; develop support requirements that are related consistently to readiness objectives, design, and to each other; acquire the required support; and provide the required support during the operational phase at minimum cost (8: 2 - 2). DOD policy, as stated in DODD 5000.39

requires that system readiness objectives receive the same emphasis as schedule, technical performance, and cost objectives. System readiness objectives are criteria used for assessing the ability of a system to undertake and sustain a specified set of missions at planned peacetime and wartime utilization rates. Examples of system readiness measures are combat sortie rate over time, peacetime mission capable rates, operational availability, and asset ready rate (8: 2 - 3). DODD 5000.39 is implemented in the Air Force by AFR 800-8, "Integrated Logistics Support (ILS) Program," AFLC/AFSC Supplement 1, and ASD Supplement 1. Air Force Regulation 800-8 states that the objective of the ILS program is "to field weapon systems and equipment that achieve the required readiness and sustainability posture at an affordable life cycle cost (13:1)." One of the functional requirements of the ILS program is to use Logistics Support Analysis (LSA) techniques to ensure reliability, maintainability, and supportability requirements are fully integrated with the production design. LSA is the selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the systems engineering process. The LSA process is an iterative and multidisciplinary activity which can be divided into two general parts (a) analysis of supportability and (b) assessment and verification of supportability (9:59). The analysis of supportability part of LSA begins at the system level. The analysis affects the design and operational concepts; identifies gross logistic support resource

requirements of alternative concepts; and relates design, operational, and supportability characteristics to the system readiness objectives and goals. The LSA process includes studies, comparative analysis and support driver identification, identification of technological opportunities, tradeoffs between support, operational and design concepts and between alternative support concepts e.g., organic versus contractor support. The objective of LSA is to assist the Integrated Logistics Support (ILS) management process in (1) causing support considerations to influence design, (2) defining support requirements that are related optimally to design and to each other, (3) acquiring the required support, and (4) providing the required support during the operational phase at minimum cost (13:1). The LSA data is documented in the Logistics Support Analysis Record (LSAR) (9:8). MIL-STD-1388-1A provides general requirements and task descriptions governing performance of LSA during the life cycle of systems and equipment (9:1). MIL-STD-1388-2A prescribes the data element definitions, data field lengths, and data entry requirements for logistics support analysis record (LSAR) data (10:1). DODD 5000.39 requires that the ILS program begin at program initiation and continue for the life of the system. AFSC/AFLCR 800-36, Logistics Support Analysis, requires that the LSA program be established and maintained throughout the acquisition cycle as an integral part of the systems engineering effort. The application of

LSA on a specific program is accomplished through the selective application (tailoring) of the generic analysis task statements of MIL-STD-1388-1A. The tailoring process considers acquisition phase, acquisition strategy, type of program, design latitude, work already accomplished, and previous experience base.

ILS Elements

ILS elements are the basic components of a weapon system's total support capability. Each element is inter-related and interdependent with one or more of the other elements as well as the weapon system design. The integration of each element with the other elements and the weapon system design is achieved through the LSA process (MIL-STD-1388-1A and MIL-STD-1388-2A). The ILS elements include maintenance planning (MP); manpower and personnel (M&P); supply support (SS); support equipment (SE); technical data (TD); training and training support (TTS); computer resources support (CRS); facilities (FA), packaging, handling, storage, and transportation (PHS&T), and design interface (DI). MP is the process conducted to evolve and establish maintenance concepts, plans, and requirements for the on- and off-equipment maintenance to be performed during the life of the system or equipment. M&P is the identification of military and civilian personnel requirements with the skills and grades needed to operate and support a weapon system and equipment over its lifetime

at peacetime and wartime rates. SS encompasses all management actions, procedures, and techniques necessary to determine requirements to acquire, catalog, receive, store, transfer, issue, and dispose of secondary items. SE is all equipment (mobile or fixed) required to support the operation and maintenance of a weapon system, except that which is an integral part of the mission equipment. TD is recorded information regardless of the form or character of scientific or technical nature. TTS encompasses the processes, procedures, techniques, and equipment used to train active, reserve, and civilian personnel to operate and maintain a weapon system throughout the system's life cycle. CRS is the facilities, hardware, software, and personnel needed to operate and support mission-critical equipment. FA are the permanent or semipermanent real property assets required to support the weapon system consistent with the operational and support concepts. PHS&T encompasses the requirements, resources, processes, procedures, design considerations, and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly. DI is the ILS element that specifically relates logistics design parameters to systems readiness resource requirements and support cost.

LSA Tasks

The LSA tasks are divided into five general sections

(9:4):

Section 100, Program Planning and Control

Section 200, Mission and Support Systems
Definition

Section 300, Preparation and Evaluation of
Alternatives

Section 400, Determination of Logistics Support
Resource Requirements

Section 500, Supportability Assessment

Each LSA task, as identified in MIL-STD-1388-1A is divided into four parts; the purpose, task description, task input, and task output. The purpose describes the reason for performing the task. The task description provides the detailed subtasks which comprise the overall tasks. The specific tasks should be "tailored" to the particular program during each phase. The task input specifies the information required to perform each task. The task output identifies the expected results from performance of the task. The LSA tasks are identified in Table I (9:5 - 8). Within ASD the Deputy Chief of Staff (DCS) engineering (ASD/EN) has been designated as the office of primary responsibility (OPR) for tasks that are heavily oriented toward system and/or support equipment design. The DCS logistics (ASD/AL) has been designated as OPR for tasks that are oriented toward LSA management and/or integrated logistic support elements.

The OPR designation means the organization is responsible for management of the LSA task and not necessarily the accomplishment of the task.

Table I

Logistics Support Analysis Tasks

Task Section 100

Program Planning and Control

Purpose: To provide for formal program planning and review actions.

Task 101 - Development of an early logistic support analysis strategy (OPR: ASD/AL)

Purpose: To develop a proposed LSA program strategy for use early in an acquisition program and to identify the LSA tasks and subtasks which provide the best return on investment (9:10).

Subtask 101.2.1 - LSA Strategy
Subtask 101.2.1 - Updates

Task 102 - Logistic Support Analysis Plan (OPR: ASD/AL)

Purpose: To develop a Logistics Support Analysis Plan (LSAP) which identifies and integrates all LSA tasks, identifies management responsibilities and activities, and outlines the approach toward accomplishing analysis tasks (9:12).

Subtask 102.2.1 - LSA Plan
Subtask 102.2.2 - Updates

Task 103 - Program and Design Reviews (OPR: ASD/EN)

Purpose: To establish a requirement for the performing activity to plan and provide for official review and control of released design information with LSA program participation in a timely and controlled manner, and to assure that the LSA program is proceeding in accordance with the contractual milestones so that the supportability related design requirements will be achieved (9:15).

- Subtask 103.2.1 - Establish Review Procedures
- Subtask 103.2.2 - Design Reviews
- Subtask 103.2.3 - Program Reviews
- Subtask 103.2.4 - LSA Review

Task Section 200

Mission & Support Systems Definition

Purpose: To establish supportability objectives and supportability related design goals, thresholds, and constraints through comparison with existing systems and analyses of supportability, cost, and readiness drivers.

Task 201 - Use Study (OPR: ASD/EN)

Purpose: To identify and document the pertinent supportability factors related to the intended use of the new system/equipment (9:19).

- Subtask 201.2.1 - Supportability Factors
- Subtask 201.2.2 - Quantitative Factors
- Subtask 201.2.3 - Field Visits
- Subtask 201.2.4 - Use Study Report and Updates

Task 202 - Mission Hardware, Software, and Support System Standardization (OPR: ASD/AL)

Purpose: To define supportability and supportability related design constraints for the new system/equipment based on existing and planned logistic support resources which have benefits due to cost, manpower, personnel, readiness, or support policy considerations, and to provide supportability input into mission hardware and software standardization efforts (9:21).

- Subtask 202.2.1 - Supportability Constraints
- Subtask 202.2.2 - Supportability Characteristics
- Subtask 202.2.3 - Recommended Approaches
- Subtask 202.2.4 - Risks

Task 203 - Comparative Analysis (OPR: ASD/EN)

Purpose: To select and develop a Baseline Comparison System (BCS) representing characteristics of the new system/equipment for (1) projecting supportability related parameters, making judgments concerning feasibility of the new system/equipment supportability parameters, and identifying targets for improvement, and (2) determining the supportability, cost, and readiness drivers of the new system/equipment (9:23).

- Subtask 203.2.1 - Identify Comparative Systems
- Subtask 203.2.2 - Baseline Comparison System
- Subtask 203.2.3 - Comparison System Characteristics
- Subtask 203.2.4 - Qualitative Supportability Problems
- Subtask 203.2.5 - Supportability, cost, and readiness drivers
- Subtask 203.2.6 - Unique System Drivers
- Subtask 203.2.7 - Updates
- Subtask 203.2.8 - Risks and Assumptions

Task 204 - Technological Opportunities (OPR: ASD/EN)

Purpose: To identify and evaluate design opportunities for improvement of supportability characteristics and requirements in the new system/equipment (9:26).

- Subtask 204.2.1 - Recommended Design Objectives
- Subtask 204.2.2 - Updates
- Subtask 204.2.3 - Risks

Task 205 - Supportability and Supportability Related Design Factors (OPR: ASD/EN)

Purpose: To establish (1) quantitative supportability characteristics resulting from alternative design and operational concepts, and (2) supportability and supportability related design objectives, goals, thresholds, and constraints for the new system/equipment for inclusion in program approval documents, system/equipment specifications, other requirements documents, or contracts as appropriate (9:28).

- Subtask 205.2.1 - Supportability Characteristics
- Subtask 205.2.2 - Supportability Objectives & Associated Risks
- Subtask 205.2.3 - Specification Requirements
- Subtask 205.2.4 - NATO Constraints
- Subtask 205.2.5 - Supportability Goals and Thresholds

Task Section 300

Preparation and Evaluation of Alternatives

Purpose: To optimize the support system for the new item and to develop a system which achieves the best balance between cost, schedule, performance, and supportability.

Task 301 - Functional Requirements Identification (OPR: ASD/EN)

Purpose: To identify the operations and support functions that must be performed for each system/equipment alternative under consideration and then identify the tasks that must be performed in order to operate and maintain the new system/equipment in its intended environment (9:31).

- Subtask 301.2.1 - Functional Requirements
- Subtask 301.2.2 - Unique Functional Requirements
- Subtask 301.2.3 - Risks
- Subtask 301.2.4 - Operations and Maintenance Tasks
- Subtask 301.2.5 - Design Alternatives
- Subtask 301.2.6 - Updates

Task 302 - Support System Alternatives (OPR: ASD/EN)

Purpose: To establish viable support system alternatives for the new system/equipment for evaluation, tradeoff analysis, and determination of the best system for development (9:34).

- Subtask 302.2.1 - Alternative Support Concepts
- Subtask 302.2.2 - Support Concept Updates
- Subtask 302.2.3 - Alternative Support Plans
- Subtask 302.2.4 - Support Plan Updates
- Subtask 302.2.5 - Risks

Task 303 - Evaluation of alternatives and Tradeoff Analysis (OPR: ASD/EN); (ASD/AL is OPR for subtasks 303.2.5, 303.2.6, 303.2.7, and 303.2.10)

Purpose: To determine the preferred support system alternatives (s) for each system/equipment alternative and to participate in alternative system tradeoffs to determine the best approach (support, design, and operation) which satisfies the need with the best balance between cost, schedule, performance, readiness, and supportability (9:36).

Subtask 303.2.1 - Tradeoff Criteria
Subtask 303.2.2 - Support System Tradeoffs
Subtask 303.2.3 - System Tradeoffs
Subtask 303.2.4 - Readiness Sensitivities
Subtask 303.2.5 - Manpower and Personnel tradeoffs
Subtask 303.2.6 - Training Tradeoffs
Subtask 303.2.7 - Repair Level Analysis
Subtask 303.2.8 - Diagnostic Tradeoffs
Subtask 303.2.9 - Comparative Evaluations
Subtask 303.2.10 - Energy Tradeoffs
Subtask 303.2.11 - Survivability Tradeoffs
Subtask 303.2.12 - Transportability Tradeoffs

Task Section 400

Determination of Logistic Support Resource Requirements

Purpose: To identify the logistic support resource requirements of the new system in its operational environment (s) and to develop plans for post production support.

Task 401 - Task Analysis (OPR: ASD/AL)

Purpose: To analyze required operations and maintenance tasks for the new system/equipment to (1) identify logistic support resource requirements for each task, (2) identify new or critical logistics support resource requirements, (3) identify transportability requirements, (4) identify support requirements which exceed established goals, thresholds, or constraints, (5) provide data to support participation in the development of design alternatives to reduce O&S costs, optimize logistic support resource requirements, or enhance readiness, and (6) provide source data for preparation of required ILS documents (technical

manuals, training programs, manpower, and personnel lists, etc.) (9:41).

- Subtask 401.2.1 - Task Analysis
- Subtask 401.2.2 - Analysis Documentation
- Subtask 401.2.3 - New/Critical Support Resources
- Subtask 401.2.4 - Training Requirements and Recommendations
- Subtask 401.2.5 - Design Improvements
- Subtask 401.2.6 - Management Plans
- Subtask 401.2.7 - Transportability Analysis
- Subtask 401.2.8 - Provisioning Analysis
- Subtask 401.2.9 - Validation
- Subtask 401.2.10 - ILS Output Products
- Subtask 401.2.11 - LSAR Updates

Task 402 - Early Fielding Analysis (OPR: ASD/AL)

Purpose: To assess the impact of introduction of the new system/equipment on existing systems, identify sources of manpower and personnel to meet the requirements of the new system/equipment, determine the impact of failure to obtain the necessary logistic support resources for the new system/equipment, and determine essential logistic support resource requirements for the combat environment (9:45).

- Subtask 402.2.1 - New System Impact
- Subtask 402.2.2 - Sources of Manpower and Personnel Skills
- Subtask 402.2.3 - Impact of Resource Shortfalls
- Subtask 402.2.4 - Combat Resource Requirements
- Subtask 402.2.5 - Plans for Problem Resolution

Task 403 - Post Production Support Analysis (OPR: ASD/AL)

Purpose: To analyze life cycle support requirements of the new system/equipment prior to closing of production lines to assure that adequate logistics support resources will be available during the system/equipment's remaining life (9:47).

- Subtask 403.2 - Post Production Support Plan

Task Section 500

Supportability Assessment

Purpose: To assure that specified requirements are achieved and deficiencies corrected.

Task 501 - Supportability Test, Evaluation, and Verification (OPR: ASD/EN)

Purpose: To assess the achievement of specified supportability requirements, identify reasons for deviations from projections, and identify methods of correcting deficiencies and enhancing system readiness (9:49).

- Subtask 501.2.1 - Test and Evaluation Strategy
- Subtask 501.2.2 - Objectives and Criteria
- Subtask 501.2.3 - Updates and Corrective Actions
- Subtask 501.2.4 - Supportability Assessment Plan (Post Deployment)
- Subtask 501.2.5 - Supportability Assessment (Post Deployment)

A recommended LSA task implementation process by program phase is shown in table II (9:53).

Statement of Problem

Logistics support is critical for providing mission ready weapon systems. Air Force weapon system development program offices use Logistic Support Analysis to determine support requirements for weapon systems. Through discussions with program office personnel and review of program documentation, Air Force personnel have found that contractual responses to Air Force LSA requirements are inconsistent and of poor quality on some Aeronautical Systems Division programs. Responses are of poor quality if they

Table II

RECOMMENDED LOGISTIC SUPPORT ANALYSIS EFFORT BY PROGRAM PHASE

PRE- CONCEPTUAL	CONCEPTUAL	DEMONSTRATION AND VALIDATION	FULL SCALE DEVELOPMENT	PRODUCTION
TASK 101	TASK 101	TASK 101	TASK 102	TASK 102
TASK 201	TASK 102	TASK 102	TASK 103	TASK 103
TASK 203	TASK 103	TASK 103	TASK 201	TASK 403
	TASK 201	TASK 201	TASK 202	TASK 501
	TASK 202	TASK 202	TASK 203	TASK 202 *
	TASK 203	TASK 203	TASK 205	TASK 205 *
	TASK 204	TASK 204	TASK 301	TASK 301 *
	TASK 205	TASK 205	TASK 302	TASK 303 *
	TASK 301	TASK 301	TASK 303	TASK 401 *
	TASK 302	TASK 302	TASK 401	TASK 402 *
	TASK 303	TASK 303	TASK 402	
	TASK 501	TASK 401	TASK 501	
		TASK 501		

* APPLICABLE TO DESIGN CHANGES ONLY

cannot be implemented or they result in logistics deficiencies. The LSA deficiencies affect the cost and supportability of the particular programs.

There have been reports from the field which indicate that less than fully integrated logistics resources have been provided. As an example, personnel found that the equipment in the field was different from that on which they were trained and differed from the instruction manual (5:32).

Current LSA Policy

The equipment/system acquiring authority (government, contractor, or subcontractor) must initially determine the LSA tasks to be done by the government, those to be shared, and those to be done by the performing activity (equipment/system developer). The LSA requirements to be accomplished by the performing activity are implemented through contractual agreements. Some of the LSA tasks are analytical efforts, such as Repair Level Analysis, which are performed by contractors to identify logistics support requirements. Repair Level Analysis (RLA) is a process which uses economic evaluation to determine whether an equipment/system should be discarded at failure or be repaired at the base or depot levels. The analysis is based on reliability and maintainability estimates, maintenance analysis, and life cycle cost data. The process identifies resource requirements for weapon system maintenance. Each ASD program office reviews

these contractor LSA responses for their programs without much horizontal information exchange between program offices i.e., there is no feedback or interchange of information between various program offices on LSA problems and successes.

Recent policy guidance has placed emphasis on moving the LSA process from the logistics to the engineering function. Gen Leo Marquez, then HQ USAF/DCS Logistics & Engineering, stated in a 17 Apr 1987 letter (15) "that we must make LSA an integral part of the system engineering and design process, thereby ensuring supportability objectives are satisfied throughout the system life cycle." An LSA study group (15:1), established by Gen Marquez, found that: (1) current directives do not place sufficient emphasis on how to do early Air Force analysis to impact system design; (2) Existing directives do not adequately address the application of LSA to mission critical computer resource software of information system program acquisition; (3) LSA and LSAR are not fully integrated with the systems engineering military handbooks, standards, and directives; and (4) Current policy does not focus on the use of LSA and the LSAR throughout system life. To implement the results of this study at ASD General William Thurman, the ASD Commander, issued a 2 July 1987 letter which endorsed implementation of the enhanced Logistics Support Analysis process on ASD acquisition programs.

Michael T. Bello, ASD/ENST, the LSA focal point and

lead integration engineer, provided insight into the enhanced LSA implementation at ASD. He stated that "LSA must be part of the systems engineering process." In order to ensure that LSA is part of that process, the ASD engineering organization (ASD/EN) has developed a system level MIL-PRIME which includes supportability considerations from the pre-conceptual through operations phases. The MIL-PRIME program is an initiative to streamline the acquisition process by improving the quality of the specifications and standards put on contract. The goal of the MIL-PRIME program is to eliminate overspecification through the process of tailoring documents to the specific weapon system's needs. ASD/EN has developed LSA guidance in its Developmental Supportability Engineering document which is mandatory background for all system program office engineers. ASD engineering personnel constantly "spread the word" about LSA requirements to new personnel in the program offices and indoctrinate them with logistics engineering requirements. The ASD Advisory Group of outside consultants review LSA implementation within ASD and make recommendations to ASD management. Membership on the advisory group includes representatives from Academia and Private Industry. Current members are from the Massachusetts Institute of Technology, University of Pittsburg, Purdue University, General Telephone and Electronics, Northrop Corporation, United Technologies, and General Research Corporation.

Purpose of Study

The purpose of this study is to develop recommendations to improve the application of LSA tasks on ASD programs in accordance with DOD and Air Force regulatory requirements. These recommendations will be used to improve the quality of LSA implementation on Air Force weapon system programs.

Scope of Study

The scope of this study was limited to the consideration of ASD programs. ASD has responsibility for acquiring aircraft systems and components for the U.S. Air Force and is responsible for obligating approximately half of the Air Force Systems Command budget. A cross section of programs will be selected to ensure that the sample is representative of the ASD workload. Although the scope of the research was limited to ASD programs, the recommendations from this research could be applied to the other AFSC product divisions - the Ballistic Missile Office (BMO) at Norton AFB, CA; Space Division (SD) at Los Angeles AFB, CA; Armament Division (AD) at Eglin AFB, FL; and the Electronics Systems Division at Hanscom AFB, MA.

II. Literature Review

Background

The trend in recent years has been to place more emphasis on reducing Operating and Support (O&S) Costs. These costs consume up to 70% percent of the total costs of some weapon systems and 40% of the personnel on the Air Force duty roster are engaged in logistics support activities (34:15). With such an investment of funds it is imperative that we manage these funds as effectively and efficiently as possible. Improved LSA implementation could enhance our management of logistics support costs.

Results of Literature Review

Capt Pierce in his thesis, "Tailoring the Tasks of Logistics Support Analysis (LSA)," defined LSA as

"An analytical technique which integrates and coordinates the ILS elements into a total definition of a system's logistics support requirements."

The purpose of his thesis was to develop simple, usable guidance for tailoring the tasks of Logistics Support Analysis (LSA). Guidance was developed using the techniques of expert panel review and problem analysis.

He identified several tailoring steps which included selection of tasks from MIL-STD-1388-1A, evaluation of tasks and possible rewording, selection of data elements for the database, and selection of the data items to be delivered with

the schedule.

The research concluded that the tailoring guidance is valid if used for its intended purpose; to make the initial selection of subtasks for a proposed contract. Eighty-three percent of the respondents in his survey said that they would use the guidance.

The guidance in Capt. Pierce's study will provide background information on how tailoring influenced LSA implementation on previous weapon system programs.

Capt Paul S. Woodland (41) researched the area of determining whether LSA process effectiveness could be measured within ASD. This research discussed the competency of LSA program managers and effectiveness of the LSA process application. Survey of opinions were sent to LSA program managers representing several programs offices and general attitudes were collected in response to forty-three measurement questions. He concluded that 96 percent of the LSA program managers were essentially qualified and the other 4 percent were training deficient but could be corrected with a LSA training program. The results also indicated that LSA process effectiveness is measurable. The study surveyed LSA management opinion on the measurability of LSA process effectiveness. The results indicated that a majority of the LSA managers in ASD believe that LSA process effectiveness can be measured in qualitative or quantitative terms.

Major Mary K. Allen in "Auditing Acquisition Logistics" states that asking the right questions is a crucial management skill (1:13). This statement is akin to the definition of effectiveness, "Doing the Right Thing." Major Allen developed a list of questions for LSA implementation which are shown in table III. Her article was developed in two parts. Part I described the acquisition logistics concept and part II provides the audit checklist (1:13). Major Allen emphasized that early traditional definitions treated logistics as a downstream activity (1:13). However, the military has long recognized logistics as a part of the entire product life cycle.

Table III

LSA Audit Questions

	Yes	No
1. Are the goals of the analysis adequately identified?	—	—
2. Are the Assumptions adequately validated or modified?	—	—
3. Do any specific assumptions treat quantitative uncertainties as facts?	—	—
4. Does the model adequately address the problem?	—	—
5. Are effectiveness and cost parameters logically linked?	—	—
6. Does the model provide for a timely feedback?	—	—
7. Does the model provide valid and reliable results?	—	—

8. Are the cost aspects of all alternatives treated consistently? — —

The significant increases in logistics support costs and the concurrent dilemma of decreasing budgets has resulted in a large portion of the budget being spent for logistics support. There is a critical need for acquisition logisticians to be involved early in the weapon system's acquisition because as much as 70 percent of a weapon system's life cycle cost is locked in by the end of the conceptual phase, and 95 percent of this cost has been predetermined by the production phase (1:14). Early involvement by logisticians improves the potential for cost savings.

The audit procedure, as presented by Major Allen, should be tailored to the scope, risk and complexity of the system's acquisition effort (1:15). For example, off-the-shelf purchases should receive an emphasis different from a full scale development effort.

Gerald Harrison in the "Acquisition Logistician: A Case for New Education Programs in Logistics" expressed a growing need for a new kind of formal education for logisticians. He further stated that the emphasis on addressing operating and support costs has created a need to educate the logistician. "In the past, acquisition program management decisions were based on trade-offs between technical performance, production schedules, and initial or flyaway costs. Operating and Support costs, which are based on reliability and maintainability, were

not a primary consideration. Mr. Harrison stresses that operating and support costs must be considered during program design.

Initiatives to improve formal education of acquisition logisticians include Air Force Institute of Technology (AFIT) courses, the Society of Logistics Engineers (SOLE) seminars, and enhancement of logistics professionalism. The AFIT degree program in acquisition logistics would provide a basis for filling key positions in acquisition logistics. SOLE offers an opportunity for training and interaction with logisticians in business and industry. Many firms have enhanced logistics professionalism by elevating the logistics organization within the corporate structure.

The article entitled "Cost-Effective LSAR System Features" discussed the features that make an automated logistic support analysis record (LSAR) system cost-effective. According to Mr. Hoffman, Automated LSAR systems generally support "relatively large" programs. Relatively large is defined as meaning at least a few hundred LSA Control Numbers (LCNs) for all data record types and approaching 1,000 parts. A part is a reparable or non-reparable system/equipment item. The LCN is a hardware breakdown sequence of system/equipment including support equipment, training equipment, and installation hardware (10:345). Most ASD programs for engines, aircraft, and components would be candidates for an automated LSAR system. It was stated that an automated LSAR contributes to

the efficiency and effectiveness of the LSA program. The article did not address the resources required to acquire a LSAR system. However, it did cover four topics which impact LSAR development. Training candidates were identified as computer programmers, LSA analysts, mid-level managers, and upper-level managers. The five task levels in MIL-STD-1388-1A were related to the LSAR system. Twenty features were identified that can make an automated LSAR system cost-effective (Appendix A). Additive features depend on how the lack of each will affect the LSA program and basic features are required for each LSA program. And finally, the article addressed LSAR system requirement documents such as dictionary and operators manual, a programming specifications document, training documentation, and a users manual.

Significance of Literature Review to Research

The literature search served several distinct purposes. First, it provided background information for the analysis in this thesis and emphasized the importance of LSA. Second, it identified other efforts that had been performed in the LSA area. And finally it provided insight into potential support cost savings to be obtained from proper LSA implementation.

III. Methodology

Overview

The procedure for conducting this research was to perform a literature search, review current LSA guidance, analyze LSA implementation problems at ASD, and to develop recommendations for improving the LSA management process. This approach was more appropriate for this type of problem because the actual data was available for performing the analysis and the selected program were representative of a majority of the ASD workload. Initially, DTIC studies and AFIT theses were reviewed to determine work that had been done in this area. During this review the research data was gathered to answer the question of whether other studies have developed a causal relationship between Air Force LSA tasking and problems with contractor LSA deliveries. The analysis included an assessment of whether or not those causal relationships can be generalized for Air Force weapon system programs. A review was made of the current Air Force LSA guidance which is contained in DOD and Air Force regulatory documents. Potential LSA tasking requirements from MIL-STD-1388-1A were compared to actual implementation on selected programs. Also, AFALC's lessons learned and the Acquisition Logistics Management Information System (ALMIS) databases were used to identify LSA implementation areas for more intensive study. The lessons learned data bank provided a source of documented

and validated problems which have occurred during LSA implementation. The ALMIS database identified contractual LSA tasking information for selected programs. Weapon system program data was gathered from selected weapon system programs within the Aeronautical Systems Division at Wright-Patterson AFB, Ohio. Data was gathered by interviewing logistics personnel in the ASD system program offices (SPOs), reviewing program office weapon system documentation, and interviewing ASD logistics staff personnel at Wright-Patterson AFB, Ohio. The interviews were used to clarify data obtained from DOD, Air Force, and weapon system program documents. After all the data was collected and reviewed, it will be combined to answer the research questions and make recommendations to improve the LSA management process.

Investigative Questions

It was important to identify the critical LSA tasks, obtain the factual LSA data and identify weapon system LSA support problems. To obtain the data required to perform this study, several questions have been developed to query ASD weapon system program personnel:

1. Which LSA tasks are most critical for determining logistics support requirements?
2. What contractual statements have the program offices been using to task the contractor (s) to perform the

necessary analyses and to develop and deliver needed LSA data?

3. What contractual deliveries have the program offices received from contractor (s)?
4. What support problems have occurred as a result of the lack of LSA tasking?
5. How is (was) LSA tasking tailored? By whom?
6. During which phase was LSA tasking first applied?

Study Tasks

The literature search focused on logistics support and efforts which have been conducted to assess the impact of applying logistic support analysis techniques.

For the SPO reviews, twelve programs were selected and the LSA data was reviewed to determine LSA tasking requirements and contractual responses. A cross section of program types were selected in order to ensure that the sample is representative of the ASD workload. The following ASD programs were identified for review:

Program Office	Program
ASD/C17L	C17A Heavy Lift Cargo Aircraft
ASD/AEAL	Standard/F-15 RLG INU
ASD/SDFL	A-7D Aircraft Upgrade
ASD/SDFL	Peace Pearl
ASD/YWL	Simulators

ASD/AEGL	Ground Powered Generator
ASD/AEIL	MARK XV Identification System
ASD/AFZL	AC-130 Hercules Cargo Transport
ASD/RWL	Airborne Tactical Reconnaissance System (ATARS)
ASD/YZFL	F100-PW-229 Engine for the F-15 and F-16
ASD/RWL	Integrated Electronic Warfare System (INEWS)
ASD/RWL	Tactical Countermeasures Dispenser (AN/ALE-47)

The LSA documents for each weapon system program were obtained from the appropriate system program offices. The weapon system contract was the primary document for performing the review. Also, the lessons learned data bank and the Acquisition Logistics Management Information System were reviewed to find documentation on the referenced programs.

All LSA related support problems were identified and summarized in order to determine whether there is a causal relationship between the problems and LSA implementation procedures. ASD and AFALC LSA experts were interviewed to gather data and evaluate the problems.

IV. Findings and Discussion

LSA Logistics Organization

The current LSA personnel in the ASD program offices are matrixed from the Air Force Acquisition Logistics Center staff which is Headquartered at Wright-Patterson AFB, OH. The program office staff is provided expertise by personnel from ASD/AL and AFALC/ER. Most of the LSA data is being automated and submitted via magnetic tapes and disks.

Logistics Engineering Emphasis

On 5 August 1986, Lt Gen Leo Marquez (HQ USAF/LE) initiated an in-depth study (15) of the Logistic Support Analysis process within the Air Force. The results of that study indicated that LSA should be made an integral part of the system engineering and design process. As a consequence of the HQ USAF/LE study and subsequent direction from HQ ASD/CC, the ASD program offices are placing more emphasis on logistics planning early in the weapon systems design process. The ASD LSA implementation initiative is being managed jointly by the ASD engineering (ASD/EN) and ASD logistics (ASD/AL) organizations. The Office of Primary Responsibility (OPR) for each LSA task is identified in table I.

LSA Lessons Learned

The Lessons Learned Data Bank maintained by AFALC/ERL has numerous examples of problems which have occurred during LSA implementation. LSA problems have resulted because of inappropriate timing of LSA implementation, incompleteness and inconsistency of LSA data, and lack of program reviews. For example, on some programs nuclear hardness critical requirements were not identified early enough and resulted in costly and time consuming redesign and retesting. The recommended solution was to identify nuclear hardness requirements during FSD so that they can be incorporated into the engineering drawings, specifications, and technical orders in a timely manner. In another example, on a U.S. Army program, the LSA process had little effect on integrated logistics support (ILS) or design engineering decisions. The project manager viewed the LSAR purely as a historical record. He failed to realize the importance of using the LSA in the ongoing decision making process, and did not review the contractor's internal LSA process to ensure the LSA was being performed and used properly (12: 1-3).

Incomplete or inconsistent data has resulted in LSA deficiencies. The completed LSA data record "A" was not presented to contractors during the T-46 trainer aircraft FSD phase. Therefore, the "A" record data was not available for LSA planning. The LSA "A" record data is provided by the

buying activity (normally the government) for systems, subsystems, and government furnished equipment (GFE). The "A" record should be available not later than initiation of the Demonstration and Validation Phase (10:24). The record is used to document the operations and maintenance requirements of a weapon system along with the environment in which it is to operate. The data record may also be used to document the allocation of these requirements to lower indenture reparables. To the maximum extent possible, applicable logistic parameters documented in the A record should reflect the system requirements in an operational environment (10:24).

During source selection for another program, the effectiveness of the source selection evaluators was reduced because of inconsistencies between the Air Force formal proposal and the source selection guidelines (12: I-7). The LSA instructions given to the contractors required them to continue the effort and direction of the previous full scale development contract. Under the previous contract informal waivers for selective application of LSA were granted to one contractor. These waivers were not tracked for future reference and consequently, the source selection guidelines on LSA were rendered ineffective as source selection criteria because of differences in LSA implementation by the contractors.

The failure to establish periodic LSA reviews between the program office and the contractor, as demonstrated on the Navy's MK III SH-60SB program, resulted in poor LSA data. Therefore, the interpretations of LSA program objectives were different between the program office and the contractor. To prevent this problem a guidance conference should be scheduled to provide an opportunity for all participants to discuss and establish guidelines for the conduct of the LSA program.

LSA Implementation by Program

C-17A. The C-17A is a heavy-lift, air-refuelable transport aircraft under development by the McDonnell Douglas Aircraft Corporation, for the rapid deployment of today's modern Military from the Conus directly to overseas areas of conflict and for airlift of outsized cargo over both inter-theater and intratheater ranges close to the forward areas.

The C-17A Program Office has progressed through the FSD phase and is currently entering production. During FSD the C-17A LSA program requirements included LSA tasks 101, 102, 103, 201, 202, 203, 204, 205, 301, 302, 303, 401, 402, and 501. C-17A logistics personnel identified task 205 as the most critical for the weapon system. Task 205 identifies supportability related design factors and is critical for influencing weapon system readiness and life cycle cost. The LSA process was performed on the entire C-17A weapon system

(Air Vehicle including engines, support equipment, etc.). The C-17A production contract requires the continuation of the LSA program established during FSD. Task 403, Post Production Support Analysis, was added to the production contract. The contractor is required to maintain and update the logistics support analysis record (LSAR) established during FSD and work performed during FSD is not to be duplicated during production.

The C-17A program office and the System Program Manager have a common on-line LSA system. Other contractor deliverables include a logistics support analysis plan, Network Repair Level Analysis (NRLA), Reliability Centered Maintenance (RCM) data, Life Cycle Cost (LCC) Reports, Trade Studies, Provisioning Data, and Support Equipment Recommendation Data.

The implementation of Tasks 101, 203, and 205 has been a problem because there has not been enough time to influence design i.e., the results from the analyses have been received too late in the program life cycle. Task 101, Development of an Early Logistics Support Analysis Strategy; Task 203, Comparative Analysis; and Task 205, Supportability and Supportability Related Design Factors should be implemented in the conceptual or demonstration and validation phase in order to ensure effective LSA implementation (9:53). Since these tasks were not applied until Full Scale Development, there was not enough time to influence design.

Funding constraints have presented a problem because program adjustments have had to be made because funds were not available. Specifically, the reduction in program funding resulted in the elimination of some TDY funds. Therefore, some LSA reviews had to either be cancelled or done through CRT screens.

Standard/F-15 RLG INU. The Standard/F-15 Ring Laser Gyro (RLG) program is under development by two contractors, Honeywell Military Avionics Division and Litton Industries, to acquire an Inertial Navigation Capability for over 4,000 aircraft in the Air Force inventory.

Problems in the program have occurred because of insufficient and missing data after making program changes. For example, the LSAR A sheet which is the government's responsibility must be upgraded to include impact of program changes on program resources. The A record is structured to include system operation, environment, and maintenance requirements. The record includes such data elements as system operating time, number of operating locations, failure rates, and repair times. Changes in the A sheet have not always been reflected in changes in SERDS, Facilities, Training, etc. Some requirements were changed but the A sheets were not updated.

Standard/F-15 RLG INU logistics personnel identified several problems with LSA implementation on ASD programs.

These problems includes 1) the fact that LSA expertise is difficult to find 2) the lateness of some SERD (Support Equipment Requirements Data) deliveries and 3) budget cuts which have resulted in many SPO management tasks being placed on contract.

Personnel who have experience in LSA are scarce within the system program offices. In order to make up for the lack of experienced LSA personnel, training programs have been established by the ASD/AL and AFALC/ER logistics staffs. Also, strawman LSA contractual inputs are available to aid in structuring LSA clauses.

SERD (Support Equipment Requirements Data) was delivered later than required by the depot. This problem resulted in some program schedule slippage, however, an aggressive recovery plan has placed the program back on schedule.

Recent budget cuts have reduced personnel within the RLG INU program office. Therefore, many tasks on this program have had to be placed on contract. An outside contractor is now responsible for conducting LCC Analysis and Estimating, Maintenance Concept Analysis, Warranty Analysis, and Reliability Analysis.

A system support implementation initiative has been developed for this SPO in order to reduce interim contractor support and ensure that the support will be in place when the system is deployed. This initiative identifies Support

Equipment Requirements Data (SERD) early in the program to facilitate reviews at the Air Force Depots before the end of the warranty period.

A-7 Aircraft Upgrade. The A-7 Prototype Modification Program is the first step in meeting the tactical air forces' and the US Army's requirement for a cost-effective close air support/air interdiction aircraft to meet the expected battlefield threat of the twenty-first century. The program will provide improved aerodynamics, avionics, and engines for the A-7D aircraft to increase survivability and extend useful life by twenty years. Two A-7D aircraft will undergo structural modifications and be reengined with the afterburning Pratt & Whitney F100-PW-220 engine. An engine adapter kit design and technical interface requirements will also be procured for the General Electric F100-GE-100 engine. First flight of the A-7 prototype aircraft is scheduled for May 1989. A reprourement data package will be provided to AFLC for future competitive modifications of the A-7D fleet.

A-7 logistics personnel identified LSA task 201, Use Study, as most critical for determining logistics support requirements. The A-7 prototype program requires LSA tasks 102, 103, 201, 202, 203, 205, 301, 302, 303, 401, and 501. LSA subtasks are tailored for all the referenced LSA tasks.

The LSA tasking was initially proposed as guidelines by the AFALC/ER staff and further tailored by the SPO management

after data review board presentation.

Program office personnel stated that the contractor has submitted inadequate justification to support the decision for development of support equipment (intermediate level test stations). The level of detail for the support equipment data is insufficient to determine supportability requirements for the proposed design. The program office rejected the initial proposal from the contractor and is currently negotiating with the contractor to resolve the problem.

Peace Pearl. Peace Pearl is a Foreign Military Sales Program to design, develop, and produce a fire-control system for the Chinese F-8II aircraft. The avionics upgrade will be produced as a Class V modification kit to be installed on the production line in the People's Republic of China.

The Peace Pearl program did not include LSA tasking in the original contract. The assumption was made that there would be no equipment design i.e., all equipment would be off-the-shelf. However, this was not the case and support problems have resulted from that assumption. The program office was unable to identify support equipment and automated test equipment resource requirements.

The support posture for this program is being restructured by the program office.

Simulators. Most training devices are purchased as contractor logistics support contract. Task 102, LSA plan, is the most critical LSA task for determining logistics support requirements and is normally the only contract delivery. Although task 102 does not identify resource requirements, it does inform the program office about the tasks which will be performed by the contractor. This is critical in the Contractor Logistics Support (CLS) environment because the contractor is in the best position to identify resource requirements. If the tasks identified are inappropriate, the program office will request a better explanation of how the tasks will be implemented on the specific programs. The problem that recurs most often is not having a complete recompetition package. Therefore, an option for requesting a recompetition package should be considered on each simulator program during program acquisition.

The LSA tasking is tailored by the contractor beginning in the development phase.

Ground Power Generator. LSA tasks 101, 102, 103, 201, 203, 205, 303, and 401 are the most critical for determining support requirements for the Ground Power Generator (GPG). Contractor deliveries include a Repair Level Analysis Report, Tools and Test Equipment List, Training Plan, Transportability Report, LSA Plan, LSAR, and Support Equipment Recommendation Data.

Since the system has not been fielded, there are no support problems identified at this time. The GPG is currently in source selection for the production phase. Therefore, data for that phase is not available.

Mark XV. The Mark XV Identification Friend or Foe (IFF) system is being developed by the Joint System Program Office as a secure, antijam, high-reliability replacement for the aging Mark XII IFF. The system will be interoperable with NATO systems and will ultimately be installed on more than seventy Air Force, Army, and Navy aircraft types, all Navy ships, and several Army air defense systems. The program has completed the Demonstration/Validation Phase and is currently in source selection for the Full Scale Engineering Development Phase.

LSA task sections 300 and 400 are most critical for determining functional requirements and logistics support resource requirements, respectively. The contractor is required to perform the LSA tasks on an iterative basis in accordance with MIL-STD-1388-1A and document task results in the LSAR. The contractor is required to establish and maintain an LSAR that meets the requirements of MIL-STD-1388-2A. The LSAR shall be capable of outputting LSA master files LSA-015, 060, 061 in addition to all other LSA output reports specified. The program office Repair Level Analysis report and the Baseline Comparison Report. There are no support

problems as of this time. The LSA tasking was tailored by the ILSM and accomplished by reviewing and comparing each task, its output, past LSA activities, and current program requirements. These LSA tasks were first applied during the Demonstration/Validation Phase.

AC-130 Gunship. The AC-130U (Gunship Program) includes the development of twelve new side-firing gunships to replace the aging, increasingly unsupportable AC-130s currently in the Air Force inventory. The Gunship Program required LSA tasks 102, 205, 301, 303, and 401. The original statement of work (SOW) for the AC-130U Gunship omitted LSA Output Summary reports required for LSAR reviews, plus the LSA-060 and LSA-061 master files. These omissions make it hard to control and maintain how the contractor's LSA program is progressing. The omitted reports above plus LSA-001, LSA-002, LSA-004, LSA-020, LSA-050, and LSA-027 are being added through an ACSN (Advance Change Studies Notice).

ATARS. The Airborne Tactical Air Reconnaissance System (ATARS) program will develop and acquire airborne electro-optical and infrared sensors, digital recorders, and a reconnaissance management system and data link for use on the RF-4C aircraft, unmanned reconnaissance vehicles, and pods for fighter aircraft. The contractor was required to perform the LSA tasks 102, 103, 201, 202, 203, 204, 205,

301, 302, 303, 401, 402, 403, and 501. The LSA subtasks are tailored for all referenced LSA tasks.

ATARS logistics personnel stressed the need for an indepth data call from all participants in the program (user, engineering, logistics, etc.). All the 68 canned LSA output summary reports should be reviewed and determined which can be helpful to the management of the LSA program.

For this program and many others, the logistics personnel expressed the need for knowledgeable LSA personnel in the tailoring of LSA tasks. No problems with LSA implementation have been identified on the program.

F100-PW-229. The F100-PW-229 Engine is an improved version of the existing F100 engine required to improve F-15 and F-16 system capability into the 1990s. Full-scale development of the derivative F100 engine is in progress, with qualification scheduled for late 1988. Production incorporation into the F-15E and F-16C/D will begin in early 1990s. The contractor is required to perform LSA tasks 205, 301, 401, and 501. No problems with LSA implementation have been identified on the program.

INEWS. Integrated Electronic Warfare System (INEWS) is a joint Air Force/Navy Program to design, develop, and deploy a next generation electronic warfare system on combat aircraft of the 1990s. In the current Demonstration and

Validation phase, the program will demonstrate maturing technologies that can provide both alert and response functions across the full electromagnetic spectrum. INEWS will be integrated with the avionics subsystems of the Air Force's Advanced Tactical Fighter (ATF) and the Navy's Advanced Tactical Aircraft (ATA). The program requires LSA tasks 102, 103, 201, 202, 203, 204, 205, 301, 302, 303, 401, and 501. No problems with LSA implementation have been identified on the program.

ALE-47. The ALE-47 is a joint USAF/Navy Program that will provide a countermeasures dispensing system capable of interfacing with radar warning receivers, tail warning systems, and other aircraft systems to provide threat-adaptive programming for expendables in multiple threat environments.

The contractor is required to perform LSA tasks 102, 103, 205, 301, 302, 303, 401, 403, and 501. No problems with LSA implementation have been identified on the program.

The application of LSA tasking varies considerably by program as illustrated in table IV. The programs are in various stages of development as shown in the table. On some programs the implementation of LSA does not follow the recommendations in MIL-STD-1388-1A (9:53). For example, in order to develop an effective LSA program, it is recommended that task 101 be accomplished during the pre-

conceptual, conceptual, or demonstration and validation phases. However, most of the programs start task 101 in the FSD or production phases.

Table IV

LOGISTIC SUPPORT ANALYSIS IMPLEMENTATION BY PROGRAM

LSA TASK	C-17L	RLG INU	GPG	MARK XV	AC-130	ATARS
101.2.1	X			X		
101.2.2	X			X		
102.2.1	X	X			X	X
102.2.2	X	X			X	X
103.2.1	X	X				
103.2.2	X	X	X			
103.2.3	X	X	X			
103.2.4	X	X	X			X
201.2.1	X	X				X
201.2.2	X	X				X
201.2.3	X	X				X
201.2.4	X	X				X
202.2.1	X	X				X
202.2.2	X	X				X
202.2.3	X	X				X
202.2.4	X	X				X
203.2.1				X		
203.2.2	X			X		X
203.2.3				X		
203.2.4	X			X		X
203.2.5	X			X		X
203.2.6				X		X
203.2.7	X			X		X
203.2.8	X			X		X
204.2.1	X			X		X
204.2.2	X			X		X
204.2.3	X			X		X
205.2.1				X	X	
205.2.2				X		
205.2.3	X	X	X	X	X	X
205.2.4				X		
205.2.5				X	X	
301.2.1	X			X		
301.2.2	X			X		
301.2.3	X			X		
301.2.4	X	X	X	X	X	X
301.2.5	X		X	X	X	X
301.2.6	X		X	X	X	X

LOGISTIC SUPPORT ANALYSIS IMPLEMENTATION BY PROGRAM

	C-17L	RLG INU	GPG	MARK XV	AC-130	ATARS
302.2.1				X		
302.2.2	X			X		
302.2.3	X			X		X
302.2.4	X			X		X
302.2.5	X			X		X
303.2.1	X		X	X		X
303.2.2	X		X	X	X	X
303.2.3	X		X	X		X
303.2.4	X		X	X		X
303.2.5	X		X	X		
303.2.6	X			X		X
303.2.7	X		X	X		X
303.2.8	X			X		
303.2.9	X			X		
303.2.10	X			X		
303.2.11	X			X		X
303.2.12				X		
401.2.1	X	X	X	X		X
401.2.2	X		X	X		X
401.2.3	X		X	X		X
401.2.4	X			X		X
401.2.5	X		X	X		X
401.2.6	X			X	X	X
401.2.7	X			X	X	X
401.2.8	X		X	X		X
401.2.9	X		X	X	X	
401.2.10	X		X	X		X
401.2.11	X		X	X		X
402.2.1	X					X
402.2.2	X					X
402.2.3	X					X
402.2.4	X					X
402.2.5	X					X
403.2		X	X			X
501.2.1	X					X
501.2.2	X	X				X
501.2.3	X	X				X
501.2.4	X	X				
501.2.5		X				

LOGISTIC SUPPORT ANALYSIS IMPLEMENTATION BY PROGRAM

INEWS ALE-47

LSA TASK

101.2.1		
101.2.2		
102.2.1		
102.2.2	X	
103.2.1	X	
103.2.2	X	
103.2.3	X	X
103.2.4	X	X
201.2.1	X	
201.2.2	X	
201.2.3	X	
201.2.4	X	
202.2.1		
202.2.2		
202.2.3		
202.2.4		
203.2.1		
203.2.2		
203.2.3		
203.2.4	X	
203.2.5	X	
203.2.6	X	
203.2.7	X	
203.2.8	X	
204.2.1	X	
204.2.2	X	
204.2.3	X	
205.2.1	X	
205.2.2	X	
205.2.3	X	X
205.2.4		
205.2.5	X	
301.2.1		X
301.2.2		X
301.2.3		X
301.2.4	X	X
301.2.5		X
301.2.6		X

LOGISTIC SUPPORT ANALYSIS IMPLEMENTATION BY PROGRAM

	INEWS	ALE-47
302.2.1		
302.2.2	X	
302.2.3	X	X
302.2.4	X	X
302.2.5	X	X
303.2.1	X	X
303.2.2	X	X
303.2.3	X	X
303.2.4	X	
303.2.5	X	
303.2.6	X	X
303.2.7	X	
303.2.8	X	X
303.2.9	X	
303.2.10		X
303.2.11	X	
303.2.12	X	
401.2.1	X	X
401.2.2	X	X
401.2.3	X	X
401.2.4	X	X
401.2.5	X	X
401.2.6	X	
401.2.7	X	
401.2.8	X	X
401.2.9	X	X
401.2.10	X	X
401.2.11	X	X
402.2.1		
402.2.2		
402.2.3		
402.2.4		
402.2.5		
403.2		X
501.2.1	X	
501.2.2	X	
501.2.3		X
501.2.4		X
501.2.5		X

V. Conclusions and Recommendations

Based on the data collected during this research it can be concluded that there is a casual relationship between LSA tasking and support problems on ASD weapon system programs.

Overall, the logistic organizations within ASD are performing a commendable job with LSA implementation. However, there are several areas which the research indicates will benefit from changes to the implementation process. One of the most difficult aspects of this research was the reluctance of the program office personnel to divulge problems within their particular weapon system programs. Therefore, a combination of program office personnel comments, the lessons learned data bank, and interviews with ASD staff personnel were used to assess weapon system LSA implementation problems. During the research effort it became apparent that there is no substitute for planning.

Recommended Areas for Improvement of the LSA Implementation Process

The LSA implementation process could be improved by changes in program management and personnel management policy. These changes can be classified in the areas outlined in the following paragraphs.

Training of Program Office LSA Personnel

Training was one deficiency that was repeatedly mentioned by the program office personnel. Unsupported and undersupported weapon systems have resulted in increased weapon system costs and impacted the readiness of our military forces. Since many of the LSA implementation problems are due to a lack of knowledge, a LSA training program is necessary for a thorough understanding of the LSA implementation process. A well trained LSA staff would be able to improve the LSA process and enable the fielding of better supported weapon systems. Program managers should ensure that all LSA personnel receive training so that they can become proficient in the LSA management process. Sources of training include the Air Force Institute of Technology and AFALC LSA courses. Expertise for LSA support is located in AFALC/ER and ASD/ALT.

Weapon System Program Stability

Program instability is another source of LSA implementation problems. Many of the program office personnel who initially develop contractual documentation do not remain with the program through contractor selection.

New personnel do not always understand the reasons for program contractual requirements and usually require a learning period to understand the program. Therefore, it is

essential that management documentation concerning program office decisions and rationale be made available to new personnel. The program manager could implement this recommendation by establishing a management information system to document the necessary program management information for ensuring program stability

Appropriate Application of LSA Tasking

LSA tasks should be tailored to fit each program. Capt Robert A. Pierce (29); Capt Paul A. Dunbar, unpublished AFIT Thesis, "A Computer-Based DSS for tailoring LSA Contract Requirements, 1988"; and Capt Steven F. Turner, unpublished AFIT Thesis, "A Comparative Study of Manpower, Personnel, and Training Requirements Management Within Air Force Systems Command, 1988" offer guidance on tailoring the LSA process. Logistics personnel should be aware that the results of not tailoring are wasted resources and deliverables that are not used by the program office.

A tailoring program can improve LSA implementation by applying only those tasks which are absolutely necessary in an effective and efficient manner. Too little (or too much) LSA tasking could result in logistics support deficiencies.

Appendix A contains further guidance on cost-effective LSAR implementation (22:12).

Timing of LSA Tasking

Results of the research indicate that many of the programs were obtaining studies which could not be used effectively by the program. For example, LSA design tasks were requested during the FSD phase which is too late to have a significant impact on weapon system design. This type of problem increases weapon system costs and reduces readiness. Therefore, logistics personnel should ensure that the LSA tasking will provide benefits in a timely manner. LSA guidance is contained in MIL-STD-1388-1A (9:53).

Measuring LSA Benefits

A procedure should be established by the program office to assess the benefits to be derived from LSA implementation. Many of the program offices in the research were not able to identify exact benefits to be obtained from the LSA tasking.

The measurement procedure would provide the structure for determining a cost/benefit analysis of LSA implementation. A management database should be established to collect the necessary information for performing the cost/benefit analysis.

Documenting LSA Responsibilities

The contractual agreements between the government and the contractor should clearly delineate the responsibilities of each party in order to reduce (or eliminate) misunderstandings. These misunderstandings have resulted in excess weapon system costs, "finger pointing", and insufficient support resources.

The consequences of unilateral actions should be clearly stated in the contractual agreements to preclude program misunderstandings.

The various program reviews should be used to ensure that the LSA responsibilities are understood by all parties.

Program Consistency

The LSA tasking should be consistent from phase to phase. This consistency should be documented in agreements between the operating command, procuring command, and the supporting command. Inconsistency and program changes have been a major reason for program cost growth and the fielding of unsupported weapon systems.

Areas for Further Study

LCC Data Evaluation

The LSA database should be evaluated to determine its usefulness for performing LCC analysis studies. This

evaluation should consider data format, availability of required data items, and changes required to make the data more useful. The Life Cycle Cost (LCC) information derived from the LSA database would be consistent with the LSA data and provide the necessary information for supporting the management decision making process.

Follow-Up Review

When the programs in this thesis are operational, a follow-up review should be made to determine whether any LSA implementation problems developed after this research. The research should be expanded to include the other AFSC product divisions.

The objective of the research should be to provide information to improve the logistics support process.

Appendix A: Features of a Cost-Effective LSAR System

According to Hoffman (22), two types of features contribute to the cost-effectiveness of an LSAR system, additive features and basic features. An LSAR system need not possess all of the additive features to be cost-effective, but must possess all the basic features to be cost-effective (22:12).

The sixteen additive features are listed below:

Automatic Data Exclusion - Facilitates trade-off analyses by providing automatic exclusion of data from output reports.

Data Entry Efficiency - This term refers to those features which saves the user time in inputting and/or processing data. This feature includes such items as cursor placement, non-repetition of keys, on-line report requests, on-line text of referenced tasks, scratch pads, screen prompts, and transaction audit history.

Engineering Logic Edits - Informs the LSA manager of all logical inconsistencies and/or danger points in the data base.

Mass Copy - Provides on-line reproduction capability without time-consuming data entry efforts when analyses are essentially the same for two subsystems (with minor differences).

Mass Delete - Allows the user to delete an entire LCN on-line or individual task description portions of an LCN.

Model Interfaces - Ensures program integration. For example, if the LSAR interfaces with a reliability and maintainability (R&M) model and a LCC model, then when data in the R&M model is updated the LSAR is automatically updated and that update is reflected in the LCC model.

On-Line Ad Hoc Query - Allows access to data such as listings of all LCNs, failure modes for LCNs, and task codes for LCNs.

Optional Flow - Provide capabilities of reviewing sequentially logical records, accessing the next desired screen, returning to the previous screen, and programming the flow of screens.

Program Function (PF) Keys - Allows for consistent movement throughout the system, regardless of what the user is doing at the time the PF key is depressed.

Reference Library - Referenced tasks should be provided for everyone to use but not everyone to change.

Review Cycle Support - Data should be available for customer review.

Skeletonizing - A reduced version of data should be provided for the customer.

Superseded Item Usage Safeguard - Forces the integration between users. When a data item is replaced information about that item should be made available for all users.

User Item Delete Safeguard - Ensures data integrity. Once an item has been used on a task, it cannot be deleted from the database.

User Access Control - Controls LSAR access to prevent data manipulation by unauthorized users.

Word Processing - Allows production of technical manuals directly from narrative portions of the LSAR.

The basic features include:

Adaptability and Growth - Adaptability refers to the ability of the LSAR system to be programmed to perform its normal functions on different types of data with no system redesign. Growth refers to the ability of the LSAR system to perform normal functions on more of the same types of data with no programming.

Increase Management Control - The ability of the LSAR system to provide better communication between the interfacing supervisors and monitor progress against schedule.

Reduce Labor Intensity - Reduction of labor for development of an LSAR system.

System Documentation - The LSAR documentation should, at a minimum, include a dictionary, an operations manual, programming specifications, training documents, and a users' manual.

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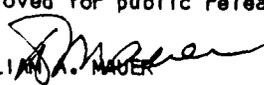
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Block 19. Abstract

The purpose of this study was to develop recommendations for improving the application of Logistic Support Analysis (LSA) tasks on Aeronautical Systems Division (ASD) programs in accordance with Department of Defense and U. S. Air Force regulatory requirements. The scope of the study was limited to ASD programs.

A literature review was conducted to provide background information for the thesis and identify other efforts in the LSA area. The literature search focused on efforts which have been conducted to assess the impact of applying logistic support analysis techniques.

LSA implementation problems were reviewed at ASD and recommendations were developed to improve the LSA management process. The results of the review indicated that there is a causal relationship between LSA tasking and support problems encountered on ASD weapon system programs.