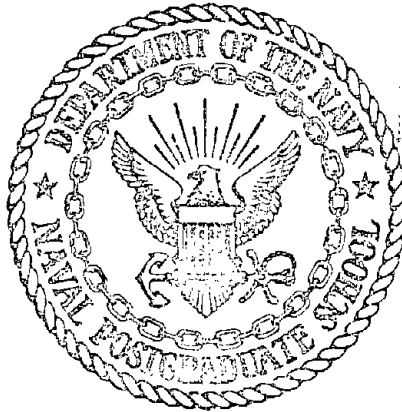AD761464

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

ATTRIBUTES OF INTEGRATED LOGISTIC
SUPPORT ORGANIZATIONS WITHIN SELECTED
NAVY WEAPON SYSTEMS ACQUISITION PROJECTS

by

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Thesis Advisor:　　　　　　　　LCDR E. A. Zabrycki

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Attributes of Integrated Logistic Support Organizations
Within
Selected Navy Weapons System Acquisition Projects

by

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Submitted in Partial Fulfillment of the
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I. INTRODUCTION

The first thoughts of logistics usually bring to mind the timely movement of men and materials in support of combat operations. The dictionary defines logistics as "the branch of military science having to do with moving, supplying, and quartering troops."[1] Currently within the realm of military minds, logistics is considered to encompass all phases of planning and operations which are not properly categorized as either tactics or strategy. Regardless of the point of view involved, all concepts and definitions of logistics appear to be built around a feed-back concept or model whereby needs are first determined and then supplies and services are provided to meet or satisfy the need; as the situation requiring the supplies and services changes, or as the supplies and services themselves change, the basic needs must still be satisfied and the system continues on iterating and adapting to change.

Navy Integrated Logistic Support (ILS) is specifically identified with Project Management or the management of the weapon systems acquisition process. Basically, the Navy's ILS objectives are:

* To Plan - for logistic support early...

* To Design - for reliability and maintainability...

* To Predict - life cycle support requirements...

* To Project - life cycle costs...

* To Improve - Fleet operational capabilities.

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[1]Footnotes are included at the end of the text.

THE ILS MANAGEMENT MISSION IN PERSPECTIVE
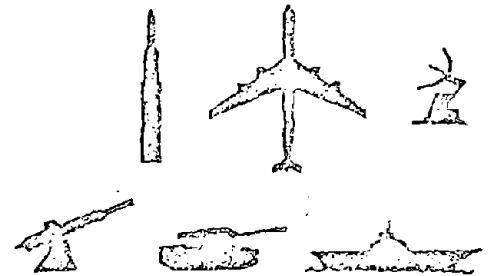
- Mission Readiness Through the Timely and Effective Integration of All Support Factors with Credible Efficiency.

MISSION READY UNITS

MISSION COMMANDS

SYSTEM SUPPORT COMMANDS

SEPARATE SERVICES

JOINT CHIEFS

SERVICE SECRETARIES

DEPARTMENT OF DEFENSE

Logistic Support Management Information
Maintainability and Reliability
The Maintenance Plan
Supply Support
Facilities
Logistic Support Resource Funds
Technical Data
Personnel and Training
Support and Test Equipment
Transportation and Handling (Includes Packaging and Preservation)

Procurement Policies (Total Package/Disengagement, Etc.)
Value Engineering, Cost Reduction, Etc.
Resource Management Systems
Life Cycle Costing
Configuration Management
Requirements/Status Reporting
Quality Assurance Plans and Inspection
Systems Engineering and Integrated Logistics Support

SUPPORT ELEMENTS ARE "Things to Manage"	ORGANIZATIONS TELL "Who Manages"	SYSTEMS, DISCIPLINES, AND TECHNIQUES ARE "Ways to Manage"

SUPPORTING CONTRACTORS AND INDUSTRIAL BASE

Figure 1

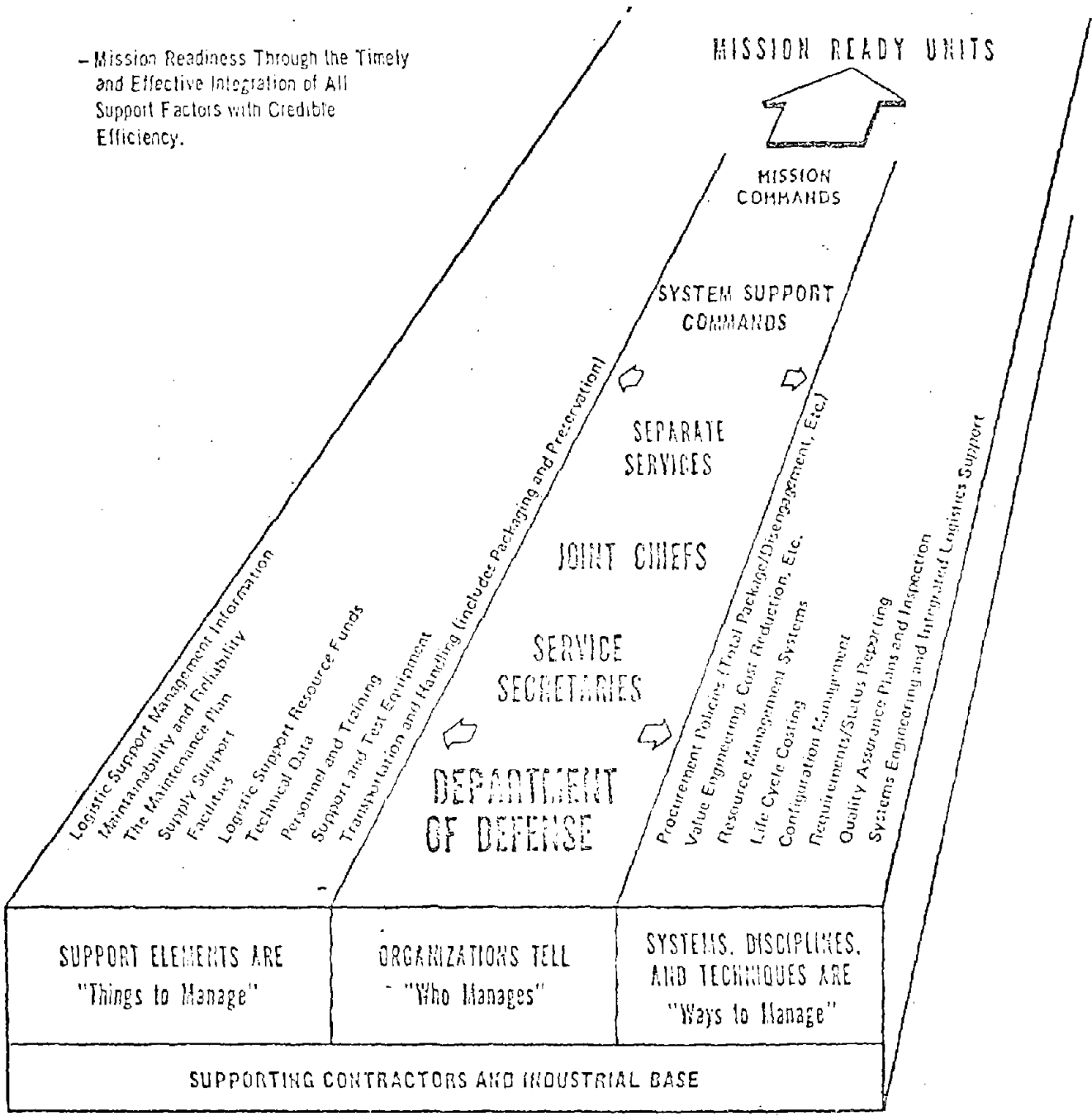In addition to formal lectures on the subject of Integrated Logistic Support, the Weapon Systems Acquisition Management curriculum at NPGS exposes the students to individual military and civilian managers currently engaged in ILS efforts. To further round out the student's depth of understanding and appreciation for both the theory and application of ILS, and to partially fulfill the requirements of the "Logistics for Project Management" course, students were assigned specific Navy Weapons Systems Acquisition Projects for careful analysis, primarily of the ILS function. The students comprising the initial section (QQ22) in this curriculum were assigned the following Projects:

HARPOON	F-14/PHOENIX	P-3C	DLGN-38
S-3A	LHA	TRIDENT	DD-963
AV-8A	AN/BQQ-5	E-2C	A-7E
CVAN	SSN-688	VAST	MK-48.

In a very real sense, this paper is an outgrowth of those student analyses. However, there is one key difference between the two: the intent of the former was merely to investigate and report whereas the intent of this paper is to analyze and evaluate with the aid of some fairly objective criteria. The sequence of major headings in this paper has been intentionally arranged to follow the pattern of problem-research-findings-recommendations.

Accordingly, before this paper was attempted, an hypothesis had to be formulated and concurrently the problem which this paper attempts to analyze and evaluate had to be described. Because of the time and other constraints the problem was intentionally reduced in scope. Once done, the basic ILS concepts and policies were reviewed; this activity also served to define one member of the criteria team, namely policy. The organizational model attributed to Scott was used as the second

criterion. These criteria were utilized to evaluate the "effectiveness" of ILS organizations, each in a particular way. Following these discussions, the paper presents the reader with a description of the research methodology, and results both in detail and in summary. The closing portions of this paper deal with related areas for study, recommendations and conclusions.

By way of a caveat, it is assumed that the reader is not only acquainted with but has also had some exposure to current Department of Defense management and thought. A glossary of terms has not been included as it was assumed that the technical terminology would be understood by the reader. Further, the facts reported are those which could be obtained within the time and other resource constraints, and analysis and conclusions follow accordingly.

II. HYPOTHESIS

Given that Integrated Logistic Support is a strong and accepted systems engineering discipline, an integral part of the weapon systems acquisition process, described in a whole family of DoD and Navy directives, capable of adapting to the peculiar needs of each Project, and implemented by people working within a matrix-organization environment, then...

> THE FAILURE OR SUCCESS OF ILS PLANNING AND
> IMPLEMENTATION IS THE DIRECT RESULT OF THE
> "EFFECTIVENESS" OF THE ILS INFORMAL ORGANI-
> ZATION.

The informal organization, rather than the formal organization, is characterized by several important attributes, namely: good communications,

a spirit of teamwork, a realistic approach to policy accomodation, and the ability to change rapidly to meet or contend with a rapidly changing environment. It was further conjectured that successful informal ILS organizations would be made up of individuals with strong personalities who relied upon their own character resources as much or more than upon any real or implied authority they might possess.

The objective of this paper was to see if this hypothesis did in fact hold true following the research and analysis and evaluation of the sixteen selected Projects. With this hypothesis and the two criteria briefly described in the Introduction, further progress depended upon a credible definition of the organizational problem.

III. PROBLEM IDENTIFICATION

One of the greatest challenges facing the logistic engineer in DoD today is the challenge to drive down weapon systems support costs.[2] Both military and congressional leaders realize that every effort must be made to reduce to a minimum these demands for manpower and money if the Nation is to continue to maintain its weapon systems and equipment in a high state of readiness. Thus, the OVERALL problem comes into view. What can ILS do about this?

Properly and selectively applied by Project Managers, ILS Planning and Implementation is supposed to encourage design innovation, rather than restrict it. In a speech before the Electronic Industries Association, meeting in Washington, D.C., in 1968, Dr. Finn J. Larsen, (former) Principal Deputy Director of Defense Research and Engineering, stated: "If the logisticians generate a logistics concept and follow this by a statement of tentative logistic requirements, the designers

and analysts can enter into the trade-off studies and analyses that
are made in the Conceptual Phase of development. An early considera-
tion of logistics, and continuing consideration during the development,
should achieve the proper balance between operational, economic and
logistics factors that is our goal."[3] But has ILS really accomplished
anything to date?

Both civilian industry and military hardware activities have
witnessed the successful application of ILS principles both in new
development and in overhaul/modernization programs, as evidenced by the
following:

Industry: DC-9 Airplane the design goal established by the maintenance
engineers of five maintenance man-hours/flight hour was attained during
the second year of operation, and the cost of ownership was significantly
reduced by designing the engines so that they could be completely changed
in less than thirty minutes.[4]

Navy: P-3 ASW Systems a total application of improvements cost some
$900 thousand, but resulted in subsequent cost-avoidance of $4 million
plus increased readiness,[5] and

Industry/Navy: DD-963 Ship Class as a result of various tradeoff
analyses aimed at reducing life-cycle costs, the following innovations
have been incorporated into the plans for these new ships:

* inorganic paints and other protective coatings which will
require less maintenance for both interior and exterior surfaces,

* extension of the time interval between regular overhauls,

* use of rotable pools of selected equipments and components
to increase ship on-line time,

* equipment selection and arrangement to reduce operational
manning requirements, and

* built-in test equipment for the maintenance of selected

new equipment.[6]

Without appearing to praise ILS excessively, it must be acknowl-
edged that there is broad support for its theory and principles across

the upper levels of both DoD and Navy management. The relative impor-
tance of ILS is nowhere more evident than in the Navy's largest Project

(PM-1); there the Project Manager has given himself the designation of

ILS Manager.

After due consideration of the overall objectives of ILS, its

documented benefits, and its endorsements, a smaller and more basic

problem began to form in the author's mind. There exist certain in-
gredients, germane to ILS Planning and Implementation, in the form of

guidance, people, dollar resources, billet and position descriptions

as well as the opportunity for/expectation of performance. A more

specific problem, as seen by the author, was the actual organization of

all of these ingredients into a system.

Because of certain constraints this definition was further reduced

to a simpler problem involving the "effectiveness" of the informal ILS

organization. If the Hypothesis depended upon the "effectiveness" of

the informal ILS organization, then the BASIC problem became:

WHAT IS AN "EFFECTIVE" INFORMAL ILS ORGANI-

ZATION, AND WHAT ARE ITS ATTRIBUTES?

Quite obviously, before an ILS organizational evaluation can be-
come meaningful to the reader, he should be afforded the opportunity

to briefly review ILS ideology and policy. This intentionally leads

the reader into an equally-detailed description and explanation of the
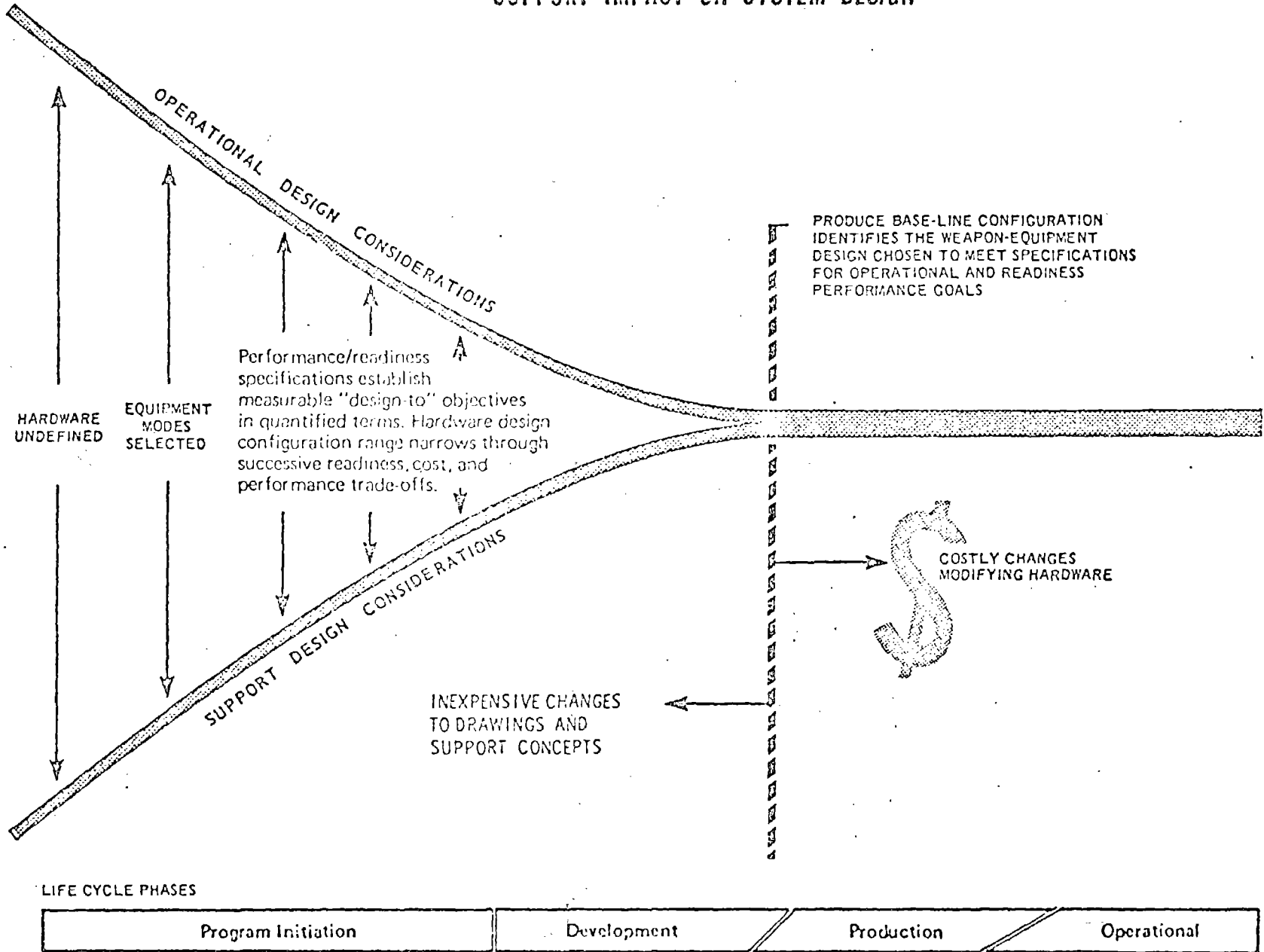
selected criteria.

IV. NAVY INTEGRATED LOGISTIC SUPPORT

A. BACKGROUND AND THEORY

In the past, logistic support has been treated in a fragmented fashion with each of the support elements considered and managed separately with little or no coordination.[7] Prior to World War II, our weapons and equipment were relatively simple. Interest in hardware support invariably followed after interest in design and production. The dropping of the first atomic bomb in 1945 and the subsequent emergence of thermonuclear weapon systems employing both long range missiles and manned aircraft, inaugurated an entirely new era of warfare, which in turn demanded radical changes in logistics and logistical systems.[8]

As a result of new approaches to management coupled with the increasing complexity of weapon systems (as well as their high cost of acquisition), their operation, and their support, DoD was subjected to a major overhaul in the early 1960's. Secretary McNamara and his Assistants introduced and installed the Planning, Programming and Budgeting System (PPBS), which although much modified is still in use today. PPBS coupled with the adoption of the project or matrix organization structure resulted in a total systems approach whereby the weapon system is priced out in terms of the total or entire life cycle costs incurred. The key feature of the systems approach is that the designer's actions must be kept in alignment with the needs of the users.[9] Actual alignment is accomplished through what is referred to as the user-producer dialogue, which is an interative process depending heavily upon information feedback.

SUPPORT IMPACT ON SYSTEM DESIGN

OPERATIONAL DESIGN CONSIDERATIONS

SUPPORT DESIGN CONSIDERATIONS

HARDWARE UNDEFINED

EQUIPMENT MODES SELECTED

Performance/readiness specifications establish measurable "design-to" objectives in quantified terms. Hardware design configuration range narrows through successive readiness, cost, and performance trade-offs.

PRODUCE BASE-LINE CONFIGURATION IDENTIFIES THE WEAPON-EQUIPMENT DESIGN CHOSEN TO MEET SPECIFICATIONS FOR OPERATIONAL AND READINESS PERFORMANCE GOALS

COSTLY CHANGES MODIFYING HARDWARE

INEXPENSIVE CHANGES TO DRAWINGS AND SUPPORT CONCEPTS

LIFE CYCLE PHASES

Program Initiation	Development	Production	Operational

Figure 2

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Integrated Logistic Support has been described as the life cycle support management of an equipment or weapon system "from womb to tomb", and parts of ILS have been with us in various forms and uncoordinated pieces for some time. Actually, ILS is an outgrowth of a trend in the early 1960's to systematize all maintenance associated with a given weapon system. An early example of this effort was a document promulgated in 1963 by the Navy's Bureau of Weapons entitled "Integrated Maintenance Management for Aeronautical Weapons, Weapons Systems, and Related Equipment (WR-30)." A significant feature of this program was the routine documentation of maintenance analyses and plans in Maintenance Engineering Analysis Records (Maintenance Engineering Analysis will be discussed later on). The following year an Ad Hoc Committee was formed and was called the DoD equipment Maintenance and Readiness Council; its task was to explore practical avenues of approach in implementing a new DoD Directive 4100.35 (Subj: Development of Integrated Logistic Support for Systems and Equipments). The objective of this directive was to ensure that the basic elements of ILS would be included in planning for the acquisition of DoD weapon systems and major items of equipment. The goal, then, of ILS is to obtain maximum material readiness and optimum cost effectiveness for a weapon system throughout its entire life cycle, from initial concept planning through development, production, modification, and finally retirement from inventory.[10]

The Navy Material Command defines ILS as a composite of all the support considerations necessary to ensure the effective and economical support of system/equipment for their life cycle. It is an integral part of system/equipment acquisition and operation and is characterized by harmony and coherence among all logistic elements. The principal

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elements related to the overall system/equipment life cycle include:

* Maintenance Plan,

* Support and Test Equipment,

* Supply Support,

* Transportation and Handling,

* Technical Data

* Facilities,

* Personnel and Training,

* Logistic Support Resource Funds, and

*Logistic Support Management Information.[11]

Additionally, it is the responsibility of the ILS function to recommend support parameters for the above elements. Such parameters shall be provided as qualitative and quantitative maintainability and reliability inputs to the design process for use in design trade-offs, risk analyses, and the development of a logistic support capability responsive to the operational requirements of the weapon system.[12]

1.   Systems Engineering Interfaces

Although ILS is pictured as a management and planning process, it is also a strong system design activity. It is thus necessary to have a logistically-structured management process and its logistically-structured counterpart in systems engineering. The following prescribes a normative approach to ILS implementation, i.e., the ideal situation.

To begin with, a system may be defined as sets of resources organized to perform designated functions in order to achieve desired results.[13] The total operational system with which the designer and the user are concerned can be split into the Prime Mission System and the Support System. The Prime Mission System is that set of resources and functions required to perform the mission with which it is concerned.

The Logistic Support System is that set of resources and functions required to keep the Prime Mission System operationally ready to perform its job. The word 'integrated' in ILS means that both the Prime Mission and Support Systems must be considered together.[14]

Actually, upon systematic examination of the ILS interfaces with systems engineering, the conclusion can be reached that ILS works because people driving the system maintain meaningful dialogue through the many inter-disciplinary interfaces comprising the ILS system. One of the basic ILS directives commonly called "the Guide" (DoD Instruction 4100.35-G) states that "support planning requires a close and dynamic working relationship between system design and support management." Given the goal of maximizing weapon and equipment readiness at optimum costs, the integration of logistic support elements into an on-going, already designed, time-phased and mission-oriented program was a logical course to follow.

During the Concept Formulation Phase the ILS/system design intefaces are primarily internal (i.e., user) interfaces in which a dialogue exists between the various logistic support managers and the Project Manager to ensure that logistic support policies and requirements are reflected in the determination of total system requirements.[15]

The interfaces which exist during the Validation Phase are of major significance because it is during this phase that the system design really begins. A valuable spin-off from this is the development of the overall System Logistic Concept, the single overriding guideline for all subsequent system and subsystem logistic support analyses. Note also that the detailed accomplishment of the logistic support design is a joint responsibility of the design and support engineering organizations with their interfaces coordinated by the ILS staff element.[16] In reality

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REPRESENTATIVE SYSTEM ACQUISITION CYCLE

PROGRAM INITIATION		FULL SCALE DEVELOPMENT	PRODUCTION/ DEPLOYMENT
CONCEPTUAL EFFORT	ADVANCED DEVELOPMENT/ VALIDATION		
o THREAT/ OPERATION NEED o CONCEPT ANALYSIS o TECH/ECON FEASIBILITY o RISK IDENTIFICATION o ALTERNATIVES o COST ANALYSIS o PRELIMINARY DESIGN FACTORS o INITIAL CHAR/ SYSTEM SPEC	o UPDATE OPERATION NEED o ADVANCED ANALYSIS o TECH/ECON CONFIDENCE o RISK RESOLUTION o BEST ALTERNATIVE o DEVELOPMENT & PRELIM. LIFE CYCLE COSTS o TEST & EVALUATION o ASSESSMENT o DEVELOPMENT/ PROGRAM PLAN (TECHNICAL, COST, LOGISTICS, SCHEDULE) o ADVANCED DEV. DESIGN	o UPDATE OPERATION NEED o ENGINEERING DEVELOPMENT o PROJECTED PRODUCTION COMPATIBILITY o PRODUCTION CONFIDENCE (BASED UPON T&E STATUS) o OPERATIONAL SUITABILITY o LOGISTICS SUPPORTABILITY o LIFE CYCLE COSTS o PROGRAM COSTS WITH AFFORDABLE LIMITS o PRODUCTION DELIVERY SCHEDULE o PRODUCTION AND LOGISTICS SUPPORT PLAN	o FULL PRODUCTION o OPERATIONAL/ SYSTEM USE PLAN
DCP	DSARC PROGRAM INITIATION DECISION Updated DCP	DSARC FULL SCALE DEVELOPMENT DECISION Updated DCP	DSARC PRODUCTION DECISION

Figure 3

there are a veritable multitude of interfaces to be attended to. However, the completion of this phase results in the ILS Plan and an Engineering Plan which together form the allocated baseline for the next phase.

During the various stages of the Engineering Development Phase, from preliminary design through test and evaluation and production design, the preliminary analyses which were performed during the Validation Phase are carried down in greater detail to lower subsystem and equipment levels. As the design becomes more refined, the analyses and trade-offs between ILS and design engineering increase significantly both as to number and degree of detail. The amount of data which must be handled during the detailed design of the system is such that computer-based management information systems become a necessity not only for design but also for adequately responsive interface management.[17]

During the Production and Installation Phases, systems engineering activities and personnel begin the phaseover to sustained engineering efforts. Product Assurance (quality, reliability, value engineering), Configuration and Data Management, Production Engineering, and Field Support Engineering become the center of interest at this time.[18]

Successful ILS management during all phases of the system life cycle requires careful attention to the interface between support element needs and Defense budgeting and financing procedures, i.e., funding. Funding activities are included as a prime element of support management. These activities should include, but are not limited to:

* Early determination of logistic support funding require-
ments which, together with experience factors from similar programs,
allow accurate forecasting of life-cycle costs,

* Accurate updating of forecasts for timely fiscal planning
and apportionment of required funds,

* Allocation of available Project funds to each logistic
support element based upon its justified need, with emphasis given to
Project schedule and task priorities, and

* Accurate accounting of funds expenditures using work
breakdown structure and measurement criteria to ensure proper funds
utilization and, where necessary, redistribution.[19]

2. Maintenance Engineering Analyses

In order to expand upon the inner workings and hidden mecha-
nisms of actual ILS management and interfacing, it is necessary to
discuss a selected group of specialized activities called Maintenance
Engineering Analyses (MEA) which in fact are responsible for the
accomplishment of a major share of the whole process. MEA is an en-
gineering review of system/equipment design configuration. The purpose
of MEA is basically threefold:

FIRST, to identify the support implications of the design,

SECOND, to provide feed-back to the designer by which he can
select a more supportable design, and

THIRD, to document specific support actions required and the
support resources necessary to effectively carry out those actions.

MEA cannot be specifically identified with any one point in
time or with any sole phase of the system life cycle; these activities
are spread over the entire life of the system. MEA performed during
Concept Formulation are concerned with applicable operation and

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maintenance policies and goals, and with their implications on system operation, maintenance activities, maintenance resources, and system configuration (maintainability design) in conjunction with operational states and missions. This should allow the appraisal of maintenance costs in terms of their effects on system design and system costs, and thus result in the establishment of realistic maintenance and maintainability objectives. Preliminary MEA performed during the Validation Phase are largely concerned with the structuring of a preliminary plan for maintenance as part of the ILS Plan. MEA continue on through the Engineering Development Phase and into the Production and Installation Phases; these activities are readily identifiable as being worthwhile, for the greater investment means a greater reward via information feedback and subsequent system improvements in both maintenance and support.[20]

The documented result of MEA is known as the Plan for Maintenance. This plan constitutes the common engineering data base which is used by all logistic element managers to compute, procure, and distribute the required support resources which comprise ILS.[21]

B. CURRENT POLICIES

Policy regarding ILS originates, of course, from within the office of the Secretary of Defense. The following statements describe the overall policy in this area:

* ILS is an integral part of weapon system acquisition and is part of the system engineering process.

* Logistic support shall be considered as a principal design parameter.

* Operational capability and availability of systems requires adequate and timely logistic support planning for and acquisition of support resources for all systems.

* The primary objective of ILS is the development of an effective and efficient logistic support program consistent with major program objectives and in phase with major program accomplishments.

* The ILS support function shall provide recommended support parameters for ILS elements.

* ILS shall provide inputs to the design process, particularly with respect to reliability and maintainability, for use in design trade-offs, risk analyses, and development of a logistic support capability, responsive to system operational requirements.

* To be cost-effective, logistic support considerations must be included in all phases of the system life cycle.[22] In putting all of this policy to good use, the Project Manager is provided with increasingly detailed directives from the OSD level and below.

1. ILS Guidance and Direction

The administrative chain of instructions guiding and directing the implementation of ILS within each Project begins at the top of the Defense hierarchy as follows:

* DoD Instruction 4100.35; Subj: Development of Integrated Logistic Support for Systems/Equipment,

* DoD Instruction 5000.1; Subj: Acquisition of Major Defense Systems,

* SecNav Instruction 4000.29A; Subj: Development of Integrated Logistic Support for Systems/Equipment,

* OPNAV Instruction 4100.3; Subj: Department of the Navy Integrated Logistic Support (ILS) System, and

* NAVMAT Instruction 4000.20A; Subj: Integrated Logistic Support Planning Policy.

While the DoD, SecNav, and OPNAV instructions provide the general authority and endorsement for ILS implementation in the Navy, NAVMAT Instruction 4000.20A addresses the subject very specifically as it applies to Project Management. Policy and guidance really do not end here by any means. There is yet an entire family of instructions and specifications promulgated by the various Systems Commands dealing with ILS as follows:

SYSCOM	Air	Elex	Ord	Ships	Supply
INSTR'N	4000.12	4000.6	4000.5A 4000.10A	4000.17A	4000.30A
SPEC'N	AR-30A	MIL-STD- 1369(EC)	OR-30	MIL-M- 24365H	

Inasmuch as the weapon system acquisition process encompasses both a USER (OPNAV/Fleet) and a PRODUCER (NAVMAT/contractors), the producer must also take an active role in ILS planning. In an attempt to achieve this goal, NAVMAT requires that ILS requirements be included in the Request for Proposal (RFP) and subsequent contracts for weapon systems to ensure that the Navy's contractors have viable and agressive ILS programs. Contracting personnel are among the first to suffer the results when inadequate ILS planning is performed or ILS plans are not implemented. All too frequently they are called upon to make "emergency" buys on a crash basis because when the basic equipment was procured someone forgot to order the repair parts.[23] In this regard, ILS personnel should fully participate in the source selection evaluation process.

To assist the Project Manager in the ILS program, an Integrated Logistic Support Manager is designated and assigned to carry out the ILS function for each acquisition at the time the Principal Development Activity receives an operational requirements document or

a decision is made to undertake the development or production of weapon systems or equipment for the Fleet.[24] Depending upon the size of the Project and the parent Systems Command, the ILS Manager may be directly in the chain of command under the Project Manager, or may be assigned from the ranks of a Systems Command's functional organization and in effect provide ILS services to the Project on an 'as tasked' basis. In either case, full program support is given by the ILS function. Understandably, all of the foregoing requires careful and systematic planning.

2. Planning Requirements

As with most worthwhile efforts, initial ILS planning is extremely important. The objective of early logistic support planning is the establishment of system end item design and configuration characteristics which reduce, and if at all possible eliminate, the need for logistic support resources. This process of converting goals into specific requirements is iterative. Subsequent iterations require that decisions made during the Conceptual, Validation, Development, Production and Operational Phases of the system life cycle take into account the logistic implications of those decisions. It is during the development and review of logistic parameters that gross estimates of logistic costs are to be made and trade-off studies identified.[25]

The actual ILS Plan may be initially developed in-house, perhaps with some limited contractor assistance. The ILS Plan is based upon information contained in the basic planning documents; it becomes continuously more refined and comprehensive as the Project progresses through the system life cycle. The function of the ILS Plan is to identify WHAT activities will be accomplished, WHO will be responsible for their accomplishment, and HOW and WHEN they will be accomplished.

One purpose of the ILS Plan is to demonstrate that the logistic support established for a specific system has been planned on an integrated basis. The plan also provides for the foundation of coordinated action on the part of both the Navy ILS Managers and the contractors' organizations, and documents the manner in which each of the applicable elements of ILS are to be obtained and integrated with the other elements throughout the system life cycle. Included in the ILS Plan are: milestones, delivery points, names, and specific responsibilities of persons accountable for each element, basic guidance on the logistic system desired, relationships and interdependencies among personnel, and the monitoring or communications system to pass information among participants.

While the actual format of each ILS Plan may vary, each of the following items must be considered and discussed as applicable:

* A list of assisting organizations together with a concise statement of responsibilities,

* Methods of communication and identification of the specific documents by which decisions relative to ILS are to be recorded and communicated,

* A list of logistic support elements,

* A specific program for assuring maximum consideration is given to trade-offs between logistic support elements as well as between logistic support and design,

* An overall plan for programming, budgeting and funding,

* A training and indoctrination plan,

* A plan for merging maintainability, reliability, and human factors requirements into the ILS Planning process,

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* A specific requirement for and a description of the logistic support analyses, and

* Identification of an appropriate management control and appraisal system for evaluating logistic support milestones.[26]

3. Management Information Systems

Effective ILS Planning, as well as execution, depends to a great degree upon efficient management of both raw data and processed information. A good system is needed for information gathering, collecting, storing, retrieving, and output. This system must be able to accommodate a variety of specialized functions over a long span and, frequently, remote intervals of both space and time.[27] It should be readily apparent that in a system of even moderate degree of complexity, there is an extremely large quantity of various types of data which must be processed during both ILS Planning and Implementation. This has resulted in an effort by many Projects to make effective utilization of automatic data processing and the establishment of logistic data banks. Management data systems required by support management functions include information regarding:

* Maintenance engineering analyses control documentation,

* Engineering test and demonstration records,

* Program schedule and cost controls (PERT/CPM),

* Maintenance management and failure data,

* Miscellaneous requirements forecasts, e.g., personnel, equipment, supplies, facilities, etc.,

* Configuration management,

* Operational readiness support status, and

* Supply management effectiveness reporting systems.[28]

A current, reliable and accessible technical data repository is mandatory and is the first step in providing adequate in-service engineering and logistic support for any weapon system. This responsibility is worth its weight in gold, but it must be kept current.[29]

These data systems should be oriented to the use of data to MANAGE, rather than to the management of data. It is necessary that the functional support managers recognize both the limitations and the capabilities of information and data processing. At best, only part of the manager's total information requirements can be coded for automatic data processing.[30] It should not be assumed that formulating any kind of management information processing plan, establishing a data repository, or promulgating voluminous and impressive documents will do the job. It takes people, more people than are normally assigned to this sort of endeavor; in particular, it takes engineers and data managers who know data and are interested in their jobs, and who are respected and heeded by the design side of the house.[31]

Having explained the first criterion, ILS policy, the next section will describe the second criterion, Scott's Model. Taken together, these criteria are subsequently used to evaluate the informal ILS organizations of the selected Projects.

V. SCOTT'S MODEL

The evaluation "model" attributed to William G. Scott is a loosely-woven fabric, a flexible structure, composed of a blend of various accepted theories of management. The model (as such) is really just Scott's way of describing modern organization theory (in particular) as a "logical and vital evolution in management thought."[32] Beginning with the classical doctrines of Fayol and Taylor, Scott traces the evolution of management thinking through the neoclassical school (described by Mssrs. Gardner, Moore, Davis and others) and finally into the modern school of organization theory. This modern school has been abudantly discussed by Mssrs. March, Henderson, Simon, Haire and many others. The key features of the modern school are the reliance on empirical research data, the analysis of decision interactions, and the integration of individual operating modules or work centers into a total organization.

The following discussion explains in more detail the six key variables in the model: the formal organization, the informal organization, the role and status constructs of the assigned personnel, the communications network serving the organization, a concept that Scott calls "balance" or the force which causes the organization to function effectively, and the environment or physical surroundings of the organization.

A. THE FORMAL ORGANIZATION

In his book The Functions of the Executive, Chester I. Barnard refers to an organization as "formal when the activities of two or

more persons are consciously coordinated toward a given objective."[33]

The basis of the formal organization is a common purpose served by a willingness to act and the ability to communicate. Typically the formal organization is the one displayed on a wiring diagram and described in an organization manual. The logical arrangement of a formal organization is an outgrowth of the principle of division of work to promote efficiency and a hierarchy of both authority (delegation) and responsibility.

B. THE INFORMAL ORGANIZATION

In the same book mentioned above, Barnard argues that the informal organization precedes the formal organization. The informal organization is merely the result of a natural, human tendency to follow gregarious impulses. Once drawn together people tend to communicate with increasing freedom from restraint, and thus discover that they share common objectives (goal congruence). Communications thus acts as a catalyst in initiating and accelerating the cohesiveness of the organization. A second binding force is the satisfaction of mutual needs. Not only is the informal organization inevitable, but it can be effectively utilized as an instrument in the hands of the skilled executive. Taking advantage of the fact that there exists a very free exchange of ideas (good communication) within the informal organization, the executive can capitalize on this feature so as to make the formal organization more effective.

C. ROLES & STATUS CONSTRUCTS OF ASSIGNED PERSONNEL

A construct is a set of notions, preconceived ideas, sensory perceptions and interrelating expectancies. Put more simply, a construct describes a person's viewpoint or perceived idea of some part,

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or all, of his environment. A distinct subdivision of modern organization theory deals with the psychological relationships relative to the interaction of behavior stemming from role demands generated by both the formal and informal organizations. Goal incongruencies among both the formal and informal organizations, as well as the individual, must be understood and then resolved in an attempt to preserve organizational integrity. Both the formal and informal organizations require the assigned personnel to assume a role and in turn they are given varying degrees of status, self-respect and satisfaction.

D. COMMUNICATIONS

Communications may be considered in the form of a network designed to transmit information vertically as well as horizontally to personnel in the organization. Communication serves equally well all five management principles: planning, organizing, staffing, directing, and controlling.[34] Although a requirement for any organization, communication is the forte of the informal organization. Communications plus "balance" describes the process whereby feedback is effected, without which the executive has a very difficult time of making good decisions and thereby managing effectively.

E. "BALANCE"

Like communications, "balance" is a linking process, but it involves some rather complex ideas. "Balance" refers to that 'magic ingredient', if you will, that makes the organization not only work, but work well. "Balance" is also a driving force as well as a stabilizing force; it serves to preserve system or organizational integrity in the face of unexpected or unplanned for developments such as natural catastrophes,

surprise shifts in political influence, human perfidy, and indecision from above. "Balance" is also an innovative force in that it can, within limits, facilitate transition between programs and subsequent adaption to change by the organization so as to preserve not only harmony and coherence but also the very life of the organization itself.[35]

F.   ENVIRONMENT

The environment or physical setting in which the organization exists is a way of describing the 'world system' of which the particular organization is merely a part. Few, if any, organizations exist all by themselves; they interact to varying degrees with other organizations through interfaces. The key factor which makes the environment so important is time, expressed in a continuum as history and/or relatively as the level of progress in development attained by one organization in comparison to others. It should be understood that system interfaces may be classified as supportive, constraintive, or some combination of the two. Scott further accentuates the importance of the physical environment when he states: "...work cannot be effectively organized unless the psychological, social, and physiological characteristics of people in the work environment are considered. Machines and processes should be designed to fit certain generally observed psychological and physiological properties of men, rather than hiring men to fit machines."[36]

Having established a hypothesis, described the basic problem and defined and explained the criteria to be used, the next section will deal with how and why the research was conducted.

VI. RESEARCH OBJECTIVE AND METHODOLOGY

A brief glance through the DoD telephone directory of activities in the Washington, D.C., area reveals that no two Navy Projects are organized the same way. Since it follows that they each have dissimilar modes of operation, so too, it was conjectured, must there be differences in both the understanding and scope of application of the basic principles of ILS. The sixteen Projects under study, as mentioned in the Introduction of this paper, had been previously assigned in a class dealing with Contracting and Contract Regulations. The students in Section QQ22 had been required to become acquainted with the respective Selected Acquisition Reports, Advanced Procurement Plans, as well as any information appearing in newspapers and periodicals. In short, each student or pair of students had been directed to become the Section briefing officer(s) for his (their) respective Projects during the period July-December 1972. Through the preparation and submission of point papers to the Instructor as well as standup verbal and visual presentations to the rest of the Section, each student or pair of students had become somewhat familiar with their respective Projects by the time they were directed to conduct the ILS analyses. These analyses in fact constituted most of the research from which this paper was drawn. The primary objective of each student's analysis was to carefully and systematically examine the organization of the ILS function and to find out just why and how it performed its assigned task within the framework of supporting management of the particular Project.

A. CONSTRAINTS

In all cases there was a single overriding constraint: geography.
The assigned Project offices are located in Washington, D.C., and NPGS
is in Monterey, California. There existed at the time the research was
conducted a great paucity of travel funds. In spite of this, one or
two students did manage to arrange for transportation to conduct their
research. The majority of the students conducted their research via
one or more of the following: questionnaires, letters, and telephone
calls. Most of the students relied upon some form of a questionnaire;
therefore, there was very little face-to-face interaction between the
students and the Project ILS personnel.

B. STRENGTHS, WEAKNESSES AND BIASES INHERENT IN THE APPROACH UTILIZED

The students were cautioned by the Instructor to use simple
questions and to try to avoid confusion and misunderstanding. By and
large these questions, in turn, were carefully worded so as to solicit
"quick, immediate-recall type responses." The goal was to discover the
topical rather than the profound.

The greatest strength in the questionnaire approach was felt to
lie somewhere in a combination of the following:

* The carefully selected words in the questions were really
cues which were designed to trigger an immediate response,

* The use of questions was rather impersonal,

* The wording and intent of the questions was carefully
arranged so that little (if any) strong convictions regarding the
subject was 'telegraphed' to the person answering the questions, and
finally

* The person responding hopefully would sense very little threat from a question originating out of NPGS student research and therefore would say pretty much what he honestly felt in lieu of responding with a 'canned' statement.

Although the use of the questionnaire has inherent strengths, it also has its weak points and is subject to the effects of personal biases. If a single word had to be chosen to describe this weakness, the word would have to be misunderstanding. There is an old saying which goes something like: "although you may have heard what I said, it is probable that you did not understand what I meant." In this instance, the words "heard" and "said" could easily be replaced with "read" and "wrote" and the basic argument would still stand on firm ground. As a matter of fact, some of the questions were not answered; the responses were either "?" or a statement like "I don't understand the question." Further, because no standardized questionnaire was utilized, the results of the analyses do not readily lend themselves to statistical methods of examination and comparison.

People being what they are, it is difficult for any person to be one hundred percent objective all of the time. Biases, especially the long-ingrown variety, have a way of coloring or shading ideas and the interaction of ideas (discussion, argument, etc.) much the say was as a filter affects the color balance of light rays striking the film in a camera.

C.   A VIABLE DEFINITION OF "EFFECTIVENESS"

The Integrated Logistic Support Implementation Guide for DoD Systems and Equipments (NAVMAT P-4000) defines "effectiveness" as "the probability that the material [system, equipment, module, etc.]

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will operate successfully when required." The same publication defines "system effectiveness" as "the ability of a system to do the job for which it was intended." Following along this line of reasoning, an organization can be considered a social system which is associated with certain goals, objectives, and purposes. Simply stated, "effectiveness" can be thought of as how well, or to what degree, the goals and objectives are achieved and how well the purpose is served.

For the purposes of these analyses a better, or at least consensus, definition of "effectiveness" might have been obtained if the entire study had been conducted with a standardized approach and reasonably similar degrees of student-Project staff interaction. It must be said, however, that all students utilized the same framework for their investigations (Scott's Model). As might be expected, the average definition of "effectivenss" turned out to be more subjective than anything else (which is not to say that that is altogether wrong). Quite simply, the study was aimed at an unsophisticated feeling of "effectiveness" as experienced by the major decision makers in the respective Project organizations. "Effectiveness" as seen from their viewpoint was thought to involve an evaluation of how the ILS function was doing what it was intended to do, and in a larger sense, how well was the ILS function serving the entire Project organization.

VII. RESEARCH RESULTS

Having explained briefly the concept and purpose of ILS as well
as the objective and methodology of the analyses used to develop this
paper, it follows that the results should be no less detailed. To
preface the results, however, a few words concerning the selected
Projects are in order. As mentioned at the beginning of this paper,
there is a tremendous diversity of systems and equipments procured by
the Navy. In addition, the procurement techniques and state of develop-
ment vary from system to system and equipment to equipment. These
factors also dictate different approaches in applying ILS. Two separate
and distinct criteria were utilized in analyzing and evaluating the
sixteen Project ILS functions prescribed doctrine and Scott's Model,
and in that order. In addition, there were circumstances whereby both
criteria were used simultaneously and the results of using one criterion
were reflected against the results of the use of the other.

A. DIFFERENCES BETWEEN ILS PROGRAMS AND PRESCRIBED ILS DOCTRINE

Remembering that there has been promulgated an entire family
of ILS instructions and specifications, there would appear to be suffi-
cient guidance in the HOW, WHAT, and WHEN of applying ILS. Although
there are noticeable differences in Systems Commands' organizational
characteristics, a careful review of their respective policies and pro-
cedures indicates a basic adherence to the spirit and intent of NAVMAT
Instruction 4000.20A. To try to compare all sixteen ILS programs with
the entire body of ILS doctrine and policy would be underproductive for
the purposes of this paper. However, using only NAVMAT Instruction

4000.20A as a benchmark, certain generalized attitudes and impressions were drawn from the separate analyses. The basic format to be followed in the subsequent discussions is to present verbatim quotations (in capitol letters) followed by a discussion of the data.

To begin with, the whole ILS effort depends upon the actions of certain key individuals within the Project organization. "THE AC-QUISITION MANAGER-A KEY INDIVIDUAL WHO HAS BEEN ASSIGNED BY HIGHER AUTHORITY THE OVERALL RESPONSIBILITY FOR ACQUISITION OF WEAPON SYSTEMS, INDIVIDUAL ITEMS OF EQUIPMENT OR FACILITIES, INCLUDING THE REQUISITE SUPPORT...THE INTEGRATED LOGISTIC SUPPORT MANAGER-A KEY INDIVIDUAL ASSIGNED BY HIGHER AUTHORITY TO SPECIFIC ACQUISITIONS TO PLAN AND MANAGE THE INTEGRATED LOGISTIC SUPPORT PROGRAM...THE INTEGRATED LOGISTIC SUPPORT ELEMENT MANAGER-THE KEY INDIVIDUAL ACTING FOR HIS ORGANIZATION FOR THE INTEGRATED LOGISTIC SUPPORT ELEMENT (E.G., SUPPLY SUPPORT, FACILITIES, PERSONNEL, ETC.) HE REPRESENTS." Of course there are in reality many more involved individuals, both within the Navy and within the contractor's organization. Each of the Projects analyzed is a major weapon system acquisition effort with a designated Project Manager armed with a Charter and a small staff. Most of these staffs are organized with some one person being assigned the responsibility of the Integrated Logistic Support Manager; he might not have an easily identifiable ILS title, but he does have the responsibility for most or all of the ILS function. In a few cases there were even a few recognizable Integrated Logistic Support Element Managers within the Project staff; in most cases the ILS Element Managers were assigned within the functional (SYSCOM) organization and shared by more than one Project.

"TRADE-OFF STUDIES WHICH ARE A PART OF THE SYSTEM DESIGN PROCESS SHALL TAKE INTO CONSIDERATION THE OPERATIONAL ENVIRONMENT IN WHICH THE SYSTEM IS TO BE USED, AS WELL AS THE LOGISTIC SUPPORT REQUIREMENTS, GENERATED BY THAT ENVIRONMENT." The range of consideration with respect to environment, as evidenced by the replies in the questionnaires, was from mediocre to "minor overkill". In their own way, each person inferred that if the basic ILS approach was accepted, then you simply had no other choice than to realistically and reasonably plan for the operation as well as the support of the weapon system in a real-world environment. The methods they advocate to achieve this reality concentrate on carefully focusing the right resources over the life-cycle of the weapon system. These essential resources or support elements must be rationally planned for, funded, scheduled and acquired. There appears to be a growing awareness to the fact that (for example) eight properly supported and maintained ships or planes or fire control systems are better than ten or twelve which are not. Although this is somewhat outside of traditional superiority-in-numbers thinking, it has become a fact of life and must be reckoned with. The difference between the eight and ten figures is simply one of dollars. Although there appears to be no real answer to how many fewer weapon systems to buy and how much more support to invest in instead, there is a growing acceptance to the fact that such decisions have to be made.

"WHILE THE APPLICATION OF THE INTEGRATED LOGISTIC SUPPORT CONCEPT IS MANDATORY...TAILORING THESE PRINCIPLES TO SUIT THE NEEDS OF THE ACQUISITION AT HAND IS OF PRIMARY INTEREST." Most of the Projects studied came into being and attained their stature about the same time that the ILS philosophy and discipline was being filled out and groomed.

One of the very first lessons learned was that since no two Projects were alike, it would be an exercise in futility to try to rubber stamp the various ILS Plans. Some ILS Plans were developed by the Project staff, some by some other SYSCOM organization, some by the prime contractor, and some by a software specialist contractor; not all of these plans are actually used, but somehow the people have not become totally overwhelmed by the paperwork and are managing to get the job done.

"OPNAV REQUIREMENTS DOCUMENTS (GENERAL OPERATIONAL REQUIREMENT /GOR/, TENTATIVE SPECIFIC OPERATIONAL REQUIREMENT /TSOR/ SPECIFIC OPERATIONAL REQUIREMENT /SOR/) SHALL BE REVIEWED FOR INCLUSION OF THE LOGISTIC DEVELOPMENT DATA REQUIRED BY OPNAV INSTRUCTION 4100.3...THE LOGISTIC WORK WHICH MUST BE DONE DURING THE CONCEPTUAL PHASE AND THAT WHICH WILL BE REQUIRED IN SUCCEEDING PHASES TO SATISFY THE OPNAV RE-QUIREMENTS, TOGETHER WITH ATTENDANT FUNDING REQUIREMENTS, SHALL BE CLEARLY IDENTIFIED." This effort is being accomplished but apparently not to a significant degree; the OPNAV requirements are basically being satisfied. Statements in the questionnaires indicate that the logistic data contained in the GOR, TSOR, or SOR is rather general if not vague; the reasons for this are usually attributed to the greater urgency of other matters at that early (beginning-of-the-Conceptual) stage of the Project and there not normally being an ILS Manager assigned on a full-time basis that early. Given the time and the proper people resources, more ILS work could be accomplished at this time (SOR or earlier) but there is an undercurrent of feeling that too much detailed ILS work too soon is not that beneficial to the Project.

"EFFECTIVE EXPRESSION OF QUANTITATIVE AND QUALITATIVE LOGISTIC SUPPORT REQUIREMENTS SHALL BE INCLUDED IN PROPOSED TECHNICAL APPROACHES,

ADVANCE PROCUREMENT PLANS, TECHNICAL DEVELOPMENT PLANS, REQUESTS FOR

PROPOSAL, EQUIPMENT SPECIFICATIONS...PROJECT MASTER PLANS...AND SOURCE

SELECTION DECISIONS." The questionnaires gave the author the feeling

that as if the OPNAV document requirements were not enough, there is

yet another whole group of documents and reports. It would seem that

every little office or activity that has been given or has taken the

authority to put their "chop" on a plan or which has been given or has

taken the responsibility to oversee the Project Manager, requires that

he submit some form of a report. ILS being an all-pervasive disci-

pline must be capable of interfacing with all of these paperwork re-

quirements; ILS attempts to do this, and to some degree it succeeds,

or rather the people who do ILS succeed. With respect to these

specifically-mentioned documents, a summary of conclusions drawn from

the questionnaires is shown below:

DOCUMENT	AFFIRMATIVE	NEGATIVE/UNKNOWN
PTA		X
APP	X	
TDP	about half and half	
RFP	about half and half	
Equip. Spec's.	X	
Proj. Master Plan	X	
Source Selection		X

"AN INTEGRATED LOGISTIC SUPPORT MANAGEMENT TEAM SHALL BE ORGANIZED

FOR ALL ACQUISITIONS THAT GO THROUGH THE FORMAL ACQUISITION PHASES..."

A review of each questionnaire indicates that there's absolutely no

question of the necessity of having a team; without teamwork ILS can

be an aggravating, ulcer-generating exercise. There are also indications

that there need be two distinct kinds of people involved in ILS;
planners for the early phases of the Project and a gradual transition
into implementors during the later phases. Trying to get any kind of
well-trained and dynamic ILS people appears to be a common problem,
notwithstanding the personnel management problems laid on the Project
by a not always flexible Civil Service establishment within the Federal
government. By and large, the teams all must contend with geographic
dispersion. Attempts are made to strengthen the lines of communication
through telephone calls, routed correspondence, and briefings. Some
Projects obviously do a better job of this than do others. The biggest
problem with the team effort, once the proper people have been drawn
together, involves dollar resources; the contractor's ILS team members
are not under the same funding constraints that the Navy ILS Element
Managers are, for example. The Project often has a great ILS Plan,
extremely talented ILS Managers, but little or no real control over
ALL the dollar resources involved in the Plan or supposedly being managed
by the ILS Manager. One of the questionnaires rather strongly inferred
that at best the ILS function was a giant exercise in coordinating
someone else's resources and that there is not too much real management
involved. This problem addresses the entire area of Navy Shore Establish-
ment Organization as well as the DoD Planning, Programming and Budgeting
System, and is obviously beyond the scope of this paper.

"REQUIREMENTS FOR LOGISTIC SUPPORT RESOURCES SHALL BE DETERMINED,
AND THE RESOURCES SHALL BE ACQUIRED BASED ON A LOGISTIC SUPPORT ANALYSIS
OF THE COMPLETE SYSTEM..." Logistic Support Analysis (LSA), or as it
was called until just recently Maintenance Engineering Analysis (see
section IV.A.2), is the prerequisite to developing the Maintenance

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Concept for the weapon system. MEA/LSA involves the establishment of maintenance requirements keyed to specific activities and levels of maintenance, considering the use of special and general purpose test equipment, identifying facilities, spares and repair parts, quantitative and qualitative manpower requirements, training aids and courses of instruction, and where appropriate the services of a contractor which will support the system during some part of or all of the system life cycle. Without a doubt, MEA/LSA has received whole-hearted support and more importantly has been put to extensive use by the engineers and logisticians working in tandem. By and large, most engineers feel that they have historically done most of the MEA/LSA anyway, particularly those with operational experience and exposure to maintenance and support in the real world.

"ENSURE THAT NECESSARY WRITTEN MUTUAL AGREEMENTS REGARDING THE FUNCTIONS AND RESPONSIBILITIES ARE REACHED WITH EACH ORGANIZATION WHICH IS TO PROVIDE A LOGISTIC ELEMENT MANAGER AND APPROPRIATE RESOURCES."[37] From reading some of the answers contained in the questionnaires, it could not be deduced that agreements had been effected in all cases. There were three distinct subsets of situations. Some of the replies indicated that there was some doubt that such written agreements existed, although since they were required it was presumed that they were on file some place. Others knew that the agreements only existed but were not sure of their contents. The largest group not only knew of the agreements but were quite knowledgeable as to their contents. Agreements regarding ILS responsibilities may be found in system specifications, contracts, joint operating agreements, memoranda of understanding, and in some cases within the Project Charters themselves. Agreements

ranged from the very simple to the very elaborate and comprehensive. nonetheless there is an apparent attitude that these are just another paperwork drill, because in the final analysis it is felt that people and not pieces of paper get the job done.

From this rather brief comparison between a single policy document and individual Project efforts, it can be safely assumed that these selected Projects are in fact planning and implementing within the spirit and intent of broad ILS policy.

B. ILS ORGANIZATIONS VIS-A-VIS SCOTT'S MODEL

In an attempt to gain a different perspective of these same ILS functions, each was analyzed using Scott's Model (see section V of this paper) as a frame of reference. Recall that this framework is composed of several key members, namely: the formal organization, the informal organization, the roles and status constructs of assigned personnel, communications, "balance", and the organization's environment. If nothing else resulted from this exercise, it was anticipated that the student would gain a greater appreciation for the challenges awaiting ILS Managers.

The Integrated Logistic Support concept is applied by people who are located in organizations, both formal and informal. Within the Naval Material Command there are diverse organizations whose form, location, responsibilities and modus operandii are the product of many factors, e.g., traditions associated with types of hardware, particular industrial communities, staffing patterns and the individual desires of the people within the organizations who in fact have the power to shape the organization and greatly influence its modus operandii. As

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a result, there is diversity between and within the hardware Systems Commands which is one of the major reasons for having to "custom tailor" the application of ILS. This need for modulation of the concept can in some cases negate or dilute the value derived from applying ILS. If the organization is so fractionated and the jurisdictional boundaries are held rigid, the application of a concept like ILS has little chance of being successfully implemented. Ironically enough, however, it is in this type of organizational environment where the concept of ILS is most needed and can be most effective. Where jurisdictional boundaries are not held rigid the application of ILS is easier to accomplish. In fact, in such cases the concept of ILS is operative whether or not it is so formally labeled. These kinds of organizations usually have an overriding common objective which precludes development of rigid boundaries in sub-functional areas. A classic example of this type of organization is the Strategic Systems Project Office (PM-1).

A review of the individual Project analyses indicates that each hardware Systems Command does in fact approach the <u>formal organization</u> for ILS somewhat differently:

NAVAIRSYSCOM - there are, under the Assistant Commander for Logistics/Fleet Support, a group identified as Assistant Project Managers for Logistics (APMLs) who serve as the ILS Managers for selected aircraft programs. They are, in fact, double hatted in that they work for Project Managers in NAVAIRSYSCOM but report to AIR-04. The E-2C Project (PMA-231) formal organization diagram is fairly typical and is shown on the following page.

```
                    ┌─────────────────┐
                    │ Project Manager │
                    └─────────────────┘
                             │
                    ┌─────────────────┐
                    │     Deputy      │
                    └─────────────────┘
                             │
      ┌────────────┬─────────┴────────┬──────────── ─ ─ ─ ┐
┌───────────┐ ┌──────────────┐ ┌────────────┐ ┌──────────┐
│ Program   │ │Configuration │ │ Readiness  │ │ APML     │
│           │ │Management &  │ │            │ │          │
│ Control   │ │              │ │ Assurance  │ │ AIR-410  │
│           │ │VAST Interface│ │            │ │          │
└───────────┘ └──────────────┘ └────────────┘ └──────────┘
```
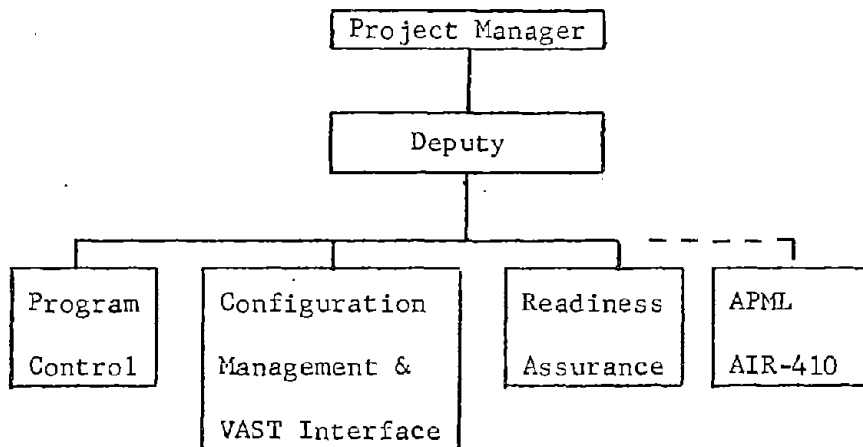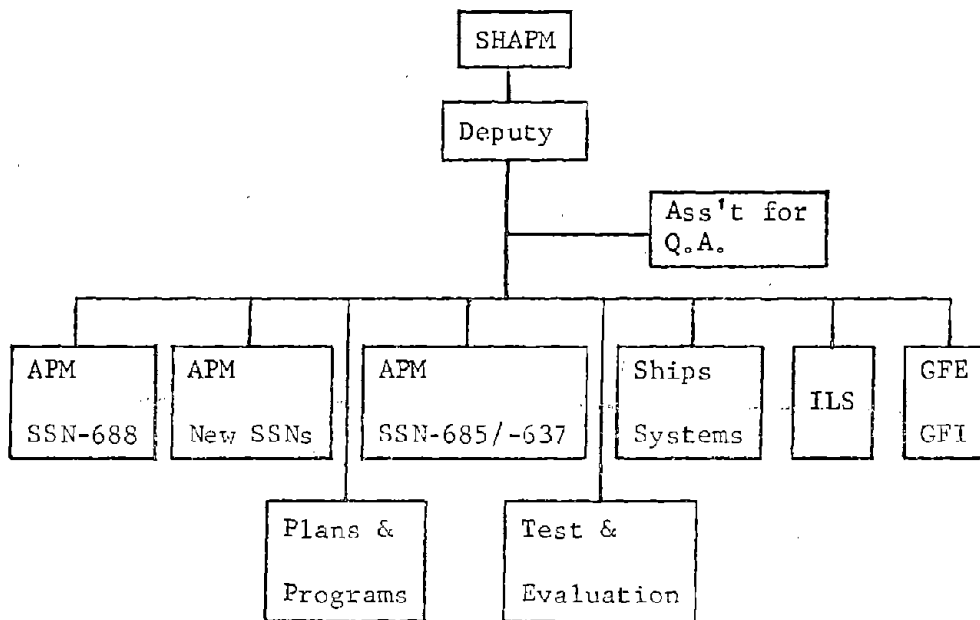
NAVORDSYSCOM - ILS implementation is approached in a some-
what different manner, holding in the main to traditional concepts and
practices. Newer acquisitions in NAVORD have adopted the concepts of
ILS but there is not the same degree of coordination that exists in
NAVAIR. There are designated "ILS Managers" but while they carry the
title, they do not appear to function as complete ILS managers (they
are better described as ILS Coordinators). Here ILS is seen organized
as a staff function rather than a line function with a resulting dilu-
tion of ILS impact. The Mk-48 Torpedo Project (PMO-402) organization
diagram is shown below:

```
              ┌─────────────────┐
              │ Project Manager │
              └─────────────────┘       ┌──────────────────────┐
                       │                │ Engineering Ass't.   │
                       ├────────────────│ for Production Cost  │
                       │                │ Control              │
              ┌─────────────────┐       └──────────────────────┘
              │     Deputy      │
              └─────────────────┘
                       │
        ┌──────────────┼──────────────┐
 ┌───────────┐  ┌───────────┐  ┌────────────┐
 │ Project   │  │ Plans &   │  │ Test &     │
 │           │  │           │  │            │
 │ Officer   │  │ Resources │  │ Evaluation │
 └───────────┘  └───────────┘  └────────────┘
                         │
                     ┌───────┐
                     │ ILS   │
                     └───────┘
```
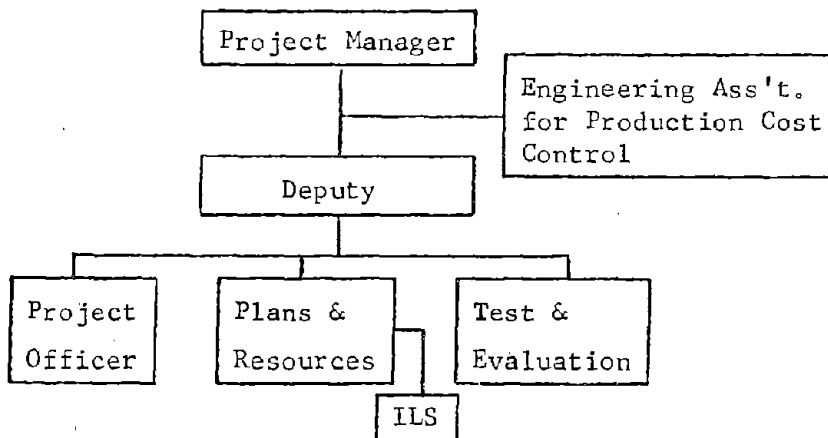
NAVSHIPSYSCOM - here we see a third approach. While ILS

policy is the responsibility of SHIPS-04, the ILS Managers are assigned

to and work directly for the Ship Acquisition Project Managers (SHAPMs).

Just as ship types differ, so too do the applications of ILS within

each Project. As an example, the SSN-688 and Newer SSN Classes Project

(PMS-393) formal organization is shown below:

```
                      ┌──────────┐
                      │  SHAPM   │
                      └──────────┘
                           │
                      ┌──────────┐
                      │  Deputy  │
                      └──────────┘
                           │        ┌──────────────┐
                           ├────────│  Ass't for   │
                           │        │  Q.A.        │
                           │        └──────────────┘
   ┌──────┬──────┬────────┼────────┬────────┬────────┐
┌──────┐┌──────┐┌──────────┐┌────────┐┌──────┐┌──────┐
│ APM  ││ APM  ││   APM    ││ Ships  ││      ││ GFE  │
│      ││      ││          ││        ││ ILS  ││      │
│SSN-688││New SSNs││SSN-685/-637││Systems ││      ││ GFI  │
└──────┘└──────┘└──────────┘└────────┘└──────┘└──────┘
        ┌──────────┐    ┌──────────┐
        │ Plans &  │    │ Test &   │
        │ Programs │    │Evaluation│
        └──────────┘    └──────────┘
```

Departing from a discussion of the "normative" approaches to

organizing for ILS, the next key member of Scott's Model to be ex-

amined is the informal organization. In each Project analyzed there

are informal organizations in varying stages of development; a few

have not yet developed sufficiently to be so recognized while most

of the others are not only well developed but well utilized. All of

this is just a way of stating that informal organizations require some

time to reach their maturity. From the Project analyses it appears that

the informal organizations evolve out of: interfaces, people weaknesses,

and the inability of the formal organization to adapt in a timely
fashion to a dynamic environment. Some feelings exist to support the
statement that you must have an informal organization because people,
not pieces of paper (formal organization charts), get the job done.
Those cases where the informal organization is particularly effective
are characterized by a noticeable degree of authority delegation.
Successful informal organizations are also described as teamwork efforts,
harmonious relationships, and mutual confidence and trust. But what
does an informal organization look like? There is not any single,
visual representation that can answer this question. Figure 4 is a
representation of the conceptual ILS informal organization as seen
within the DLGN-38 Ship Acquistion Project: the ILS Manager is the center
of what appears to be a wheel, the spokes being representative of lines
of communication and the rim being a locus of the functional and sup-
porting organizations with which the ILS Manager works. From the number
of other activities involved, and from the realization of the fact that
the ILS Manager does not in reality control all of the resources (man-
power, money, materials) for which he is held responsible to the
Project Manager it can be deduced that he is more a Coordinator and
Motivator than anything else. Time and again, the analyses reveal that
the largest sources of trouble are the functional organizations and the
contractors. These problem areas are linked to the ILS Manager via
the informal organization's communications flow. Even if these problems
do not all get resolved, the fact that the informal organization acts
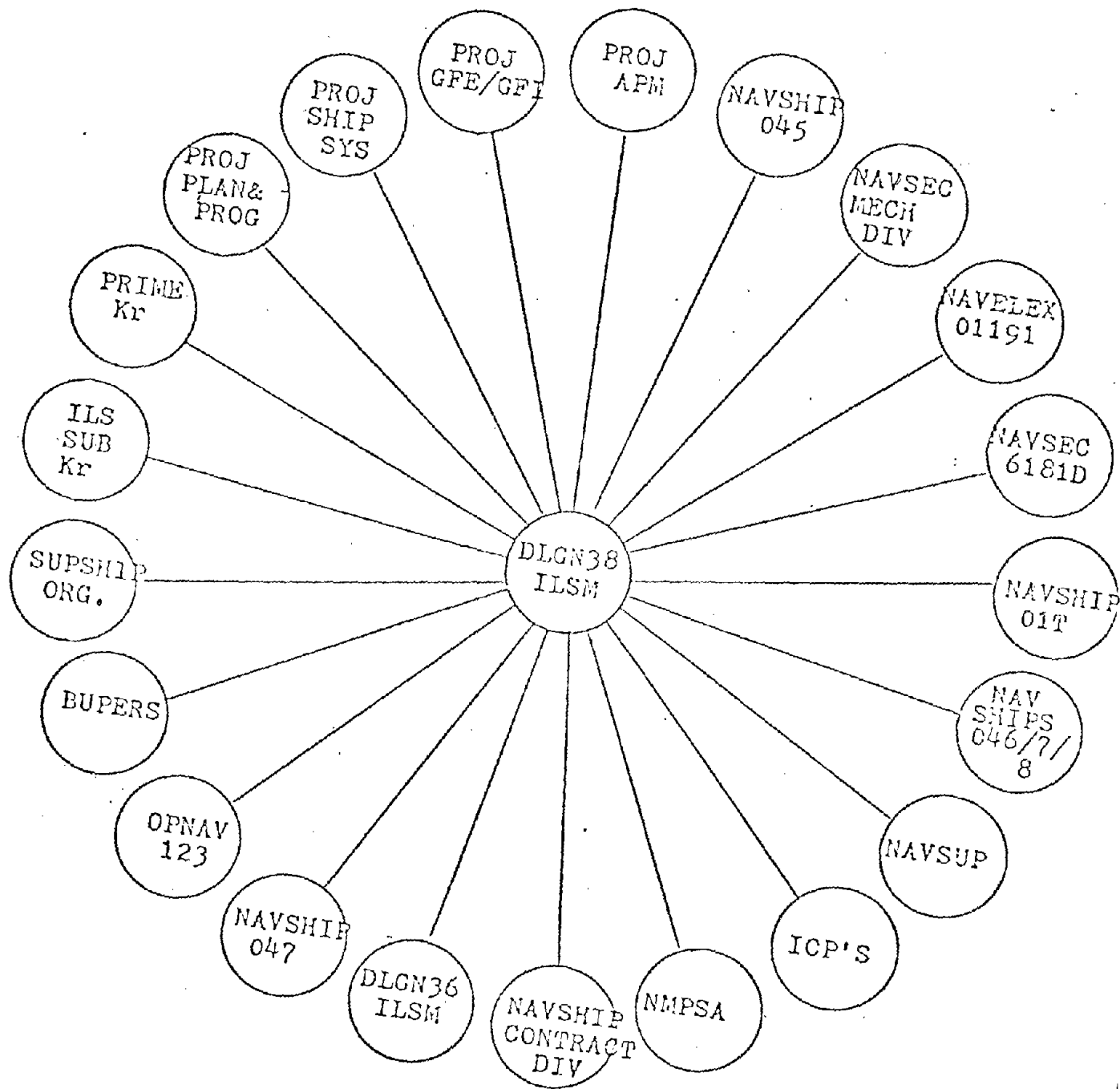as a "spotlight" and thereby makes them visible is in itself of great
benefit.

Figure 4

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The examination of the role and status constructs of the various

ILS Managers proved to be very interesting, chiefly because of the

differences. From the viewpoint of their SUPERIORS, the ILS Manager

is not only well thought of but generally given good support both with

words and (some) dollar resources. An additional facet of ILS which

the Project Managers seem to appreciate is the ability of the discipline

to indicate the far-reaching implications of dollar reductions. By and

large the Project Managers feel that ILS really is not a whole new

concept but rather the result of tying a lot of older efforts together

in a sensible fashion. As noted previously, one of the Project Managers

is such a staunch supporter of the ILS discipline that he had himself

designated the ILS Manager (PM-1). Another very strong supporter of

ILS turned out to be a former APML. On the average, the Project Managers

consider their ILS Managers to be competent and to be living up to high

expectations. Several Project Managers also seemed to feel that the life

of a ILS Manager understandably has to be quite frustrating; they realize

that the average ILS Manager has to wage a constant uphill battle against:

higher priorities, fiscal limitations, increasing modular replacement

costs, increased personnel costs, constraints on contracting, not-always-

efficient interfaces with other programs, and the ever increasing com-

plexity of systems and components.

From the viewpoint of their PEERS, the ILS Manager was considered

to be very important, a conscientious individual who was fulfilling a

needed role. By and large the ILS Manager's role was considered to

coincide with what their peers thought it ought to be. The majority of

ILS Managers were well respected by their peers, and in nearly every

case this was attributed to their personality as much as anything else.

In the NAVAIRSYSCOM Projects it was noted that the APMLs enjoy very good status and support; this was attributed to their entrenched authority and experience as much as for any other reason. By virtue of their roles and their status, it was noted in one analysis, the ILS Manager had the wherewithall to put the various bureaucracies into confrontation through the interfacing of problems. Another Project analysis indicated that the ILS Manager was looked upon as nothing more than a "firefighter" by his peers. And finally, still another Project analysis indicated that the ILS Manager would be better thought of by his peers if he were less susceptible to confusion and frustration which his peers attributed to less-than-satisfactory ILS training.

In general, the ILS Manager viewed his own role as that of mostly a coordinator, but also a monitor, motivator and a persuader. Many of them had had previous tours of duty where they were directly involved with not only maintenance and supply support, but also were confronted with the results of minimal-to-zero advanced planning in those same areas. On the whole, the ILS Managers certainly do feel constrained to an unnecessary degree, primarily in the areas of not having the dollar controls over the resources they are "managing" and not having the authority to make other-than-routine decisions. Most ILS Managers seem to feel that their role is getting larger and more important; to help handle this situation, they feel that more and better ILS training and a continuing series of seminars are required. One or two ILS Managers felt that their efforts had not had that much influence upon the design of their particular weapon system; even after nearly a decade of exposure to the disciplines and policies of Integrated Logistic Support by the functional codes in the SYSCOMs, there is still some

confusion as to just what role ILS should take in not only system

design, but also: data management, budgeting, testing and evaluation,

life cycle costing, configuration management, and advance procurement

planning.

Communications was already alluded to in the discussion of the

informal organizations. This particular aspect of the ILS function

was given a great deal of attention in all of the Project analyses.

By its very nature, a Navy Project organization has to be very good at

communicating. Communications are used to initially sell the program

and subsequently to keep it sold; there are always other programs com-

peting for the same dollar resources. In the case of one-man ILS

staffs within the Project office, he must be in constant two-way

communications with the rest of the "world" with which his ILS efforts

interact. Meetings, briefings, conferences, telephone calls, letters,

directives, reports, management information systems, formal reviews

and sales pitches all constitute not only ILS communications, but total

Project communications as well. Communications was referred to in the

analyses as the "key to success" and the "glue" of the informal organi-

zation. With most of the Projects' activities being so dispersed all

over the country, communications are absolutely vital. In short, there's

just no way to do ILS without good communications.

The determination of "balance" turned out to be by far the most

interesting portion of the exercise. From reading the individual Project

analyses, it would appear that the following forces could be included

under what Scott calls "balance": leadership of the Project Manager,

ILS support given by the Project Manager, professionalism of the ILS

staff, determination to succeed in spite of all the obstacles and

corresponding frustration, the constraints on the resources available, increased management concern for and increased visibility of ILS, the desire to get a good quality and realistically supportable weapon system out to the Fleet, the ILS ideology, a willingness to accept challenges, "Marine Corps" teamwork, the satisfaction of knowing that public funds are being invested judiciously, personal ambition, a very highly motivated ILS Manager, having to provide answers to questions asked by higher authority, dependence upon a very good contractor-manager ILS effort, and getting people to put what they say in writing because then they try to make it happen. Scott says that "balance" is a linking process; any of the above descriptions could be a cohesive and driving force, albeit some more so than others.

From a careful and systematic review of the individual Project analyses, one comes away with the definite feeling that perhaps the most frustrating aspect experienced by the Project Managers and in turn by their ILS Managers is the influence on the Project by the external forces from the environment. These forces range from attitudes or business practices prevalent in certain industries to budgetary limitations imposed by higher authority. Despite all the efforts by well-intentioned people, commissions, trade associations, special audit teams, management information systems technicians, and consultant groups to "streamline" and "improve" the way we acquire weapons systems and in turn go about trying to support them, the results are more often than not just the opposite, i.e., more reporting at higher levels and layering of increasing numbers of directives and requirements. In addition, there is an increasing desire by more and more diverse groups (e.g., employee organizations, consumer interest groups, environmentalists,

the Congress) to get more deeply involved in defense procurement policies and practices. These considerations, in turn, have differing impacts on the application of ILS to specific weapon systems programs. The most direct and visible impact involves the budget cutting which more often than not results in deferring or eliminating requirements in the area of logistic support. Although the exact relationship between operation forces or systems and support forces or systems may not be amenable to precise and objective analysis, there is nonetheless a fact-of-life connection which cannot be ignored. An expedient reduction in people-rich support programs will not only impact the total budget today, but also for the foreseeable future, the same period of time in which the weapon system being developed is to become operational and supportable. Of course, there are other factors, e.g., strikes, shortage of critical skills at the point of weapon systems production, schedule accelerations and slippages, changes in design or operational aspects, modification of the primary threat which a particular weapon system is designed to counter, etc. All of these aspects not only affect the primary or operational system but the planning and implementation for its logistic support on an integrated basis. Because these exigencies do exist, a well-defined Integrated Logistic Support Program is mandatory if the Naval Material Command is to provide adequate support for the systems and equipments being delivered to the Fleet.

It would hardly be fair to expect the reader to remember every detail of all the research findings; some findings are not worth repeating whereas on the whole most findings honestly deserve another consideration. Accordingly, the next section presents the more significant findings in the form of an 'executive brief'.

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VIII. SUMMARY OF FINDINGS

Looking back over this paper, it can be concluded that Integrated Logistic Support is truly a vital part of the weapon system acquisition process; not only is it an iterative process but it appears to be a logical outgrowth of both the PPBS and Systems Engineering disciplines. That ILS works can be attributed to people because people, much more than all the paperwork, drive the system and maintain meaningful dialogue through the many interdisciplinary interfaces.

Of the several ILS functions analyzed, most of the more successful ones were begun early in the system life cycle, specifically in the Conceptual Phase. The policy objective of early logistic support planning is not as idealistic as it may first sound: the establishment of system end-item design and configuration characteristics which reduce, and if at all possible eliminate, the need for logistic support resources. Although ILS policy provides for the tailoring of ILS principles on an individual-case basis, there is still room for growth in this area. This is the result, in part, of the fact that most large-scale ILS efforts to date have been learning exercises and that there has been a conservative more than an innovative approach to ILS planning and implementation.

One of the major deficiencies experienced to date in applying ILS is the failure to really tailor the level of effort and related data requirements imposed by the contract to the particular phase of system/ equipment development and complexity. Perhaps a more serious short-coming is the lack of realization on the part of some Project Managers that tailoring must be accomplished for their specific programs to avoid

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proliferation of data and unnecessary inflation of project cost.

Obviously, the more effort (and resources) invested in ILS, the greater the benefits realized; as an indirect benefit of the Maintenance Engineering/Logistic Support Analyses, the impact of logistic support over the entire life cycle of the weapon system has become more visible. However, without the support of a good data-management/information-processing system this would not be possible. Nonetheless, extreme care must still be exercised to avoid buying too much data; contractors are every ready to promote the procurement of more-than-adequate and very costly and profitable information.

From the eye of the skeptic, there appear to be two main areas of concern: ILS methodology regeneration and the challenge of the matrix organization. There appears to be sufficient guidance promulgated in the basics of ILS application but there does not appear to be very much inter-project exchange of ILS "lessons learned" information, thus the same problems appear time and again with new efforts (and resources) being required to solve them; with a severely constrained budget being common to all Projects, greater use should be made of "profits by experience." That the Naval Material Command utilizes the matrix organization mode in structuring its Projects is an accepted decision, and is beyond the scope of this paper. However, by its very nature the Project and functional organizations are placed in competive confrontation for the same sets of resources. Both tunnel vision and inertia further complicate this already very challenging state of affairs. Finally, because of the inconsistencies and/or disconnects between the matrix organizations, the functional organizations and the budget-flow process, ILS Managers rarely are afforded the opportunity to really "manage" in the sense of

planning/organizing/directing/controlling all the resources for which they are "responsible" to their respective Project Managers.

IX. AREAS FOR FURTHER STUDY

Quite obviously, a paper so constrained by time and available resources can only scratch the surface of a management concept so pervasive as Integrated Logistic Support. Subsequent students in the NPGS Weapons System Acquisition Management curriculum, as well as ILS Managers in the real world of Navy Project Management, may consider any of the following questions suitable topics for greater in-depth investigation and thought:

* Do barriers to the successful implementation of ILS really exist, and what may be done to eliminate them or what would be the best way to change the principles of ILS so as to accommodate them?

* What kinds of additional training do practicing and future ILS Managers require?

* Is a separate ILS information system required, or should existing Project planning and control systems be modified significantly to more effectively process ILS data?

* Can a method be developed to more accurately relate logistic support funds to development and operational funds?

With the research concluded, the results summarized, and a few areas of further study suggested, it would not be proper to end the paper at this point. With nearly half a man-year invested in this project, it was impossible not to become familiar with several areas of ILS endeavor which require further management attention. Therefore, the next section of the paper presents a number of modest recommendations which should be practical to implement.

X. RECOMMENDATIONS

Some sort of a serious refocusing effort needs to be done in the area of Project-functional organization responsibilities (particularly overlaps and gaps). The greatest single problem noted in the analyses of the sixteen Navy Projects was the confusing and conflicting organizational environment. Perhaps besides a program of paperwork and policy reshuffling, "group encounter" and Dale Carnegie type courses would help to alleviate some of the people-to-people friction.

The written body of thought comprising ILS doctrine and policy needs to be reduced, and to some degree simplified. Some of it appears to be written by PhDs and can only be read and appreciated by PhDs. The average person involved in both planning and implementing ILS is a middle manager, very few of whom are even designated doctoral candidates.

There definitely needs to be more interchange of information based on experience; some sort of a vehicle similar in format and intent to the Headquarters Naval Material Command Procurement Newsletter (NAVMAT P-2182) would suit this need. Recurring problems and how they have been approached previously, as well as current key issues should be identified and cogently discussed; this vehicle could also very appropriately act as a sounding board for suggestions aimed at improving the ILS discipline.

XI. CONCLUSIONS

Given the goal of maximizing weapon system and equipment readiness at optimum costs, the integration of logistic support elements into an on-going, already designed, time-phased and mission oriented system was a logical course to follow. This cross-fertilization and mutual-interaction process of trade-off analyses should start along with the conceptual studies for a new weapon system or equipment and continue throughout its entire life cycle. Rather than establishing separate, independent ILS organizations, Navy Projects basically depend upon the systematic infusion of a concern for logistic considerations into existing organizations and activities. Although ILS seems to be based upon very sound theory, it is in reality quite difficult to implement successfully. The major effort still is to ensure that the procedures are applied in a manner consistent with the complexity of the hardware program and in keeping with the phase of the acquisition.

With regards to the hypothesis (The failure or success of ILS Planning and Implementation is the direct result of the "effectiveness" of the ILS informal organization.), the author feels that it was proved correct although not conclusively. A review of the doctrine showed what ILS is supposed to do; using the meaning of the word "effectiveness" as derived in this paper, the more successful ILS organizations are actually doing what they were intended to do in the first place. Formal ILS organizations within Navy Projects serve to identify the importance of ILS and serve as a focus for all ILS activity. By virtue of the typically small formal ILS organization, ILS Managers

physically cannot accomplish their ILS objectives by themselves. Of a

necessity, ILS Managers must encourage the evolution of an informal

organization structure to attain their goals. Therefore the success

of the ILS endeavor does depend in part upon the informal organization,

most of which were found to be well developed. Most of the ILS Managers

did in fact possess strong personalities and this coupled with the

linking forces of good communications and "balance" reinforced the

informal organizations and caused them to function effectively.

However, the author readily admits that there are other factors which

also must be considered in evaluating the degree of success of the

ILS function including morale of the assigned personnel, overcoming

the challenges presented by the matrix organization, and the externalities

or demands placed upon the Project by the environment.

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[1] Webster's New World Dictionary of the American Language, College Edition, p. 862, World Publishing Co., 1965.

[2] Fallon, Edward R., COL, USAF, "The Real Issues of Logistic Support", Logistics Spectrum, Vol. 5, No. 3, p. 6, Fall 1971.

[3] Excerpts from a speech by Dr. Finn J. Larsen, (formerly) ODDR&E, before a meeting of the Electronic Industries Association Symposium at Washington, D.C., 7 Mary 1968.

[4] Geneste, Elmon A., CAPT, SC, USN, "Integrated Logistic Support: From Concept to Reality", National Security Management, Industrial College of the Armed Forces, p. 11, 1969.

[5] ibid, p. 12.

[6] Genovese, James J., "Lessons Learned in the Application of ILS", contained in Melvin B. Kline's "Integrated Logistic Support", Five-day Short Course Notes (UCLA Course - Engineering 885.10), p.4, September 1970.

[7] Kline, Melvin B., "Integrated Logistic Support and Logistics Education", Logistics Spectrum, Vol. 2, No. 3, p. 5, Fall 1968.

[8] Thompson, Markita J., "The Logis of Logistics", Logistics Spectrum, Vol. 3, No. 2, p. 25, Summer 1969.

[9] Kline, op. cit., p. 5.

[10] Geneste, op. cit., p. 1.

[11] Naval Material Command Instruction 4000.20A, Subj: "Integrated Logistic Support Planning Policy", p. 55, 18 March 1971.

[12] Department of Defense Directive 4100.35, Subj: "Development of Integrated Logistic Support for Systems and Equipments", p. 3, 10October 1970.

[13] Kline, Melvin B., "Integrated Logistic Support", Five-day Short Course Notes (UCLA Course - Engineering 885.10), p. 4, September 1970.

[14] ibid, p. 4.

[15] ibid, p. 1.

[16] ibid, p. 4.

[17] ibid, p. 7.

[18] ibid, p. 2-24.

[19] Holsclaw, Gerald R. and Fred T. Carlson, "Integrated Logistic Support; The Life Cycle Task of Support Management", Logistics Spectrum, Vol. 3, No. 1, p. 13, Spring 1969.

[20] Kline, Five-day Short Course Notes, op. cit., p. 11-13.

[21] Bussell, Horace, "Manpower Implications of Integrated Logistic Support", Logistics Spectrum, Vol. 3, No. 1, p. 30, Spring 1969.

[22] From a lecture delivered by Dr. Melvin B. Kline to Weapons Systems Acquisition Management students at NPGS Monterey, California, 6 October 1972.

[23] Larson, L.O., CAPT, SC, USN, "Procurement Planning for ILS", Headquarters Naval Material Command Procurement Newsletter, p. 5 July-September 1971.

[24] Naval Material Command Instruction 4000.20A, op, cit., p. 5.

[25] ibid, p. 17.

[26] ibid, p. 26.

[27] Geneste, op. cit., p. 18.

[28] Holsclaw, p. cit., p. 10.

[29] McCreery, Bernard L., "Integrated Logistics Management", Logistics Spectrum, Vol. 3, No. 1, p. 25, Spring 1969.

[30] Holsclaw, p. cit., p. 10.

[31] McCreery, op. cit., p. 25.

[32] Scott, W.G., "Organization Theory: An Overview and an Appraisal", Journal of Academy of Management, p. 33, April 1961.

[33] Barnard, C.I., The Functions of the Executive, Chapter 7, Harvard University Press, 1938.

[34] Koontz, H. and C. O'Donnell, Principles of Management, 4th Ed., p. 590-592, McGraw-Hill, 1968.

[35] Scott, op. cit., p. 35.

[36] ibid, p. 36.

[37] This and the immediately preceding seven quoted policy statements were all taken from Naval Material Command Instruction 4000.20A, ot. cit.

BIBLIOGRAPHY

Barnard, C.I., *The Functions of the Executive*, Harvard University Press, 1938.

Bussell, Horace, "Manpower Implications of Integrated Logistic Support", *Logistics Spectrum*, Vol. 3, No. 1, Spring 1969.

Department of Defense Directive 4100.35, Subj: "Development of Integrated Logistic Support for Systems and Equipments", 1 October 1970.

Fallon, Edward R., COL, USAF, "The Real Issues of Logistic Support", *Logistics Spectrum*, Vol. 5, No. 3, Fall 1971.

Geneste, Elmon A., CAPT, SC, USN, "Integrated Logistic Support: From Concept to Reality", *National Security Management*, Industrial College of the Armed Forces, 1969.

Genovese, James J., "Lessons Learned in the Application of ILS", contained in Melvin B. Kline's "Integrated Logistic Support", *Five-day Short Course Notes* (UCLA Course-Engineering 885.10), September 1970.

Holsclaw, Gerald R. and Fred T. Carlson, "Integrated Logistic Support; The Life Cycle Task of Support Management", *Logistics Spectrum*, Vol. 3, No. 1, Spring 1969.

Kline, Melvin B., "Integrated Logistic Support and Logistics Education", *Logistics Spectrum*, Vol. 2, No. 3, Fall 1968.

Kline, Melvin B., "Integrated Logistic Support", *Five-day Short Course Notes* (UCLA Course-Engineering 885.10), September 1970.

Koontz, H. and C. O'Donnell, *Principles of Management*, 4th Ed., McGraw-Hill, 1968.

Larson, L.O., CAPT, SC, USN, "Procurement Planning for ILS", *Headquarters Naval Material Command Procurement Newsletter*, July-September 1971.

McCreery, Bernard L., "Integrated Logistics Management", *Logistics Spectrum*, Vo. 3, No. 1, Spring191969.

Naval Material Command Instruction 4000.20A, Subj: "Integrated Logistic Support Planning Policy", 18 March 1971.

Scott, W.C., "Organization Theory: An Overview and an Appraisal", *Journal of Academy of Management*, April 1961.

Thompson, Markita J., "The Logic of Logistics", <u>Logistics Spectrum</u>,
  Vol. 3, No. 2, Summer 1969.

<u>Webster's New World Dictionary of the American Language</u>, College
  Edition, World Publishing Co., 1965.